THE DEVELOPMENT AND PSYCHOMETRIC EVALUATION OF AN INNOVATIVE SELF-REPORTED MENTAL HEALTH ASSESSMENT INSTRUMENT FOR SCHOOL-AGED CHILDREN

A Thesis submitted by

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ABSTRACT

The overarching objective of this PhD Research Program was to develop a broad, digitally animated assessment instrument capable of detecting self-reported emotional and behavioural distress in primary school children (aged 5-11 years). The instrument utilises cartoon animations as assessment items and is presented via a highly accessible internet-based application. The ultimate purpose of the instrument, named the Interactive Child Distress Screener (ICDS) is to increase detection rates of emotional and behavioural difficulties to facilitate prevention, further assessment, and earlier intervention for child mental health problems.

The ICDS was co-designed and tested in this research with 366 children over staged iterative development and validation studies. An exploratory sequential mixed methods approach with an emphasis on iterative, participatory codesign was utilised throughout each stage. In the pilot study, assessment domains were identified with experts (N = 9) in child and youth mental health and psychometrics, and feasibility of the digital, animated concept was supported with children (N = 18). Study 2 aimed to first understand the Child's (N = 20) perspective of emotional and behavioural constructs and then develop a series of emotional and behavioural typologies from which the animated items were subsequently designed. Study 3 qualitatively validated and refined the animated assessment items with children (N = 62) until >80% accuracy and acceptability ratings were attained. Study 4 field tested the ICDS instrument in a community sample of parent and child dyads (N = 266) and conducted preliminary psychometric validation.

Classical evaluation of the ICDS revealed a clear two-factor structure with good overall psychometric properties and high acceptability with children aged five through 11 years. Results demonstrated that young children can accurately report on their own internalising and externalising states via digitally animated assessment items. Findings also highlighted the importance of iterative and participatory co-design methodologies when developing instruments for children to ensure outcomes are acceptable and accurate. This research program produced a digitally animated instrument capable of obtaining self-reported emotional and behavioural distress from young children. The highly accessible and unrestricted format of the internet based ICDS presents a feasible approach for broad application.

CERTIFICATION OF THESIS

This Thesis is the work of Kirsty Lee Zieschank except where otherwise acknowledged, with the majority of the authorship of the papers presented as a Thesis by Publication undertaken by the Student. The work is original and has not previously been submitted for any other award, except where acknowledged.

Principal Supervisor: Professor Sonja March
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Student and supervisors' signatures of endorsement are held at the University.

STATEMENT OF CONTRIBUTION

The following detail is the agreed share of contribution for candidate and co-authors in the presented publications in this thesis. All journal impact factors (IF), SCImago Journal Ranks (SJR), and h-index (h-) where available are correct at 9th, June 2021:

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LIST OF CONFERENCE PRESENTATIONS

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

2D	Two dimensional
ADHD	Attention Deficit Hyperactivity Disorder
App	Application (as in mobile application – computer program designed to
run on	a mobile device such as a phone, tablet, or computer)
APS	Australian Population Framework
ASEBA	Achenbach System of Empirically Based Assessment
Att	attention
BERS-2	Behavioral and Emotional Rating Scale - 2
BPM	Brief Problem Monitor
BPM-P	Brief Problem Monitor – Parent Form for Ages 6 – 18
BPM-Y	Brief Problem Monitor – Youth Form for Ages 6 – 18
BYI	Beck Youth Inventories
CBCL	Child Behavior Checklist
CBCL6/18	Child Behavior Checklist Parent Form for 6–18-year-olds
CBCL-LDS	Child Behaviour Checklist for Ages 1½-5 and Language Development Survey
CCM	Constant Comparison Method
CFI	Comparative Fit Index
CRC	Convention on Rights of the Child
CTT	Classical Test Theory
DI	Dominic Interactive
DSM	Diagnostic and Statistical Manual
DSM-IV	The Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition
EFA	Exploratory Factor Analysis
Ext	Externalising
GP's	General Practitioner's
ICDS	Interactive Child Distress Screener
ICDS-SS	Interactive Child Distress Screener Satisfaction Survey
ICDS-US	Interactive Child Distress Screener Utility Scale
Int	Internalising
MAAC	Mood Assessment via Animated Characters

MDD	Major Depressive Disorder
M&MS	Me and My School Questionnaire
PAD	Principled Assessment Design
RMSEA	Root Mean Squared Error of Approximation
SAD	Social Anxiety Disorder
SDQ	Strengths and Difficulties Questionnaire
SDQ-P	Strengths and Difficulties Questionnaire – Parent Forms (4–10 and 11–17 years)
SDQ-Y	Strengths and Difficulties Questionnaire – Youth Form 11–17 years
TRF	Teachers Report Form (Child Behavior Checklist)
SEIFA	Socio-Economic Indexes for Areas
SQL	Structured Query Language
SRMR	Standardised Root Mean Square Residual
TLI	Tucker Lewis Index
Tot	Total Problems
WHO	World Health Organisation
YSR	Youth Self Report Form for 11-18 years (Child Behavior Checklist)
YWCRC	Young and Well Cooperative Research Centre

CHAPTER 1: INTRODUCTION

Like adults, primary school-aged children aged five through 11 years can and do experience mental illness and distress. Half of all mental health conditions present before 14 years of age, and prevalence rates are increasing (Ivey, 2020; Paton et al., 2021). Mental illness impacts a child's self-esteem, behaviour, ability to make and maintain social relationships, ability to learn, and resilience to stress (Farmer et al., 2020; Royal Australian and New Zealand College of Psychiatrists [RANZCoP], 2010b). Over the past decade, there has been an increasing awareness of the importance of childhood mental health within families, in the media, and from leading mental health bodies. However, parents and caregivers report many barriers to accessing care for their children. These include not knowing when or where to get help, long waiting lists to access care, high costs of assessment and intervention services, and lack of recognition of existing mental health symptoms as a problem (Johnson et al., 2018; Lawrence et al., 2016; Paton et al., 2021).

Current research priorities support developing methods for 1) detecting, 2) preventing, and 3) treating child and youth mental health difficulties (Royal Australian and New Zealand College of Psychiatrists [RANZCoP], 2017). The outcomes of this program of research will meet the first of these priorities and support pathways toward the second and third priorities by making steps toward the development of a novel animated screening instrument for detecting early signs of emotional and behavioural distress in children. The instrument will overcome some of the known barriers to detection by increasing access to child mental health screening with its highly accessible internet-based delivery format. It will also provide children with the opportunity to self-report on their own mental health experience via a presentation and response format that is developmentally appropriate. It is important to note from the outset, that this program of research focuses on primary school aged children, those under the age of 11 and those who have typically been observed through the eyes of parents and carers. This chapter will first describe the prevalence of childhood mental illness and the importance of early detection. Further discussion follows about why universal mental health screening carried out as part of a formal national public health approach is warranted but difficult to achieve. Current screening instruments and screening approaches will be reviewed, and then a summary of the proposed program of research will be presented.

1.1 Problem Scope of Childhood Mental Illness

Epidemiological studies indicate that clinical levels of mental illness and behavioural disorders affect anywhere between 10-20% of children and adolescents, and all agree they are the leading cause of health-related burden (Belfer, 2008; Kieling et al., 2011; Lawrence et al., 2015; Palinkas, 2018; Vos et al., 2020). A meta-analysis of 41 studies from 27 countries by Polanczyk et al. (2015) estimated the worldwide prevalence rate of mental disorders to be 13.4%. This statistic closely aligns with reported prevalence rates of mental illness in Australian youth at 13.9% (Lawrence et al., 2016). This Australian data was collected in 2013 and 2014 from a representative sample of 6300 Australian families with children and/or adolescents aged 4-17 years (Lawrence et al., 2016). Data for children aged 4-11-years was exclusively reported by parents/caregivers, whereas some adolescent data was self-reported. The most commonly reported mental health conditions experienced by children worldwide are internalising and externalising disorders (Guy et al., 2016; Keenan & Wakschlag, 2000; Levitt et al., 2007; Paton et al., 2021). Again, this remains true for Australian children and includes attention-deficit hyperactivity disorder (ADHD, 7.4%), anxiety disorders (6.9%), major depressive disorder (MDD, 2.8%), and conduct disorder (2.1%). Comorbid conditions are frequent, with one-third of the children diagnosed with ADHD or conduct disorder also suffering from anxiety and/or depression (Lawrence et al., 2016).

Internalising problems refer to difficulties with expressing or managing emotions. They can include inhibited behaviours such as withdrawal, worry, fearfulness, and shyness, and may lead to disorders such as anxiety and depression (Farmer et al., 2020). Externalising problems are overtly disruptive and can include impulsivity, aggression, restlessness, difficulty paying attention, and challenging defiance (Farmer et al., 2020). Throughout this thesis, the terms internalising, and externalising are used interchangeably with the terms emotional and behavioural, and symptoms of mental illness may be described as difficulties, problems, or distress. Any reference to disorder describes a clinical level mental illness that meets diagnostic criteria. Behavioural problems tend to demand attention from parents and caregivers and are typically more obvious to the observer. In contrast, emotional difficulties may be more easily overlooked as they are experienced internally and are therefore more covert and difficult to notice (Lawrence et al., 2016). In Australia, one in seven children (13.9%) are affected by an emotional or behavioural disorder,

ranging from mild (59.8%) to severe (14.7%), and half of those requiring professional help will not receive it (Johnson et al., 2016; Moore et al., 2013; Sawyer et al., 2001).

The second Australian National Child and Adolescent Survey of Mental Health and Wellbeing (known as Young Minds Matter survey) revealed 51% of Australian infants are born at risk for developing mental illness, 14% of 4-11-year-olds already experience a diagnosable mental disorder (up to 20% at the sub-clinical level), and many others are exposed to multiple risk factors that can lead to future mental health difficulties (e.g. poverty, neglect, parental unemployment, abuse, domestic violence) (Ivey, 2020; Lawrence et al., 2016). When socioeconomic disadvantage is considered, there is an even greater risk for mental illness. There are disproportionately higher prevalence rates of childhood mental illness among children living in low socioeconomic areas (19%) than what is seen in children from higher socioeconomic backgrounds (12%) (Hashmi et al., 2020). Risk is also accumulative; therefore, the potential for mental illness rises with additional risk factors, as do multiple exposures (Fryers & Brugha, 2013; Silva et al., 2015). Figure 1.1 illustrates a snapshot of the worrying mental health trends affecting Australian children.

Figure 1.1

Worrying Childhood Mental Health Trends in Australia

Untreated mental illness during childhood has high human and financial costs for the families themselves and society as a whole. Mental health problems in childhood impede healthy social development, have detrimental effects on educational progress, lessen opportunities from the early years right through

adolescence, and increase the probability of enduring psychosocial disorders into and throughout adulthood (Hashmi et al., 2020; Moffitt et al., 2011; Moreira et al., 2013; Royal Australian and New Zealand College of Psychiatrists [RANZCoP], 2010a). Adolescent and adult mental health problems are correlated with substance abuse, poor vocational outcomes, family separation and violence, unemployment, homelessness, and poverty, any of which increases the risk for the next generation of children, thus perpetuating the cycle (Centre for Community Child Health, 2006). Consequently, the economic, social, and personal cost of untreated mental, emotional, and behavioural disorders among young people are extremely high (RANZCoP, 2017). It is clear that to change such trajectories, the earliest recognition of adverse symptomatology is crucial. To do so, we must offer easily accessible opportunities for detection.

1.2 Early Detection and Barriers to Help-Seeking

A large proportion of children with mental health problems do not receive adequate care because their symptoms are simply not recognised (Ivey, 2020; Koning et al., 2019). Failure to detect symptoms is problematic because, without recognition, difficulties may progress, and suffering continues. Longitudinal studies have determined that early emerging socio-emotional and behavioural problems are not transient and show problem stability and diagnostic persistence (RANZCoP, 2017; Stemmler & Losel, 2012). The trajectory of mental health problems in children is reported to be evident as early as kindergarten (Essex et al., 2009), and one study found as many as 50% of 3-year-old children with a disruptive disorder will continue to have the diagnosis up to four years later (Briggs-Gowan et al., 2006). In this same study, rates of problem persistence were reported to be higher over time for boys than girls for both emotional disorders (boys 54%, girls 18%) and behavioural disorders (boys 46%, girls 33%) (Briggs-Gowan et al., 2006). The same is true for Australian children, with prevalence rates of mental disorders higher for 4-11-year-old boys (16.5%) than girls (10.6%) (Lawrence et al., 2016). Essex and colleagues (2009) further report that children who have recurrent and comorbid internalising and externalising symptoms that present earlier will develop the most impairing problems by late childhood and require intervention. Accumulated evidence suggests that early symptoms of mental ill-health in most children may precede diagnosable disorders by two to four years (O'Connell et al., 2009), and that early and persistent problems increase the likelihood of further impairment and the development of

comorbid disorders (Feeney-Kettler et al., 2011). It is clear that early detection is essential so that preventative measures can be put in place to impede the onset of disorders and facilitate interventions to reduce the severity of existing problems.

However, despite such evidence, there appears to be a culture of late intervention or a ‘wait-to-fail’ approach regarding children's mental health generally. This means children with problems are experiencing difficulties for longer before help is being sought, or they only come to the attention of health professionals when there are serious or evident signs of distress (e.g., school refusal, self-harm), or they are negatively impacting others (e.g., aggressive or disruptive behaviour, delinquency) (Humphrey & Wigelsworth, 2016; Johnson et al., 2016). According to the Australian Young Minds Matter survey, help-seeking is more common when the severity of disorder is higher. Yet, just over half of youth (56%) aged 4–17 years with an emotional or behavioural disorder had reported accessing any support in the previous 12 months (Johnson et al., 2016). For the other 44% of youth who did not receive any help, this suggests that caregivers or young people do not recognise the existence and/or severity of a disorder or cannot access help for other reasons. Stigma related to seeking help for mental health issues, poor mental health literacy, and difficulty accessing appropriate services due to long waiting lists or financial limitations have been cited as known barriers (Johnson et al., 2016; Paton et al., 2021).

Primary care general practitioners (GP’s) are the most commonly accessed service for seeking help, yet there is reportedly great variation between GPs in terms of experience, knowledge, confidence, and skills in assessing child mental health problems (Johnson et al., 2016; Parker et al., 2020; Paton et al., 2021). American studies report medical professionals rarely identify early emotional and behavioural difficulties as precursors to disorder and identify less than 50% of children experiencing serious disorders because they rarely or never use valid screening tools and typically ‘screen’ for mental illness by informally talking to children or parents (Biel et al., 2015; Glascoe, 2000; Ivey, 2020). This may contribute to mental health problems in children being under-reported and result in fewer referrals for intervention. A systematic review of factors associated with identifying child mental health problems suggested that routine preventative mental health screening with evidence-based instruments and improved training might increase the sensitivity of

medical professionals to child mental health problems; thereby increasing recognition (Koning et al., 2019).

Increased detection is essential as childhood emotional and behavioural difficulties can be treated effectively if detected early and before they develop into clinical level disorders (Jacka & Reavley, 2014). According to the definition specified by Moore and McDonald (2013), the term 'early intervention' refers to "intervention early in the 'life' of a problem in order to limit the potential for that problem to develop further and potentially escalate to crisis point" (p. 8). Accordingly, universal and targeted mental health screening for early intervention has been listed as a priority recommendation in multiple reports, policies, and planning strategies by the Australian government and professional mental health bodies for many years (Australian Health Ministers' Advisory Council, 2015; Banks et al., 2014; Cortina, 2020; Moore et al., 2013; RANZCoP, 2010b). They each stressed the necessity for research into accurate methods for early detection, particularly since problems that interfere with a child's social and academic functioning can have such deleterious and potentially lasting consequences.

With adequate detection, early intervention can help young people avoid the harmful trajectories associated with mental illness by interrupting problem progression and limiting problem severity (Glascoe, 2000; Murray, 2010; Nixon, 2002). Early detection is also warranted from economic and health prevention standpoints (Bidaut-Russell et al., 1998; RANZCoP, 2010a, 2017; Smith & Smith, 2010). The financial burdens of mental illness and care are far-reaching for individuals and communities alike. Routine screening activities have the potential to reduce significant health and financial cost burdens for the community generally and reduce some of the barriers to seeking help.

1.3 Mental Health Screening

Screening may be broadly defined as a systematic process where people in a particular group are tested for the presence of a particular attribute (McCrae & Brown, 2018). Preventative mental health screening aims to either rule out or recommend further assessment by mental health specialists for targeted intervention. This may be achieved by identifying risk factors or detecting specific symptomology whose presence in a group of individuals makes the development of psychological or behavioural problems more likely (O'Connell et al., 2009). Due to the high rates of comorbidity among youth mental health disorders, broadly assessing emotional and

behavioural difficulties is recommended over targeted screening for specific disorders such as anxiety, even when a presenting problem may appear obvious (Kazdin, 2015). Health researchers advocate a population-based approach to monitoring and addressing youth mental health difficulties, with screening being the first step (Dowdy et al., 2010). Universal prevention describes any population-based public health activity that is designed to reduce risk at a population level (Costello, 2016). In this vein, a universal child mental health screening program would routinely assess and identify symptoms in all primary-school-aged children, provide a baseline for future monitoring, and facilitate preventative measures and treatment for those who require it.

Schools are often proposed as prime locations for implementing universal mental health screening programs because children, teachers, and parents may be more conveniently targeted to facilitate the completion of standard measures (Dray et al., 2017; Fatori & Polanczyk, 2020; Humphrey & Wigelsworth, 2016; Massey et al., 2005; O'Dea, King, et al., 2021). Australian school staff are known to play an informal role in detecting mental health difficulties, as teachers are often amongst the first to notice concerning behaviours and suggest that help is needed (Lawrence et al., 2015; O'Dea, Anderson, et al., 2021). A recent study by Soneson et al. (2018) demonstrated parental acceptability of screening for mental health difficulties in primary schools was high, with 98% of those surveyed believing it was important to identify difficulties early in life and 82% believing screening would be helpful. Researchers investigating patterns of childhood mental health symptoms also proposed a universal school-based mental health screening strategy beginning at school entry to detect recurring symptoms and improve follow-up evaluation and treatment planning (Essex et al., 2009). Further grounds for implementing routine mental health screening within schools or during primary health care check-ups is that normalising mental health assessment may help overcome lingering stigma related to seeking mental health care (Lefler et al., 2012; Neil & Christensen, 2009). However, despite promising evidence on the utility of universal mental health screening and good examples recently attempted with Australian adolescents (O'Dea, King, et al., 2021; O'Dea, Subotic-Kerry, et al., 2021; Parker et al., 2020), there are currently no standard screening programs in Australian schools or primary care settings for children. Despite much support for screening and the importance of early intervention there are no concrete proposals about how universal or routine

mental health screening for children might be implemented or which measures might be appropriate.

Decisions about whether such a program might be implemented are based on satisfying strict criteria within The Australian Population Screening Framework (APS framework) (Standing Committee on Screening of the Clinical Principal Committee [SCoS], 2018). Table 1.1 outlines the APS framework, which was adapted from the World Health Organisation (WHO) Principles of Early Disease Detection (Wilson & Jungner, 1968).

Table 1.1

The Australian Population Screening Framework Criteria

1. The Condition:
    - is an important health problem
    - has a recognisable latent or early symptomatic stage
2. The test:
    - is highly sensitive
    - is highly specific
    - is validated
    - is safe
    - has a relatively high positive predictive value
    - has a relatively high negative predictive value
    - is acceptable to the target population, and ideally includes important subgroups such as target participants who are from culturally and linguistically diverse backgrounds, Aboriginal and Torres Strait Islander people, people from disadvantaged groups, and people with a disability.
3. Assessment
    - systems should be in place for evidence-based follow-up assessment of all people with a positive screening test regardless of rurality, ethnicity, socioeconomic status, or disadvantage status.
4. Treatment
    - the treatment must be effective, available, easily accessible, and acceptable to all patients with the recognised disease or condition.
5. Screening Program
    - there should be an agreed policy on whom to treat as patients
    - facilities for diagnosis and treatment should be available
    - the cost of case-findings (including diagnosis and treatment of patients diagnosed) should be economically balanced in relation to possible expenditure on medical care as a whole
    - case-finding should be a continuing process and not a ‘once and for all’ project

Note. Based on Commonwealth of Australia (Department of Health) material (SCoS, 2018). pp. 8-12. Reprinted with permission under Creative Commons Attribution 4.0 International Public License.

The large body of evidence demonstrating that the health burden of childhood mental illness is a significant problem with distinguishable symptomatology satisfies the APS framework’s first criterion regarding an identified ‘Condition’. In addition,

the abundance of research into child mental health disorders and authoritative texts such as the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; American Psychiatric Association, 2013), which defines and classifies mental disorders, provides diagnostic criteria, and guides treatment approaches, should satisfy the second APS framework criterion regarding 'Treatment'.

It is beyond the bounds of this research program to presume that the APS framework 'Assessment' and 'Screening Program' criterion will be satisfied because they require policy development and agreement from the Federal, State, and Territory governments. However, the APS framework 'Test' criterion aligns with many of the goals of good psychometric test construction and, therefore, also inform this research program concerning what is expected of a screening tool suitable for universal application.

It is apparent that mental health is essential to overall health and that detecting a problem via screening is the first step in enabling those who require help to receive it. However, there are logistical issues and barriers to implementing routine early identification practices. These include the availability of personnel and resources to conduct the screening, the need for experts or trained professionals to score and interpret the results (which makes most tools prohibitively expensive for use in large scale screening), and the general lack of age-appropriate and low-cost broad screening measures for children.

1.4 The Child's Perspective and the Importance of Self-Report

Historically, younger children's perspectives have typically been disregarded and there is a dominance of written survey style instruments that utilise adult proxies (i.e., parents, teachers, mental health professionals) to provide mental health information on behalf of the child (Childs et al., 2013; Greco et al., 2016; Jensen et al., 2006; Massey et al., 2005; Stiffler & Dever, 2015). However, childhood is a unique phase that should not be compared to adulthood and ignoring children's perspectives because collecting data from them may be challenging is a methodological problem that should be addressed. Prevailing pen-and-paper instruments rely heavily on verbal and cognitive abilities that often exceed younger children's mental capacity and attention spans to comprehend, self-evaluate, and respond to written, text-based questions and complex response formats (e.g., Likert scales). According to Bevans et al. (2020), the cognitive abilities required to complete this type of instrument include comprehension, processing, attention,

working memory, long-term memory, temporal sequencing, and judgment. Primary-school-aged children (5-11-years) and especially those in the younger years (e.g., Prep/Kindergarten - Year 4) have undeveloped (though developmentally normative) reading and language comprehension abilities (Arseneault et al., 2005; Njoroge & Bernhart, 2011). Given the significant developmental variations between five and 11-year-olds, crafting items using appropriate language that is broadly suitable has been the challenge for scale developers. Concessions such as applying adult constructs to child problems or redesigning existing measures used with adults to be more child friendly by revising terminology (McDougall et al., 2013; Myers & Winters, 2002) may have failed to recognise the unique differences between adult and childhood reporting requirements.

Accumulating evidence suggests that younger children can provide accurate information when measures are presented age-appropriately and that the use of self-reported screeners are an ideal, preferred, and accurate method for assessing a child's behavioural and emotional functioning (Barry et al., 2008; Nordness et al., 2014; Riley, 2004; Stiffler & Dever, 2015; Warming, 2011). Including accommodations such as auditory voiceovers or illustrations and using image-based response categories may enhance children's understanding, but whether these are merely decorative or increase the reliability and validity of children's self-report is not entirely known (Bevans et al., 2020). Simply reading the items to children may not be a solution because evidence suggests that children are less likely to answer questionnaires honestly when they have to provide or discuss their response in the presence of an adult (Bradford & Rickwood, 2012; Deighton et al., 2014; Mash & Hunsley, 2005). This is particularly common with younger children (ages 6-9 years) who tend to provide socially desirable answers because they want to give the 'right' answer or what they think might be the 'good' response as opposed to what is the true response (Grills & Ollendick, 2003; Mash & Barkley, 2007). This suggests that developmentally appropriate screening tools that children can understand and complete on their own are needed.

Another issue that arises when child-reported information is excluded is that parents and teachers do not always know how children are truly feeling. Many studies have verified that discrepancies exist between child- and adult-reported information, and teacher- and parent-reported information (Carter et al., 2004; Frick et al., 2010; Riley, 2004; Stanger & Lewis, 1993; Stiffler & Dever, 2015). Symptoms

are often inaccurately reported by parents, especially by those who are themselves experiencing mental health difficulties. For example, children's self-reported depression is commonly reported as oppositional and attentional problems by depressed parents (Kashani et al., 1985). Agreement ratings between children and parents regarding social anxiety disorder (SAD) are very poor, with SAD symptomology often rated by parents as oppositional or defiant behaviour (Foley et al., 2004). Differences between parent's and teacher's ratings exist due to biases in reporting, measurement error, or symptom variability across settings (Vaz et al., 2016). Children behave differently in home and school contexts, so problematic behaviours may only be present in one of setting or appear differently in each setting and parents and teachers may use different benchmarks when evaluating behaviours based on their own mental health literacy. To avoid treatment or intervention decisions being made on incomplete data, the inclusion of child reports needs to be given more weight generally, and particularly concerning symptoms of internalising problems such as depression and anxiety that are more easily hidden and consequently overlooked.

Some progress has been made in moving beyond adult reporting exclusively by including self-report options for children as young as five years in measures of social skills and coping (Greco et al., 2016), but very few screening tools exist for children younger than 11 years that provide self-reported information on broad domains of emotional and behavioural difficulties.

1.5 Child Mental Health Screening Instruments and Approaches

As outlined in the APS framework, an effective screening instrument should primarily be reliable and valid with adequate specificity and sensitivity to identify those at risk. Sensitivity refers to the accuracy of a test in correctly identifying an individual with a problem, and specificity refers to correctly identifying an individual without a problem (DeVellis, 2017). Therefore, a psychological screening instrument for children is considered reliable and valid when it produces consistent results and accurately discriminates between children who do and do not have a problem (Nordness et al., 2014). Failing to detect problems means children who need interventions will not receive them, whereas detecting problems that aren't there (i.e., false-positive errors) may cause undue stress and worry for families and waste time and resources on unneeded additional assessment.

As specified above, this program of research focuses on children aged between 5 and 11 years of age. Thus, the below review of literature refers to instruments that could be utilised with this age group. It is acknowledged there is a much greater instrument base to draw from when conducting screening in adolescents. A search of brief instruments designed for screening psychosocial problems in school aged children demonstrated that many available screening instruments are 1) disorder-specific (e.g., screen for anxiety only or depression only etc.); 2) population-specific; 3) include supplemental general well-being, substance use, or physical health assessment items; or 4) have costly and burdensome administration or scoring requirements (Thabrew, McDowell, et al., 2017). Disorder specific and population specific screening tools are unsuitable for broad screening while the other examples listed are factors that limit a measure's feasibility for use in routine implementation. Researchers largely agree that an ideal and effective screening instrument should be able to quickly and accurately screen large numbers of children, be brief, inexpensive, standardised, and simple to administer, score, and interpret (Deighton et al., 2014; Levitt et al., 2007; Nordness et al., 2014). However, finding a screener designed to provide a broad screen for emotional and behavioural difficulties in primary-school-aged children that is feasible for wide implementation and meets all of these expectations is quite challenging.

Table 1.2 provides an overview of the screening measures of child socio-emotional and behavioural problems that are suitable for the target age group and can be utilised as screening instruments. Three of the measures listed in Table 1.2 are commonly used and well recognised screeners of child and adolescent socio-emotional and behavioural problems: the Child Behaviour Check List (CBCL; Achenbach & Rescorla, 2011), the Brief Problem Monitor (BPM; Achenbach et al., 2011), and the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997). The fourth screener, the Me and My School Questionnaire (M&MS; Wolpert et al., 2011) is the only measure that offers a self-reported (child-reported) screening option for children under 11 years. Table 1.2 provides a brief comparative overview of the socio-emotional and behavioural screening measures with respect to the number of items included in each instrument, whether costs are incurred for their use, accepted respondents, and the problem subscales they include.

Table 1.2

Broad Screening Measures of Child Socio-Emotional and Behavioural Problems

Measure	Items	Cost	Respondent	Subscales
Child Behaviour Check List (CBCL)	119-123	Yes	[b] P [c] T 1 ½-5 yrs. & 6-18 yrs. [d] YSR 11-18 yrs.	Int Ext Tot
Brief Problem Monitor (BPM)	19	Yes	P T 6-18 yrs. YSR 11-18 yrs.	Int Ext Att Tot
Strengths and Difficulties Questionnaire (SDQ)	25	[a]Free + Scoring Cost	P T 4-17 yrs. YSR 11-17 yrs.	Int Ext Tot
Me and My School Questionnaire (M&MS)	16	Free for research	YSR 8-12 yrs.	Int Ext Tot

Note: [a]paper version only; [b]Parent/Caregiver, [c]Teacher, [d]Youth self-report. Int = Internalising, Ext = Externalising, Att = Attention, Tot = Total Problems.

As well as being extensively validated, each of these measures have been scrutinised in studies examining the identification of child mental health problems via screening or in systematic reviews of child socio-emotional and behavioural measures (Deighton et al., 2014; Gadeberg et al., 2017; Greco et al., 2016; Halle & Darling-Churchill, 2016; Humphrey et al., 2011; Ivey, 2020; Levitt, 2009; McCrae & Brown, 2018; Moffa et al., 2021; Tarren-Sweeney, 2013; Thabrew, McDowell, et al., 2017). Each of these measures are presented as written surveys and utilise Likert response formats. Measures with both parent and youth versions comprise corresponding item statements. In most cases the informant-rated statements are turned into first-person "I" statements for the youth-rated versions (e.g., "Kind to younger children" becomes "I am kind to younger children"). A brief overview of these measures will be described next, along with their potential as routine screening instruments for 5-11-year-old children specifically.

1.5.1 The Child Behaviour Checklists (CBCL)

The Child Behaviour Checklists (CBCL) are part of the Achenbach System of Empirically Based Assessment (ASEBA) and were some of the first rating scales to measure a broad range of child competencies and emotional and behavioural problems. A "bottom-up" empirical approach was used to develop the original version of the CBCL which began in the 1960s with items and response scales based on previously published literature, child psychiatric case histories, and expert opinions from medical, mental health, and education professionals (Achenbach et al.,

2017, p. 5). The CBCL School-Age Forms & Profiles are suitable for children and youths aged 6-18 years, while five-year-old children are included in separate Preschool Forms and Profiles spanning ages 1½-5 years (Achenbach & Rescorla, 2011). The CBCL forms are described on the proprietary website as an integrated system of multi-informant assessment (ASEBA, 2021a) and are completed by parents or caregivers via the CBCL/6-18 or CBCL-LDS for 1½-5-year-olds. Teachers complete the Teachers Report Form for 6-18-year-olds (TRF) and youths complete the Youth Self-Report Form for 11-18-year-olds (YSR). There is no opportunity for children younger than 11 years to provide self-reported information. The preschool forms obtain parent and teacher/caregiver ratings of problems, disabilities, sleep concerns, 310-word language development survey, and "best things" about the child, and are much more than brief emotional and behavioural screening tools (ASEBA, 2021b).

The CBCL School-Age Forms are quite lengthy with 119 (youth informed) to 123 items (adult informed) and report on children's competency in activities, social relations, and school performance. The 2001 revision of the CBCL provides scores on eight empirically based syndrome scales, and six DSM-oriented scales. The eight syndrome scales are anxious/depressed, withdrawn/depressed, somatic complaints, social problems, thought problems, attention problems, rule-breaking behaviour, and aggressive behaviour. The six DSM-oriented scales are affective problems, anxiety problems, somatic problems, attention-deficit/hyperactivity problems, oppositional defiant problems, and conduct problems. The syndrome scales result in Broad Band Internalising and Externalising Scale scores and Total Problems scores. The TRF has additional items related to school performance, and 14 problem items in the YSR have been replaced with socially desirable items typically endorsed by youths (T. M. Achenbach et al., 2011). For all scores (internalising and externalising problems, total scores, syndrome scales, and DSM-oriented scales), culture-specific norms are provided for normal, borderline clinical, and clinical range scores. There is little difference in the wording between the informant-rated CBCL/6-18 and TRF and self-report YSR apart from being written in the first or third person. The School-Age Forms mostly consist of corresponding statements for adult and youth respondents such as "Argues a lot" / "I argue a lot" and "Cries a lot" / "I cry a lot". Some statements are respondent specific. For example, "Overly anxious to please" and "Unclean personal appearance" along with academic questions appear only on the

TRF and "Wets the bed" and "Wishes to be the opposite sex" along with questions about social habits and family dynamics appear only on the Parent informed CBCL/6-18. All forms utilise a 3-point Likert response scale (0 = "*Not True*", 1 = "Somewhat or Sometimes True", and 2 = "*Very true or Often true"*) to describe the child/youth now or within the past 6 months (Achenbach & Rescorla, 2011; ASEBA, 2021a, 2021c, 2021b).

The proprietary CBCL/6-18, TRF, and YSR paper forms are typically administered and scored by hand for an initial set-up cost of $699AU (to assess 50 children). This cost provides a manual, 50 packs of each form (CBCL, TRF, YSR), hand scoring profiles for boys and girls for each form and scoring templates for each form. Scoring via ASEBA-PC Software costs $975AU and includes a starter kit of 50 administration forms (ACER, 2020b). A new online subscription-based administration and scoring system has just been launched via ASEBA-WEB.org that requires a $140US yearly access fee and package costs of $95-$2,500US for 100 and 5000 e-units or $0.5-1US per form. An e-unit is charged each time a form is created for online completion, printed for manual completion, or uploaded for scoring (ASEBA, 2021a). So, even though a professional is not required to complete the forms; in Australia, a minimum qualification of a master's degree in psychology or a bachelor's degree in psychology plus evidence of postgraduate qualifications in psychometric testing is required to access (i.e., purchase), score, and interpret them (ACER, 2020b).

As reported in the CBCL Manual (Achenbach & Rescorla, 2011), the CBCL forms have been well validated in large samples with ranges of good to excellent internal consistency. For example, the following ranges of alpha coefficients are reported for the syndrome scales in samples of, 1) parents (N = 3210; α = .78, thought problems subscale to α = .94, aggressive behaviour subscale); youth (N = 1938; α = .71, withdrawn/depressed subscale to α = .86, aggressive behaviour subscale); and 2) teachers (N = 3086; α = .72, somatic complaints subscale to α = .95 attention problems, subscale). The Internalising (α = .90) and Externalising (α = .94) broad band scores, and Total Problems score (α = .97) all have excellent internal consistency. Equally excellent alpha coefficients are reported for the youth version broad band scores and total scores (YSR α = .90, .90, and .95) and teacher version (TRF α = .90, .95, and .97). Mean reliability scores were high for the CBCL/6-18 and TRF (r = .90) and slightly lower for the YSR (r = .82) (Achenbach & Rescorla,

2011). Goodman and Scott (1999) suggest that the length of the CBCL forms make them more suitable for research studies or clinical assessments of childhood psychopathology. Despite excellent psychometric properties, some have criticised the CBCL Forms for their tedious and error-prone subjective scoring procedures, duplication of items across scales, and low internal consistency coefficients across age and gender groups (Bose-Deakins & Floyd, 2004). Considering the length of the CBCL Forms, clinical accessibility restrictions, and prohibitive costs of administration and consumable testing materials, the CBCL is better suited to targeted use by mental health professionals rather than routine, broad screening for 5-11-year-old children.

1.5.2 The Brief Problem Monitor (BPM)

In response to the length of the CBCL forms, the Brief Problem Monitor (BPM) was developed as an abridged 19-item screening measure for use in schools, clinical, outpatient, and forensic settings (Achenbach et al., 2011). Comprised of subsets of items selected from the full-length CBCL/6-18 and YSR instruments, the Internalising and Externalising subscales of the BPM were initially developed in isolation using item response theory and factor analysis in a study by Chorpita et al. (2010). In a separate study by McConaughy et al. (2010) the BPM Attention subscale was developed by testing the ability of 10 items common to the CBCL/6-18 and TRF Attention Problems syndrome scale to discriminate between children with and without an ADHD diagnosis using stepwise discriminant analyses. From this analysis, they retained five items. A third study performed independent confirmatory factor analyses, which supported retaining the five items resulting from the discriminant analyses and in adding a sixth item “Acts too young for age” to form the current BPM Attention subscale (Dumenci et al., 2004).

The BPM assesses functioning on Internalising, Externalising, Attention, and Total Problem scales (Achenbach et al., 2011). Separate forms are completed by parents (BPM-P) and teachers (BPM-T) at two age levels (6-11 and 12-18-years), and by youths aged 11-18 years (BPM-Y). Once again, there is no opportunity for children younger than 11 years to provide self-reported information. Older youth and adult respondents are asked to read similarly written brief statements such as “I argue a lot” / “Argues a lot”, “I have a hot temper” / “Temper tantrums or hot temper”, and “I threaten to hurt people” / “Threatens people”. Spaces are provided for respondents to write additional problems or comments on the statements which they are asked to

rate on a 3-point Likert scale as to whether the described behaviour is "*Not True*" (0), "*Somewhat True*" (1), or "*Very True*" (2) for them at user-selected periods of days, weeks, or months. Scoring for the BPM is via a proprietary BPM Software program. Scoring output includes cross-informant scale scores in bar graphs that indicate standard scores (*T* scores) based on the applicable multicultural norms for individual gender, informant, and age groups (Achenbach et al., 2011). Individual interpretation of each scale is required; however, *T* scores are provided for each scale with scores <65 in the normal range and *T* scores ≥65 considered elevated (Achenbach et al., 2011).

The reliability and validity of the BPM has been extensively examined with demonstrated high internal consistency overall (Cronbach's alpha (α = 0.91) and satisfactory scores for the Internalising (α = .78), Externalising (α = .86), and Attention (α = .87) scales (Piper et al., 2014). High correlations between the CBCL and BPM were identified for the Total score (r = .95), Internalizing (r = .86), Externalizing (r = .93), and Attention (r = .97) scales (Achenbach et al., 2011, 2017). Such high correlations would be expected considering the BPM items were derived from the CBCL items. The BPM manual states that "many children younger than 11 may be able to complete the BPMY-Y" by themselves or via interviewer (Achenbach et al., 2011, p. 2), however psychometric information is not reported, so its reliability and validity for this younger age group are unknown. In Australia the proprietary BPM can be purchased at a cost of $790AU for a starter kit of 50 paper administrations of each form with hand scoring or a BPM 6-18 Software CD-ROM for PC can be purchased to automate scoring for an additional $270AU (ACER, 2020a). Like the CBCL, professionals are not required to complete the forms but a minimum qualification of a master's degree in psychology or a bachelor's degree in psychology plus evidence of postgraduate qualifications in psychometric testing is required to access (i.e., purchase), score, and interpret them (ACER, 2020b). Such professional administration requirements, costs, and lack of self-report option for younger children may exclude its potential use as a routine screening tool for 5-11-year-old children for wide implementation.

1.5.3 The Strengths and Difficulties Questionnaire (SDQ)

The Strengths and Difficulties Questionnaire (SDQ) is a 25-item instrument divided into five scales, that may be used in clinical assessment, as a treatment-outcome measure, and as a research tool (Goodman, 1997). The SDQ is presented as

a written survey and screens for the presence and impact of Emotional Symptoms, Conduct Problems, Peer Relationship Problems, Hyperactivity/Inattention, and Prosocial Behaviour. Respondents are parent and teachers for assessing 4-10 and 11-16-year-olds, and a self-reported version is validated for completion by youths aged 11-18-years (Goodman, 1997). Again, there is no opportunity for children under the age of 11 years to provide self-reported information via this measure. The SDQ items and subscales were developed by Dr Robert Goodman via a top-down approach based on child mental health diagnostic categories classified by the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; American Psychiatric Association, 1994) and the *International Classification of Diseases* (10th ed.; World Health Organization, 1992; Vaz et al., 2016).

Like the CBCL and BPM forms, adult and youth respondents completing the SDQ measures are asked to read and respond to similarly written brief statements that describe behaviours. For example, the statements "Restless, overactive, cannot stay still for long" and "Often unhappy, depressed, or tearful" from the parent and teacher forms are equivalent to "I am restless, I cannot stay still for long" and "I am often unhappy, depressed, or tearful" on the youth reported form. All respondents are asked to rate each statement on a 3-point Likert scale based on behaviour over the past six months or school year, where 0 = "*Not True*", 1 = "*Somewhat True*", and 3 = "*Certainly True*". Twenty items are coded as stated, while items 7 (Conduct scale), 11 and 14 (Peer Problem scale), 21 and 25 (Hyperactivity scale) are reverse scored. An Internalising subscale is summed from the Emotional Symptoms plus Peer Problem scale scores and an Externalising subscale is summed from the Conduct Problem plus Hyperactivity scale scores. A Total Difficulties score ranging from 0-40 is the summation of all four difficulties scales.

The SDQ scale scores are divided into three bands that classify children into the highest 10% (abnormal), the next 10% (borderline), and the remaining 80% (normal) (Goodman, Meltzer, et al., 2003). The scoring bands suggest "high", "medium" and "low" levels of difficulties based on cumulative frequency distributions (Biel et al., 2015). According to Goodman and Scott (1999), the SDQ highly correlates with the CBCL and when judged against a semi-structured interview, the SDQ equals the CBCL at detecting internalising and externalising problems and is better at detecting attentional problems. For screening purposes in community samples, the authors state that multi-informant SDQs (parent, teacher,

and youth) can predict the presence of a psychiatric disorder with good specificity 94.6% (95% CL, 94.1-95.1%) and moderate sensitivity 63.3% (range 59.7-66.9%) (Goodman, Ford, et al., 2003; Goodman et al., 2000). With multiple informants the SDQ is able to identify 70% of youth with conduct, hyperactivity, depressive, and some anxiety disorders, but less than 50% of youth with specific phobias or separation anxiety, and sensitivity is substantially poorer if a single informant is used (Goodman, Ford, et al., 2003).

There is no professional qualification required to administer or access the SDQ form and individuals and non-profit organisations providing free services are permitted to download and print paper versions of the SDQ for free via the proprietor's website (i.e., youthinmind.com). However, a license is required to create or distribute electronic versions for any purpose and a 'per unit used' cost is applied. Further, the distributers of the SDQ youth*in*mind actively discourage users from hand scoring the SDQ paper forms and state that doing so will generate an inferior report and be prone to error (Youthinmind, 2020). Therefore, a license is also required for scoring the SDQ by computer with software such as SPSS. Alternatively, scoring may be completed via the youth*in*mind scoring website (i.e., https://sdqscore.org/) at a cost of $1.00US per unit which includes a report. Such professional scoring requirements and costs, and the lack of a self-report option for younger children may reduce its feasibility as a routine screening tool for 5-11-year-old children.

1.5.4 The Me and My School Questionnaire

Considering children offer valuable and unique perspectives, the importance of capturing all children's perspectives via developmentally appropriate formats is necessary. The only broad screening tool to offer a self-report option for children younger than 11 years is the Me and My School (M&MS) questionnaire. The M&MS is a 16-item school-based measure comprising ten brief internalising problem statements and six externalising problem statements (Deighton et al., 2013). Emotional subscale statements include "I feel scared", "I worry when I am at school", "Nobody likes me", "I have problems sleeping" and "I cry a lot". Behavioural subscale statements include "I lose my temper", "I do things to hurt people", and "I break things on purpose". Children are asked to read the written statements and choose the response that best describes how they feel from a 3-point Likert scale, where 0 = "*Never*", 1 = "*Sometimes*", and 3 = "*Always*". Item 15 ("I am

calm") which is on the externalising subscale is reverse scored. The first 10 items are summed to produce an Emotional Difficulties subscale score (range 0-20) and the remaining six items form the Behavioural Difficulties subscale (range 0-12) giving a Total score range of 0-32. Deighton et al. (2013) established cut-off scores using the SDQ where scores above 12 on the Emotional subscale and above seven on the Behavioural subscale are indicative of clinically significant difficulties.

With a focus on usability by younger age groups and their more limited reading capacity, the initial pool of items in the M&MS were developed based on a review of outcome measures by Wolpert et al. (2008, as cited in Deighton et al., 2013) and an analysis of emotional and behavioural scales (Deighton et al., 2013). The authors of the M&MS then went one step further and conducted focus groups with children to determine which items were best understood by them. The specific outcomes of the focus groups are not reported, so how the feedback was incorporated is not clear. The questionnaire can be downloaded for free via the Child Outcomes Research Consortium website (https://www.corc.uk.net/) however, a license may be required for use outside of England depending on how it will be used. The M&MS is reported to have good internal consistency ($\alpha = 0.72$ emotional subscale and $\alpha = 0.78$ behavioural subscale) and good convergent validity with the corresponding emotional ($r = .67$, $p < .001$) and conduct ($r = .70$, $p < .001$) subscales of the SDQ (Deighton et al., 2013; Patalay et al., 2014). The M&MS has been validated to use with children as young as eight years old and can be completed by children in less than 10 minutes (Deighton et al., 2013). Though the statements are short and outwardly simple, their written format still requires reading and cognitive abilities that possibly preclude the youngest of primary-school-aged children from utilising this measure.

Instrument Summary. Even though the CBCL, BPM and SDQ are excellent, well validated measures that show good psychometric properties in older youth and with multiple informants and the M&MS has made excellent strides towards obtaining data from younger children, several factors limit their potential for universal or routine screening of younger children (5-11 years). In practical terms, the need for multiple informants for the CBCL, BPM, and SDQ, requires coordinating data collection from pairs of parents and teachers. Given how time-poor and over-burdened teachers already are with non-teaching tasks and large class sizes (McGrath-Champ et al., 2018), it would likely not be feasible to expect teachers to

take part in routine screening and complete measures for every one of their students. In addition, each of the measures require professional scoring or interpretation of results which incurs additional time, personnel, and labour costs on top of the fees to purchase or score the measures. Based on available estimates and depending on the measure and the clinical expertise of the professional, it may cost anywhere from $100 to $500AU for a child to complete screening. In summary, the CBCL is too long, and the BPM, SDQ, and M&MS each require somewhat burdensome or potentially costly administration, scoring or professional interpretation, and most importantly, lack self-report options for all primary-school-aged children (5-11 years). Therefore, cost-effective, and less organisationally intensive methods are needed that are 1) more feasible to implement at a broad level, and 2) do not depend on proxy informants but rather utilise self-reported information from the children themselves.

1.6 Digital Instruments for Children

Digital technologies have increasingly been utilised over the past decade to increase accessibility to mental health information, support, and interventions. Parents of children already seek and use mental health support for their children online, as do children themselves via websites such as kidshelpline.com and beyondblue.org.au and internet-based interventions such as the BRAVE Program for the prevention and treatment of child anxiety (Lawrence et al., 2016; March, Spence, et al., 2018). A recent systematic review demonstrated increasing use of internet enabled mobile devices and tablets by children at school and at home (Thomas et al., 2020). Statistics show that at least 97% of Australian households with children aged under 15 years have access to the internet with an average of 7.8 devices per household (e.g., computers, smart phones, tablets, internet connected TV's and games consoles) (Australian Bureau of Statistics, 2018). Therefore, it is not surprising that children begin interacting with digital media as young as four months of age and toddlers are using mobile devices on a daily basis (Kabali et al., 2015). Such inherent use of devices means that by the time children reach school, digital devices are seen as essential and ever-present sources of information, entertainment, and communication (Chassiakos et al., 2016).

In an attempt to overcome some of the challenges of assessing younger populations with more traditional methods, digital technologies have been applied for the problem of increasing children's engagement with and understanding of

psychometric assessments. A computer-administered version of the SDQ with added colourful graphics was pilot tested in 2001 for children aged between eight and 15 years. It reportedly demonstrated some evidence of clinical sensitivity (in children 11 years and older), higher user satisfaction ratings, and improved engagement compared to the standard pencil-and-paper version (Truman et al., 2003). No other information is available regarding this adaptation, and it seems further development has not continued. Another attempt at digitising a paper-based measure is the Dominic Interactive (DI). The DI is a computerised adaptation of the paper-based Dominic-R which was designed to assess self-reported, internalised mood states (feelings) in 6-11-year-olds (Kuijpers et al., 2013). The DI reads item questions to the child via a voice-over to remove the need for an adult interviewer and supplements its 91 written items with exemplar drawings to overcome the limited verbal and reading abilities of children (Kuijpers et al., 2013). The DI items were originally developed for the Dominic-R via a top-down approach based on the DSM-IV diagnostic criteria (APA, 1994) and measures seven common mental health problems of primary school children: Specific Phobia, Separation Anxiety, Generalised Anxiety, Major Depressive Disorder, Oppositional Defiant Disorder, Conduct Disorder, and ADHD. The drawings in the original Dominic-R were designed by adults to depict situations based on DSM-III-R criteria (APA, 1987) and evaluated by 36 children who were asked to explain what they saw in the drawing to determine their accuracy (Valla et al., 2000). Adults judged whether the children's explanation reflected the intention of the drawing, and images were retained or redrawn based on how accurately they were interpreted. Various studies evaluating the psychometric properties of the DI found its reliability was not always satisfactory; however, concurrent use with several instruments have reportedly demonstrated moderate to good convergent validity (Epstein, 2000; Shojaei et al., 2009). A Dutch study examining the factor structure could not support the theorised underlying factor structure due to internalising items from some scales loading onto theoretically incorrect externalising factors, but a later study confirmed the seven-factor structure in a larger sample (Kuijpers et al., 2014; Kuijpers et al., 2013). Despite its somewhat mixed psychometric properties, the DI is described as easy and enjoyable for children to use who respond to questions by clicking on "*yes*" or "*no*" boxes which are automatically recorded and analysed by the program.

The Mood Assessment via Animated Characters (MAAC) was an anxiety screener for young children (4-11 years) that was specifically designed in a digital format to overcome the limitations of language-based assessment for younger children (Manassis et al., 2013). The MAAC assesses internal distress via self-comparison to an animated female character named Teena. The animated format was chosen because children are able to "*read"* animated emotions and identify social emotions more readily when provided with visible situational cues (Manassis et al., 2013, p. 150). To complete the MAAC, children were to indicate how they were feeling by tapping an image of Teena's face that best represented their own. Tapping the image caused a full-sized version of the Teena character to briefly animate and demonstrate the chosen emotion. The children were then asked to indicate how closely their own feelings matched the feeling demonstrated by the animation by ticking a cross for 'no match' or up to five checkmarks for a 'perfect match' (Manassis et al., 2009). The authors sought qualitative feedback from children when designing the Teena character to ensure that the emotions she represented were recognisable and appealing and developed the digital interface via an iterative prototyping workflow (Manassis et al., 2009). The MAAC was reported to be highly engaging for children who found it "fun"; initial psychometric evaluation supported convergent validity with some standardised anxiety measures and demonstrated clinical utility in distinguishing anxious from nonanxious children (Manassis et al., 2009, 2013). There are no other details on the development or outcomes of the MAAC and it does not appear to have been developed further.

Though two of these measures did not progress further, the apparently high levels of engagement support the premise that using digital methods for the assessment of younger children is acceptable. In addition, the available psychometric data demonstrates that pictorial representations of scenarios and contextual animations do overcome some cognitive limitations of younger children and have potential to increase younger children's understanding of assessment items. Advances in technology and the widespread availability of relatively low-cost animation and app-building software also means that the development of digital tools is more accessible to researchers interested in pursuing such methods. There are currently no well-validated self-report instruments of any type for young children under eight years and certainly no digitally delivered self-report screeners for emotional and behavioural difficulties that are suitable for primary school children

aged five through 11 years. Considering children are so technologically savvy and their digital literacy skills are only growing, a digital screening tool should be well received and more feasible to implement in community settings if it can be designed to be low-cost and not require specialist administration or interpretation.

1.7 Conclusion

Behavioural and emotional problems in children are not uncommon and can be a precursor to long-term mental health disorders such as depression, anxiety, and behavioural conditions (Levitt et al., 2007). The prevalence of mental health needs for children worryingly outpaces access to care, so it is essential to interrupt progression and prevent delays to treatment (Arora et al., 2016). Universal mental health screening of children is rarely implemented in routine practice despite its potential to identify problems early, alter the trajectory of disorder development and minimise social, emotional, and economic burden (Lynch & Clarke, 2006). This may be due to several factors that compromise the utility and wide-spread use of existing emotional and behavioural distress screening instruments. Some of these factors include lengthy, costly, and unfeasible administration requirements, and a lack of brief, self-guided options for children that might overcome some of these issues. Innovative screening tools that don't rely on the verbal or cognitive abilities of young children will likely assist with the detection of mental health symptoms to aid prevention. Due to such widespread use of digital devices and the uptake of online mental health supports, an open access, engaging, and animated digital screening instrument such as the proposed ICDS may be a viable alternative to increase screening opportunities. This research aims to overcome some of the limitations of current methods, advance attempts towards self-reported screening instruments for young children, and ultimately promote early detection of emotional and behavioural difficulties.

1.8 Overview of the Present Research

The objective of this research is to take steps towards increasing the detection rates of emotional and behavioural difficulties in children to facilitate prevention of mental health disorders. To do this, it will develop an innovative, self-report, broad instrument designed to detect early symptoms of emotional and behavioural difficulties in primary school children. The ICDS aims to increase mental health assessment opportunities for children by addressing some of the limitations that impede more widespread use of existing screening tools in the community. The

proposed ICDS will be the first self-reported broad screening tool for primary school children aged 5-11 years and the first to utilise animated assessment items co-designed with children in what is expected to be a highly accessible and acceptable web-based modality to capitalise on children's growing digital literacy skills.

After establishing the feasibility of the concept, the specific aim of this research program is to develop and validate digitally animated assessment items for a highly accessible, rapid, and cost-effective animated screening instrument. It is expected that the instrument will be meaningful to children and be able to capture self-reported distress. The proposed instrument differs from available instruments in several ways. First, it will be able to broadly assess for emotional and behavioural difficulties in all primary school-aged children from prep through to year 6 via child-self-report. With the exception of the M&MS questionnaire, this is in stark contrast to all other broad measures which require proxy respondents to report on behalf of any child under 11 years. Second, the ICDS will utilise short, animated cartoons to convey item content in a manner that is familiar and engaging to young children and does not require verbal or reading skills. Third, development will incorporate an iterative and participatory co-design approach with children during item development to capture the child's perspective for optimal understanding. Finally, the ICS will use a digital web-based platform that will be open-access (i.e., free) and therefore highly accessible which should increase screening opportunities for detection.

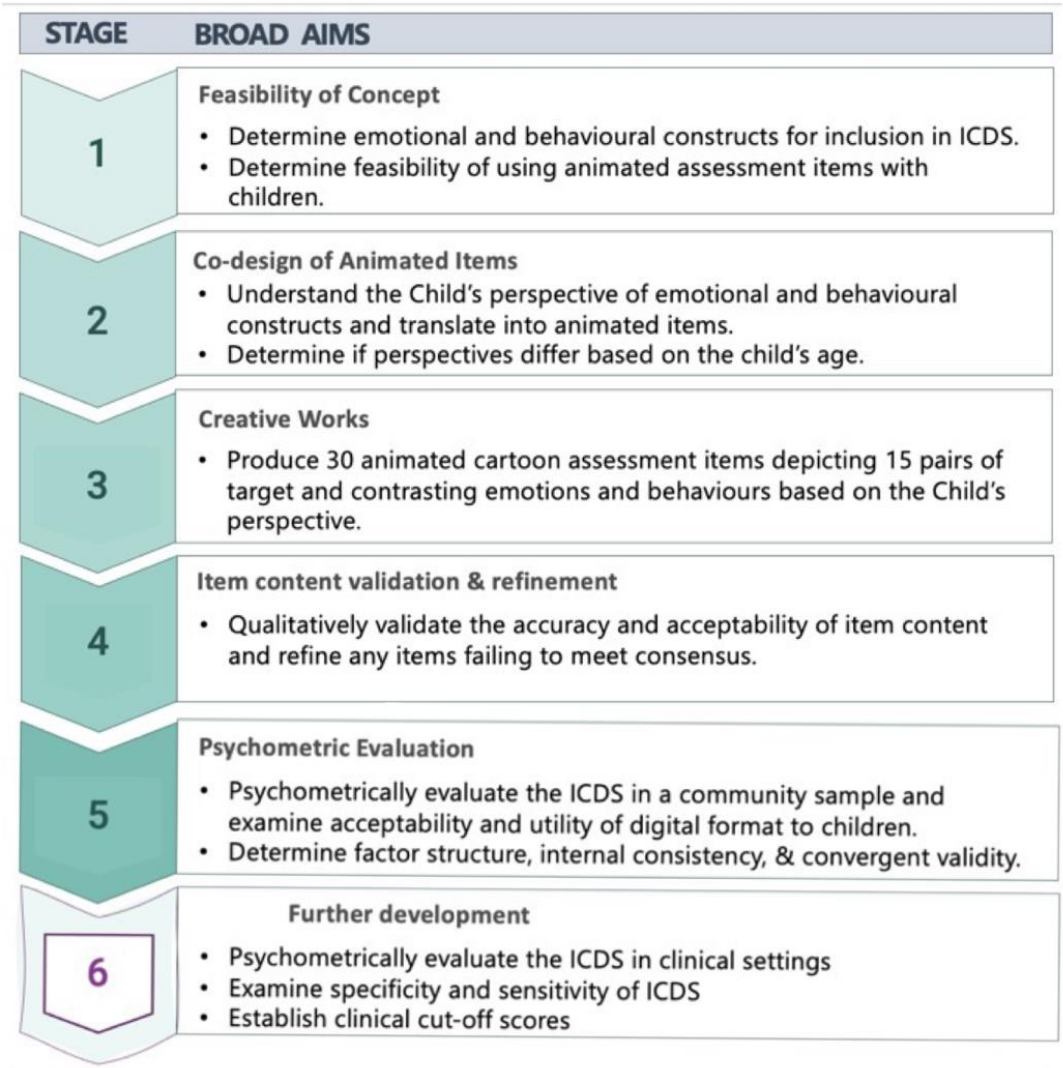
In summary, the ICDS has the potential to obtain valuable self-reported data from children using a method that is acceptable and meaningful to them, and ultimately, to assist in the detection of those at risk of emotional and behavioural mental health problems. This staged research program will develop the entire ICDS instrument with children and conclude with a preliminary psychometric evaluation as the first stages in establishing this instrument. The following research questions will be answered through a series of studies.

1.8.1 Research Questions and Instrument Development Stages and Studies

The following section provides an overview of the stages of scale development and the aims and research questions of each related study in this research program. The research questions are exploratory and apply to Studies 1 - 4. Hypotheses apply to Study 4 only. Figure 1.2 outlines the stage of development, associated study and general aims in brief.

Figure 1.2

Stage of Scale Development, Associated Study and General Aims



Stage 1 – Study 1: Feasibility of Concept. This first stage will comprise of two studies. The first study will determine which emotional and behavioural problem domains should be included in the proposed screening instrument. An expert panel of researchers and psychologists will review the relevant domains and develop a potential item pool. For the second study, three pairs of contrasting animations will be created to demonstrate three assessment items. The feasibility of using such animations as assessment items will be determined via interviews with a community sample of children aged four to 12 years.

1. What domains are important for inclusion in a broad emotional and behavioural screening instrument for children?
2. Can children accurately understand and recognise the target and contrasting emotional and behavioural constructs when presented in animated format?

Stage 2 – Study 2: Codesign of Animated Item Content. The principal aim of this stage will provide data from which the remaining animated items will be created. This study will utilise qualitative methodologies, including semi-structured individual and small group interviews and focus group techniques. Questions will gather insight into the child's perspective to obtain representative exemplars of the children's comprehension of the emotional and behavioural constructs intended for inclusion in the ICDS and determine: 1) how children understand, recognise, describe, express, and display each of the targeted and contrasting emotional and behavioural constructs and 2) if perspectives differ based on the child's age.

3. How do primary school-aged children understand, recognise, describe, express, and display emotional and behavioural constructs?
4. Does age influence how children understand, recognise, physically express, and describe target emotional and behavioural constructs?

Stage 3: Production of Original Prototype Animation Suite. This stage will involve the practical creation of prototypes of the entire animation suite of 30 individual animations. The raw data and results of Study 2 will be collated and translated by the researcher into storyboard scripts from which an animation artist will create the animations. This process requires an iterative codesign collaboration between the researcher and an animation artist.

Stage 4 - Study 3: Validation and Iterative Refinement of Animated Item Content. The principal aim of this study will be to qualitatively validate the content accuracy of the animated items and determine their acceptability with children. A second aim will be to facilitate refinement of any items that fail to reach acceptability parameters determined a priori. Again, this stage of development will utilise an iterative codesign collaboration between the researcher and the animation artist based on child participant responses.

5. Do the animated items developed for the ICDS accurately represent the target and contrasting constructs, and are they acceptable to children aged five through 11 years?

Stage 5 - Study 4: Preliminary Psychometric Evaluation. The principal aim of the final stage of development will be to psychometrically evaluate the ICDS instrument in terms of its ability to measure emotional and behavioural constructs and examine its acceptability and utility. This study will implement a cross-sectional

survey in a large community sample of parent and child dyads and follow the principles of classical test theory.

6. Is the ICDS a reliable and valid instrument for assessing emotional and behavioural constructs in children aged five to 11 years?

Hypotheses. The hypotheses presented below apply to Study 4 only. Failure to support any of these hypotheses will suggest that further refinements are required to the ICDS instrument before deployment. Assuming the ICDS instrument is valid, it is expected that:

1. The ICDS animated items will demonstrate high levels of acceptability and utility for a brief assessment instrument as reported by primary-school children aged five to 12 years.
2. The ICDS will demonstrate structural validity, showing a clear unidimensional factor structure identified through exploratory factor analysis (EFA) in a community sample.
3. The ICDS will demonstrate convergent validity with moderate to strong correlations (r = > 0.50) with the child-rated Me and My School questionnaire and small to moderate positive correlations with traditional parent-rated instruments developed to assess equivalent constructs (i.e., the Strengths and Difficulties Questionnaire, Brief Problem Monitor).

A comprehensive figure providing an overview of this research program, including reference to the study sample sizes and methodologies is included at the conclusion of the Methodology chapter (i.e., Figure 3.3. on page 52). This figure will be expanded upon and referred to in each chapter of this thesis to assist with illustrating the process of work and the flow of studies conducted.

1.9 Format of Thesis

This thesis is presented in the format of a Thesis by Publication. The fundamentals of instrument design and development are described next in Chapter 2. Chapter 3 summarises the research design and methodological procedures utilised throughout this research program, including the approach to codesigning a psychological instrument developed with children. The published manuscript describing the feasibility of the animated concept (Study 1) is presented in Chapter 4. Chapter 5 presents the published manuscript describing the findings of Study 2. Chapter 6 explains the animation production process in detail, which represents Stage 3 of this research. Chapter 7 includes the published manuscript describing the

qualitative evaluation of the animated items (Study 3), and Chapter 8 presents the manuscript submitted for publication describing the initial psychometric evaluation of the ICDS instrument (Study 4). Lastly, an overall discussion of the entire research program is presented in Chapter 9, including an overview of the findings, strengths and limitations of the research, implications, suggestions for future research and conclusions. Clinical cut-off scores and sensitivity as a screening instrument will not be established until psychometric evaluation of the instrument occurs in a clinical sample of child participants. This stage will not form part of this thesis.

CHAPTER 2: DESIGN, DEVELOPMENT, AND EVALUATION CONSIDERATIONS

2.1 Overview of the Chapter

This program of research aims to develop and evaluate a robust, animated, self-report assessment instrument for children: the Interactive Child Distress Screener. In the context of developing the ICDS, two fundamental, but distinct concepts must be considered. First are the general steps in test construction and the established conventions of psychometric analysis that apply when developing any psychological measurement instrument. Second are the participatory codesign methods that apply when constructing such a novel digital instrument for children (Greene & Hogan, 2011). This chapter will begin by firstly describing general models of test development and how they guided this program of research. This will be followed by a summary of psychometric measurement from the perspective of classical item analysis as related to the validation of the ICDS instrument in this research. The second half of the chapter will describe participatory co-design approaches with children and the importance of including the child's perspective as related to item design and development when a digital instrument is being designed for use by children. Both are crucial to this program of research.

2.2 General Models of Test Development

The design and development of the ICDS and this overall program of research will be guided by empirically based general models of test development (DeVellis, 2017; Furr, 2011; Netemeyer et al., 2011c; Reynolds & Livingston, 2019). General models of test development describe scale construction as a stepped approach. A comprehensive general model will assist test developers with decision making and planning out every step of the development process. Though no two models are the same, they will typically include some direction on, 1) articulating the testing constructs and context; 2) choosing an appropriate response format and assembling the initial item pool; 3) collecting data from respondents; and 4) examining the test's psychometric properties and quality (Furr, 2011). Common across all models is the recommendation that a researcher creating a new instrument must begin by articulating the test context which includes nominating the intended user of the test and the likely administration context (Coaley, 2010; DeVellis, 2017; Furr, 2011; Reynolds & Livingston, 2019). The intended user is central to good test design and development. Once the user of a test is established it will dictate all

decisions that are subsequently made about item format, administration methods, response formats, and interpretation (DeVellis, 2017; Furr, 2013; Kaufman, 1980; Netemeyer et al., 2011c; Stickle & Weems, 2005; Stoyanov et al., 2016).

The general model of test development described in The Handbook of Psychological Assessment is comprehensive and partitions development steps into four broad design stages. These include: 1) Test Conceptualisation; 2) Specification of Format and Structure; 3) Specification of Psychometric Studies; and 4) Plan Implementation (Reynolds & Livingston, 2019). The following provides an overview of these steps, as described by Reynolds and Livingston (2019). Test conceptualisation involves articulating the target population for the test, the constructs it will be measuring, how it will be administered and who will be administering it. Specifying the test format and structure involves the many decisions to be made regarding the length of the test, the number of items to include, the most suitable response format, and most importantly planning the methods for item development. These decisions will be impacted by age of the target population and the presentation format of the test. Psychometric testing is the third stage of instrument planning and involves evaluating the items and scale in a sample of the intended test population and includes initial estimates of dimensionality, reliability, and validity. These terms will be discussed in more detail below. At this stage of test construction decisions are made regarding the performance of items. Some items may be refined whilst redundant items may be removed based on statistical results. Once the items of a scale are finalised then a developer must establish administration recommendations and norms across samples from relevant populations. Final steps include planning the implementation of the scale for wider use. This phase requires a developer to prepare a test manual with administration, scoring, and interpretation instructions and publishing the test for use by others.

Regardless of the type of test being constructed, general models of test development will favourably inform psychological test development and are essential in planning the development of an instrument (DeVellis, 2017; Furr, 2013; Netemeyer et al., 2011c). This program of research was designed and implemented according to Reynolds and Livingston's (2019) comprehensive general model of test construction. The specific steps that are applicable to the ICDS are outlined in Chapter 3 which describes the methodology of this research. Once the appropriate steps of instrument development are planned in line with theory, it is subsequently

important to consider theories of instrument testing in order to inform the specific approach to validating the instrument's psychometric properties. The following section describes such theories.

2.3 Psychometric Testing

In the behavioural and social sciences, both examiners and respondents must be able to trust that available assessment instruments accurately measure what they intend to measure. An inadequate scale limits the validity of any conclusions an examiner might reach from its scores and can lead to incorrect decisions being made (DeVellis, 2017). As outcomes of clinical decision making can have far-reaching implications for a client, psychometric development and evaluation of an instrument must be the foundation of ethical psychological test construction. To that end, this program of research must involve scientific examination of the ICDS scale. Classical Test Theory (CTT) is regarded as a simple, robust model that provides a foundation for measure development via established psychometric principles, concepts, and methods. It is particularly suitable for testing measures of constructs that are not directly observable (DeVellis, 2006), such as children's subjective experiences of emotions or behaviour. This approach was chosen because the estimation of CTT models is conceptually straightforward, the analytic techniques are robust, and relatively small samples are acceptable for CCT assumptions (e.g., N = 100-300) (Hambleton & Jones, 1993; Kline, 2014).

2.3.1 Classical Item Analysis

Classical item analysis is based on Classical Test Theory (CTT). Classical test theory is also known as true score theory and involves assumptions about the relationships between observed test scores and factors that affect scores (Kean et al., 2014). As is commonly understood, the classical measurement model asserts that an observed score (X) is determined by the true score of the unobservable variable of interest (T), plus error (e): $X = T + e$ (DeVellis, 2017; Kean et al., 2014). In this equation X represents the actual score an individual receives on the measure, T represents a hypothetical true score of the individuals' genuine attitude or mood etc., obtained over an imagined infinite number of repeated tests; and *e* represents a score of expected error in measurement

Understanding error is an important component of CTT and its assumptions. Error increases the variability of responses, but it is expected because it is randomly introduced by individual respondent factors such as misreading items, being tired or

upset during test taking, or guessing etc. However, because this error is random and is independent from the error of other items on the measure, the combined error theoretically cancels itself out and has little to no effect on the true score (DeVellis, 2017; Kline, 1995). The implicit CTT assumptions are that; 1) all items contribute equally to the overall scale score, 2) response options have equal intervals, 3) error applies equally to all scores *across* the measurement continuum and 4) errors are not correlated with the true score and have a mean of 0.0 when aggregated across large numbers of respondents (DeVellis, 2017). The assumptions of CTT are key to this process of reducing error and enhancing the relationship between observed scores and true scores.

A limitation of CTT is that it is sample dependent, therefore the utility of item statistics is reduced if the testing sample differs from the intended test population (Hambleton & Jones, 1993). In light of this, and in the understanding that there is inevitable variance between how younger and older children respond, it will be important to test a measure being designed for children with a sample of children that comprises adequate representation across the intended age span. Other fundamental concepts that are closely tied to CTT and its assumptions are dimensionality, reliability and validity (DeVellis, 2017). As described below, dimensionality is initially determined via Factor Analysis. Item and scale reliability are typically assessed via three primary methods: internal consistency, test-retest-reliability, and parallel forms (i.e., measuring correlations between different versions of equivalent tests). Guided by CTT it is expected as good practice to conduct comprehensive psychometric testing on any new measure.

2.3.2 Analyses Within CTT

Dimensionality. In addition to the assumptions already discussed, CTT assumes that both the items or sets of items that constitute a scale are unidimensional (DeVellis, 2017). The dimensionality of a scale is defined as the number of latent variables needed to account for the correlation among a set of items (Netemeyer et al., 2011a). For example, a unidimensional scale would comprise of items all related to one dimension or factor. A multidimensional scale would comprise of sets of related items creating two or more factors where each set of items might measure facets of depression. Factor analysis tests the structure of a scale and determines how many dimensions represent the constructs being measured (Cai, 2013). Exploratory Factor Analysis (EFA) is the most common method of evaluating the dimensionality

of a scale in the initial phase of test construction (DeVellis, 2017). An EFA further identifies which items are performing poorly and may need removal or refining, which empirically supports the reliability and validity of a scale (Cai, 2013; DeVellis, 2017). A detailed discussion of the specific statistical procedures required to perform EFA can be found in cited literature (Cai, 2013; DeVellis, 2017; Kean et al., 2014; Kline, 2014; Netemeyer et al., 2011c). For a measure that aims to screen for emotional and behavioural distress in children it is expected that one to three factors might be extracted from the ICDS items based on the factor structure of the original measures that the assessment domains were drawn from. These measures were the SDQ (Goodman, 1997), BPM (Achenbach et al., 2011), and M&MS (Deighton et al., 2013). Potential ICDS factors include one factor measuring overarching distress or two individual factors representing emotional distress and behavioural distress separately, plus a third potential factor representing items assessing attention and hyperactivity.

Reliability. Reliability refers to the consistency of measurements. That is, a reliable scale will produce measurements that will not change significantly unless there has been a change in the subject that is being examined (Sattler & Hoge, 2006). In psychometrics, reliability can be defined as the extent to which variability in observed scores are consistent with true score variability (DeVellis, 2017). That is, the reliability of test scores increases as the proportion of error variance in the test score decreases. The conventional method for estimating the reliability of an instrument is by examining the homogeneity or internal consistency of the items within a scale and is determined by how highly the items are correlated to one another (DeVellis, 2017; Netemeyer et al., 2011b). Internal consistency is typically computed as coefficient alpha statistic (α) but for dichotomous variables, can be computed as ordinal omega (ω) which provides a more accurate estimate of reliability (Gadermann et al., 2012). DeVellis (2017) suggests coefficient alpha values between .70 and .80 to be respectable; between .80 and .90 to be demonstrative of very good reliability, and when much above .90, to shorten the scale. Though a lengthy scale might increase its reliability, it does not justify increasing burden on respondents.

Validity. Validity describes whether an item or a scale measures what it is designed to measure (DeVellis, 2017). There are several methods for evaluating whether the construct a scale was intended to measure corresponds to the items and

scale developed. These fall into three broad categories: content validity, criterion-related validity and construct validity. Content validity is the degree items within a measure represent the domain being assessed (Sattler & Hoge, 2006). Content validity may be informed by theoretical and empirical literature and supported by expert verification that items included in a measure are appropriate and representative of content that is relevant to the construct the instrument is being designed to measure (DeVellis, 2017). Criterion-related validity is composed of convergent validity, discriminant validity, concurrent validity, and predictive validity (Furr & Bacharach, 2008). Convergent and discriminant validity are demonstrated when a measure is similar to another measure that it should theoretically be related to and dissimilar to another measure it should not be theoretically related to, respectively (Furr & Bacharach, 2008). This is calculated by correlating or regressing scale scores with other proven indicators of the underlying construct being assessed and with measures that theoretically should be unrelated to the underlying construct being assessed. For instance, for the ICDS to show respectable convergent validity, it should relate highly to other validated measures of broad emotional and behavioural distress such as the Parent-rated SDQ and BPM. Much like convergent validity, concurrent validity is described as the ability for a measure to relate to relevant variables measured at the same time as the primary measure being evaluated (Furr & Bacharach, 2008). Predictive validity, on the other hand, assesses how well an item or set of items predicts a future outcome. Thus, concurrent and predictive validity can be considered a subtype of convergent validity. The validity of a scale is also sample specific meaning validity in one population does not automatically generalise to dissimilar samples. Additionally, the ICDS may not adequately discriminate between healthy and other clinical samples on symptoms of distress. Therefore, comprehensive item and scale validity needs to be tested using the above methods in a variety of samples, including clinical and non-clinical samples, to provide convincing evidence of strong validity. Initial item and scale validity testing would target these methods in a staged manner.

This synopsis of scale development and validation has described key steps in comprehensively planning and evaluating a proposed screening instrument as well as the tenets of Classical Test Theory that this program of research is grounded in. However, it must be acknowledged that scale development is dependent on the purpose of the research, the end-users of a scale, and resources available to aid

development. Therefore, the precise steps will vary from study to study and adaptations may be required based on unfolding results as development progresses. This program of research will focus on establishing the core psychometric properties of the ICDS. That is, establishing scale dimensionality, internal consistency, content validity, and convergent validity in a general population of children aged 5-11 years. More specific details of the analytic approach are described in Chapter 3. But first the concepts of participatory codesign and iterative prototyping, which are central to the development of digital instruments for children, will be discussed.

2.4 Including the Child's Perspective with Participatory Codesign – Children as Experts

Historically, children's perspectives have been under-represented within research programs and measurement tools. The conventional approach to researching children's experiences has been to observe them and make subjective judgments or to question the adults in their lives (Darbyshire et al., 2005). When children are not involved in research that is about them, researchers may misperceive the needs and interests of children and their welfare (Hill, 2006). Society's views on childhood have progressed and research is now far more inclusive of their experiences and child-centred methods of inquiry aim to empower and give voice to children (Clark, 2010; Hagen et al., 2012). One way to do this is to invite children to be a part of the research team. In the field of youth mental health, there is increasing value being placed on including children's perspectives and recognising that young people are the experts in their own lives. Orygen: The National Centre of Excellence in Youth Mental Health. (2019) states that youth involvement in research requires them to be active partners in decisions about their direct care, service design, quality improvement, or evaluation to ensure that mental health care is accessible, appropriate and effective (Hagen et al., 2012). This participatory rights perspective actualises Articles 12 and 13 of the United Nations Convention on the Rights of the Child (CRC) (Bäckström, 1989). The CRC states that children have a right to: 1) participate in all matters that affect them, express opinions freely, and to have that opinion considered seriously; and 2) have the right to freedom of expression and the right to seek, receive and impart information of all kinds (Bäckström, 1989). Thus, it follows that a psychological instrument designed for use by children, should absolutely involve them in the development process.

One important facet of involving children in research is ensuring that the methods used are suited to children's differing levels of understanding, knowledge, interests, and ability. The goal of understanding the child's perspective can be accomplished via qualitative methods and child-centred practices. Mishna et al., (2004, p. 405) explains that listening to children's voices through qualitative methods allows researchers to "step outside the bounds of adult thinking and discover unexpected differences in the perceptions of adults and children". The choice of method should also depend on its suitability to the purpose of the research. Qualitative methods conducive to participatory research include (but are not limited to) interviews, focus groups, games, role play, tacit forms of showing and telling, and imaginative activities such as drawing, collage, and creating prototypes (Clark, 2010; Greene & Hogan, 2011). The condition of using such approaches with children is that the researcher must be flexible and consider the individual child's developmental capabilities and capacities. This can be accomplished by adapting data collection methods, techniques, and resources to support their continued involvement. For example, adaptions may include the use of cognitively appropriate language, the provision of ad hoc explanations, frequent 'checking in' that the child understands, and being mindful of children's shorter attention spans and need for breaks and allowing them to speak freely and in their own time (Carter & Ford, 2013).

An earlier model of participatory research (Shier, 2001) identifies five levels of increasing child participation in decision-making processes that align the CRC rights of the child. For example, Level 1 begins with the requirement that the adult is ready to listen to the child, but without any other expectations and progresses to Level 5 where the adult makes an explicit commitment to share their power and provide opportunities and procedures that enable children to be responsible for decision-making. This model named Pathways to Participation (Shier, 2001) further presents an ordered sequence of 15 action-oriented questions such as, "Does your decision-making process enable you to take children's views into account?". The questions are essentially thought provoking prompts to enhance children's participation at each level. A recent systematic review aiming to develop participatory design methodology in the field of eHealth identified four guiding principles of Participatory Design (Vandekerckhove et al., 2020). The principles were identified as democracy, mutual learning, tacit or latent knowledge, and

collective creativity. From this perspective, democracy describes the aim to involve all stakeholders involved in a project as equally important during the development process and responsible for the resulting outcome. Mutual learning describes the knowledge gained and shared by all stakeholders. Tacit or latent knowledge is more difficult to describe but has been explained by Sanders and Stappers (2014) as a deeper knowledge that includes sharing explicit and implicit technological expertise. Finally, collective creativity describes the design process that involves the group of stakeholders' collective participation and the outcomes of this expression. Both models demonstrate that participatory design is not simply a consultation process where participants are asked for an opinion but have no input on outcomes. The crux of true Participatory Design is that mutual learning and decision-making occurs between researchers and participants and outcomes are the result of generative, experiential, and action-based co-design methods (Hagen et al., 2012).

2.4.1 eHealth and Participatory Design

In relation to research involving interactive technology and eHealth, emphasising the child's perspective involves implementing a participatory co-design approach that is characterised by iterative development phases. Participatory research entails inviting and facilitating children's contributions as research partners and much more than observed users or testers of a final product (Stålberg et al., 2016). Iterative (i.e., repeated) prototyping, testing, and refining has been shown to increase the likelihood of end-user engagement with the end-product and increases the probability that the child's perspective is truly captured (Stålberg et al., 2016). In this approach, the child is valued at each stage of development because their input is essential for the following step. Though this approach is still quite novel concerning the development of self-report instruments generally and the creation of digital mental health assessment items specifically, there is much support in the literature establishing the reliability and validity of children's reports and experiences, and their right to be involved in research that affects them (Hogan, 2005; Cree et al., 2002; Edwards et al., 2016; Stålberg et al., 2016). For example, the use of participatory techniques such as focus groups with adolescents in the construction of questionnaires has provided valuable insights into which formats are most suitable for children (Ten Brummelaar et al., 2014). Co-design and participatory processes have increasingly been utilised in the development of eHealth intervention tools for adolescents (Fleming et al., 2019; Hill et al., 2018; Shepherd et al., 2015). Examples

where research teams have successfully employed co-design methods and developed eHealth interventions with children and young people are Starship Rescue, a computer game for treating anxiety in children with long-term physical conditions; HABITS, a multistage digital intervention for youth with mental health problems, and a self-monitoring app for use by youth receiving treatment for depression (Thabrew et al., 2018). Thabrew et al. (2018) describe how co-design can be implemented across complete development of interventions beginning with engaging users in gentle exploration, intensive generation of ideas, development and evaluation of prototypes, and post-design evaluation.

Implementing a participatory codesign approach with children puts emphasis on development occurring from the user perspective. This involves sharing decision-making power, eliciting ideas via developmentally appropriate and engaging methods, integrating children's proposals, involving them in evaluating outcomes, taking part in usability testing, and then refining work based on their feedback (Hagen et al., 2012). Such a process necessitates iterative cycles of idea generation, data synthesis, evaluation, and refinement. The operationalisation of this approach in this research program has been described in the Methods Chapter (Chapter 3) which outlines the co-design phases that were incorporated in developing the animated ICDS assessment items with children.

CHAPTER 3: METHODOLOGY

3.1 Overview of the chapter

This chapter describes the research methods utilised in the construction of a novel self-reported screening instrument for children. Specifically, it steps out the ICDS design and development plan and then describes how the child-focused codesign methodologies were implemented throughout this program of research to: 1) identify suitable assessment domains with experts and to ascertain the feasibility of the digital, animated concept with children: (Study 1); 2) understand the Child's perspective of emotional and behavioural constructs: (Study 2); 3) produce and refine digitally animated assessment items (Study 3) via a creative works component; and 4) field test and conduct preliminary psychometric validation on the ICDS instrument: (Study 4).

3.2 Steps in Scale Development

As described in Chapter 2, scale development and evaluation typically follow a series of general steps that have been well summarised in literature (DeVellis, 2017; Furr, 2011; Netemeyer et al., 2011c; Reynolds & Livingston, 2019). Since the ICDS is a new instrument, the more comprehensive general model of test development described by Reynolds and Livingston (2019) was utilised to guide the instrument design and development plan in this program of research. As discussed in the previous chapter this model poses a series of questions at each step and guides authors in decision making regarding planning a proposed instrument. The proposed ICDS design and development plan is outlined in Table 3.1.

Table 3.1

Prospective ICDS Instrument Design and Development Plan

Step 1. Test Conceptualisation
1. Context for the intended measure • The target population – children aged 5 – 11 years • Constructs to be measured – broad domains of emotional and behavioural distress • Administration context – web-based digital application 2. Proposed application • How the test will be used – brief screening instrument • Setting – G.P clinics, Primary Health Networks, Child and Youth Mental Health Services, Primary Schools, clinical practice, research 3. Specify users of the measure

- Test administrators – educators, medical professionals, and mental health professionals, school guidance officers, researchers, parents/caregivers

4. Specify conceptual and operational definitions of the constructs
   - Conceptual: Emotional and behavioural distress is an umbrella statement that describes deteriorating emotional well-being or behaviour that can signify the presence of an internalising and/or externalising disorder such as anxiety, depression, or ADHD
   - Operational: On the ICDS scale, emotional and behavioural distress will be measured by summing ratings where higher scores reflect higher levels of distress

Step 2. Specify Test Format and Structure

1. Specify the age range and impacts of the target population
   - Age range – Primary school children aged 5 to 11 years
   - Impact on the response format – younger children typically respond at the extreme ends of rating scales and perform better with simple forced-choice formats
2. Specify the test format
   - Who completes the test? – the child
   - Group or individual administration? – individual
   - Presentation format? – via web-based application on digital devices such as smartphones, tablets, laptops/computers
3. Specify the internal structure
   - Will the test yield one score? – yes - a total score
   - Will the test yield multiple subscale scores? – potentially two or three subscales depending on the factor structure resulting from exploratory factor analysis
   - What will subscales measure? – emotional, behavioural, and attentional constructs
4. Specify the item format
   1. Item presentation – pairs of animations depicting children experiencing emotions and behaviours in contrasting scenarios
      - target animation depicts distress scenario
      - contrasting animation depicts no distress scenario
   2. Item response format – two questions, self-selected forced choice
      - Which one is most like you? – to choose animation
      - How much is it like you? – to choose the magnitude (lot/little)
   3. Item scoring – 0 – 3
      - 0 = contrasting animation – lot
      - 1 = contrasting animation – little
      - 2 = target animation – little
      - 3 = target animation - lot
5. Estimate how many items to include
   1. Approximately 15 items
6. Plan methods for item development
   1. Item construct selection and refinement via expert review
   2. Pilot test feasibility of animated items

- Feedback interviews – accuracy and acceptability

3. Co-design animated items with children
   - Focus groups – to formulate item content
   - Feedback interviews – to refine item content
   - Item content analyses – accuracy and acceptability

Step 3. Conduct Psychometric Testing

1. Evaluate item and scale performance
   - Field administration in a convenience sample of the intended population
     - Community sample of child and parent dyads (N >200)
     - School and Online recruitment
   - Examine psychometric properties including initial estimates of:
     - Dimensionality – exploratory factor analysis.
     - Model fit indices – e.g., Chi-square test χ^2, Root Mean Squared Error of Approximation (RMSEA; ≤ 0.05 is indicative of close fit), Comparative Fit Index (CFI; ≥ 0.95 is often considered an acceptable fit), Tucker Lewis Index (TLI; ≥ 0.95), Standardised Root Mean Square Residual (SRMR; ≤ 0.08 is an acceptable model fit).
     - Reliability – Cronbach's alpha and ordinal omega coefficients; Nunnally recommends a threshold of ≥0.90 for assessing internal consistency for scales
     - Validity – correlations with parent-rated SDQ-P, BPM-P, and child-rated M&MS, BPM-Y
   - Examine scale utility – ease of use, ease of instructions,
   - Examine scale acceptability and satisfaction

Based on this plan and the exploratory nature of the development phase of this research program, a mixed methods research design was chosen. According to (Creswell & Plano Clark, 2011), mixed-methods research ensures a better understanding of research problems than either approach will allow in isolation. Qualitative research can provide context, explanations, and understanding as well as allow the exploration of important concepts not currently understood (Kelle, 2006). Qualitative methods are best applied when we aim to understand the "nature of human perceptions, thoughts and ideas, to recognise the complex and dynamic quality of the interpersonal world" (Storr, 2004, p. 424). This certainly applies to the research questions that we plan to answer during the design and development phase of the ICDS items (Studies 2 and 3). Thus, it provides value in this body of research, which involves the exploration of children's perspectives of emotional and behavioural constructs within a specific and unresearched context. As described in Chapter 2, quantitative methods will then dominate during the latter psychometric

evaluation stage (Study 4). Quantitative research facilitates understanding at a group or population level to generalise findings, but it is not able to provide deep and nuanced understandings of context and culture (Kelle, 2006). Quantitative methods via statistical testing are most appropriate for evaluating measures, describing data, drawing inferences about a population, and generalising results from a sample which are essential steps in determining the fidelity of the ICDS instrument. Table 3.2 describes how mixed-methods approaches will be applied at specific steps in this research program to develop and evaluate the ICDS instrument. Quality mixed methods research can lead to more rich, contextualised, nuanced, and (potentially) generalisable findings than either approach in isolation (Kelle, 2006; Plano Clark, 2017; Teddlie & Tashakkori, 2009).

Table 3.2

ICDS Mixed Methodology Plan

Scale	Development Steps	Mixed Methods Approach
1	Define and refine the constructs to be measured	Expert feedback and review
2	Examine feasibility of the animated concept with prototype items	Feedback interviews with target population: children 5 – 11 years
3	Develop item content	Focus groups, interviews, activities to codesign content with target population: children 5 – 11 years
4	Produce prototype items	Creative production via iterative codesign development processes (interdisciplinary – researcher and animator)
5	Field test items, qualitative content validation and refine item content.	Feedback interviews and surveys with target population: children 5 – 11 years Creative production via iterative codesign (interdisciplinary – children, researcher, and animator)
6	Conduct preliminary scale evaluation. Utility and satisfaction testing.	Cross-sectional surveys with target population – child and parent dyads Psychometric examination

3.3 Mixed Methods Research Approaches

An exploratory sequential mixed methods approach with an emphasis on iterative and participatory codesign was the research design utilised throughout this program of research. This research design is the most appropriate methodology for instrument development and typically consists of two to three phases involving item development, scale development, and scale evaluation (Creswell & Plano Clark,

2011). This also aligns with general models of test development, further demonstrating its suitability. The first stage of this research program required an initial primary item construct definition and refinement stage via expert review and an item feasibility testing stage with members of the target population. Once feasibility of the concept was confirmed, this was followed by full development of the scale incorporating exploratory, iterative codesign, and evaluation phases. Besides being practical, the purpose of the iterative codesign phases in this research were to gather data from the Child's perspective to inform and operationalise progressive item content development. A comprehensive understanding of the Child's perspective was essential to strengthen the meaning of the assessment items and the utility of the ICDS instrument for target users. The final quantitative phase evaluated the psychometric properties of the ICDS scale via statistical testing based on classical measurement theory as described in Chapter 2.

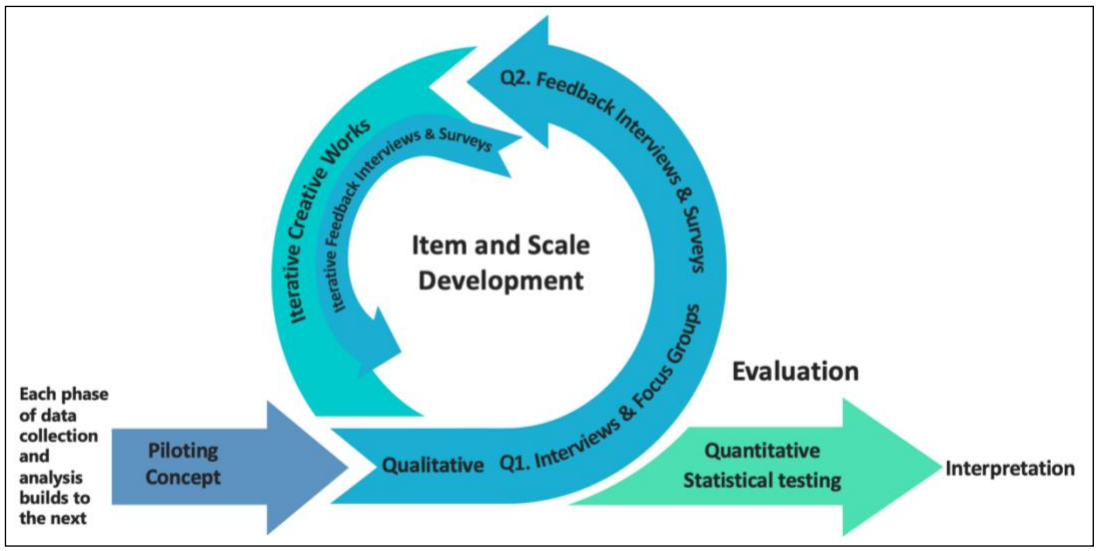
The ICDS instrument utilises brief, animated scenarios as assessment items to measure the presence or absence of subjective emotional and behavioural distress. So, the decision to employ a combination of qualitative methods to maximise the fidelity of ICDS instrument was two-fold. First, it was driven by the premise that qualitative data collection methods grounded in exploring child participants' experiences and integrating their perspectives would produce more meaningful animated items. Second, the socio-cognitive skills that an individual child possesses has a direct impact on their awareness of their thought patterns and mental state (Wakabayashi & Katsumata, 2011). So, understanding how children might interpret the test item content was imperative. With each animation, the aim is to elicit internalised recognition responses from children that convey how they feel and behave. Each animated assessment item must be equally meaningful to 5-year-old respondents as they are to the 11-year-old respondents. Therefore, the accuracy of the animations in representing each construct is crucial to the psychometric success of the ICDS instrument. To create meaningful items, understanding how children from across the age range conceptualised each of the emotional and behavioural constructs being assessed was key. Accurate animated items based off these understandings will increase item response accuracy and maximise clinical interpretability of test results.

To achieve this, the methodological design of this research program emphasised the inclusion of children throughout the design and development process

of the ICDS via iterative and participatory codesign approaches and utilised several different qualitative methods of data collection. As outlined in Chapter 2, quantitative analyses are a fundamental step in classical test theory and psychometric evaluation of measures (Bandalos, 2018) and followed the development phases to complete the evaluation phase of this research. Figure 3.1 illustrates how the different phases of the overarching exploratory sequential design were integrated.

Figure 3.1

Exploratory Sequential and Iterative Mixed Methods Research Design



3.4 Qualitative Methods

3.4.1 Interviews, Focus Group Techniques, Observations, and Physical Activities

The qualitative methodologies utilised throughout this research took a child-centred participatory design approach in the collection of data. Semi-structured individual and small focus group style interviews took place face-to-face throughout all phases of data collection. Such methods provided a space for children to share their views and be heard which is one of first tenets of participatory design. From a researcher's perspective it facilitated the collection of rich data and allowed the analysis to gain an in-depth understanding of participants' perceptions, attitudes, and experiences on a specific topic or phenomenon (Clark, 2010; Paradis, 2016). When interviewing young children, research has shown that they can give accurate accounts of personally experienced events, but that they respond best when they can freely respond to open-ended questions rather than yes or no responses (Hill, 2006). Therefore, interview scripts were drafted to avoid closed-ended questions, which typically lead to short yes or no responses. Instead, interviews in this research

incorporated open-ended questions and physical activities such as demonstrative role plays, which encouraged children to intuitively elaborate on their verbal accounts. Using a semi-structured question script provided a standardised question guide for the researcher but also allowed for some flexibility. Flexibility is important when working with all children, but particularly so with younger child participants (i.e., 5-7-year-olds) who may feel more reticent to take part in an atypical situation, such as a research focus group.

The first series of interview and focus group questions were formulated to gain insight into the Child's cognitive understanding of the emotional and behavioural constructs that form the ICDS assessment items, and on providing data to develop item content. Though questions remained the same for all children, the delivery and phrasing of questions were adapted based on the age-range of participants within each group in an effort to promote rapport between the researcher and participants and support the children in expressing their views. The semi-structured nature of this method (as opposed to rigorously structured questions) was more suitable for children because the questions could be modified in response to the individual participants needs with respect to wording or phrasing. This made for a more inclusive process and helped increase their engagement in the research method. Interview questions in later phases of the research were formulated to investigate the content validity of the animated items and iteratively refine the digital content. This was a critical step in ensuring that the ICDS instrument accurately measured what it intended to measure so that respondents were able to correctly interpret the items. Again, interviews were the most appropriate method to determine whether children accurately understood the prototype animations. It would have been far too burdensome and impractical to ask young children to respond to written questions, therefore face-to-face interviews in a conversation style allowed for children to easily describe what they saw and explain their comprehension of the items.

Semi-structured questions also have several advantages over completely informal discussions. First, prearranged questions allow for data comparison between heterogeneous groups and for discerning whether similarities or differences exist. Any analogous themes and patterns that are likely to emerge from such data may be more generalisable to others (Vanderstoep & Johnston, 2009). This was particularly important in the initial phase of the research program because any similarities across the age group levels would directly inform item content. The accuracy of the item

content will influence item comprehension and ultimately the reliability of the ICDS scale. Standardised questioning is also a more efficient form of interviewing in delivery and in data analysis (Vanderstoep & Johnston, 2009) that is beneficial to the researcher and reduces time burdens on participants.

Interview data was supplemented by nonverbal responses and observational techniques for the early qualitative studies, which supported children's choices in how to express their views and participate in this study. Such observational data was important to collect because physical records of the children's facial expressions and body movements informed the actions that were incorporated into the animated scenarios. Such true representations allowed for more accurate translation of the data into animated format. This type of data would have been very difficult to collect via verbal accounts or field notes only and would have been more prone to subjective inaccuracies. The collection of visual data and inclusion of active methods also provided younger children and those with more limited verbal abilities with additional opportunities to participate in the research (Crivello et al., 2009). Having multiple response options provided an environment conducive to interactive disclosure and encouraged the children to participate at their own comfort level, all of which increased engagement. Such methods are advocated for when conducting research with children (Groundwater-Smith et al., 2015; Vaughn et al., 2012).

Finally, adjustments were made to interview and focus group dynamics, with groups kept to participants in close age ranges (i.e., 5 and 6 years; 7 to 9 years; 10 and 11 years) so that modifications to example narratives, verbal phrasing, probing questions, and interpersonal interactions were developmentally appropriate for all children in each group. Such techniques assisted the researcher to maintain participant attention and engagement and encouraged rapport building. Sufficient sample sizes for qualitative research are typically guided by saturation parameters rather than a specific number of participants (Vasileiou et al., 2018). The sample selection criteria for the qualitative studies in this research program was determined a priori and was purposeful pertaining to composition and minimum acceptable numbers. That is, each study aimed to recruit an equivalent number of participants based on their named gender and by age in years. This reflected the intention of the participatory codesign approach, which is to ensure adequate representation from the intended target population of the research. It was also driven by data adequacy and

the potential for additional recruitment at each stage was unrestricted based on outcomes.

3.5 Iterative and Generative Participatory Codesign

The iterative and participatory codesign methods that were employed in the development, production, and evaluation of the ICDS were influenced by the Young and Well Cooperative Research Centre (YWCRC) innovative methodologies guide and supported by the model of participatory design outlined in Chapter 2 (Hagen et al., 2012; Shier, 2001). The YWCRC guide provides direction on how to integrate evidence-based data collection approaches (such as qualitative methods) with participatory design approaches to keep the needs, experiences, and knowledge of participants at the forefront of research activities (Hagen et al., 2012). The purpose of an iterative and participatory design methodology is to involve the end-user of a product, tool, or intervention as an active decision maker throughout the design and development process over cycles of data collection, production, refinement, improvement, or feedback stages. This method is often applied in the development of interactive technology and digital mental health interventions to improve outcomes (Liverpool et al., 2020; Stålberg et al., 2016; Vandekerckhove et al., 2020). The YWCRC framework outlines three key principles that direct the involvement of young people in research activities. These principles suggest that participants should 1) be involved as active co-designers throughout the design process from problem-setting to problem-solving; 2) contribute to idea generation and provide feedback on existing design concepts; and 3) be involved in evaluation of outcomes to ensure they are relevant, meaningful, and engaging to the young people who will benefit from them.

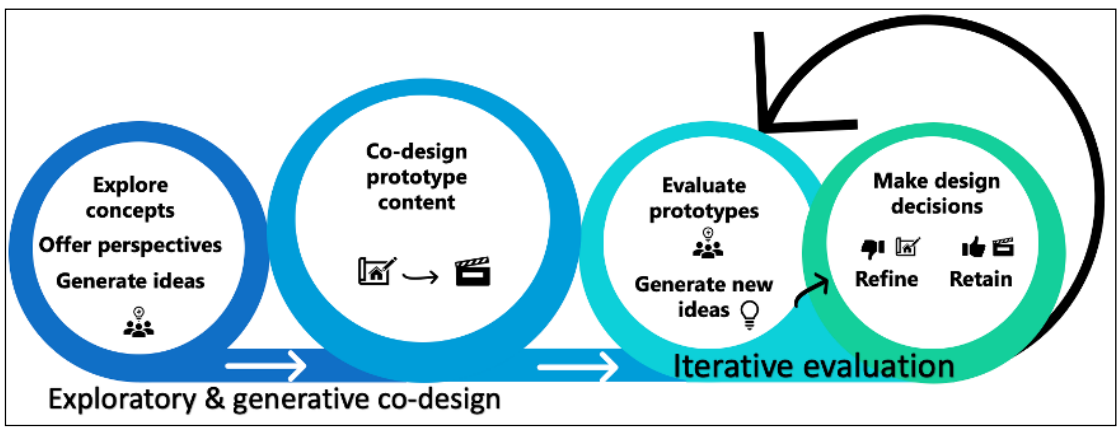
In this project, the design and production of the animated assessment items was central to the ICDS application and therefore a main focus of development. While child participants could not contribute to the applied production of the animations which required technological expertise, their knowledge and perspectives wholly directed the co-design and evaluation of the item content. Item content generation involved exploratory methods to conceptualise and co-design the content for the prototype animations and evaluation involved iterative feedback and refinement processes to improve them until participants agreed they were acceptable and could be retained. The first phase of participatory design approaches utilised in this research involved exploring emotional and behavioural constructs with children

via participatory focus groups, interview, and physical activity-based methods. The purpose of this was to understand how emotions and behaviours were perceived by children so that the animation content would be developed in a way that was relevant to them. Children were able to generate ideas and shape creative concepts from which prototypes could be produced for later evaluation.

The second phase of participatory design in this project involved recruiting children to evaluate the prototypes that were produced. Again, children were involved in interviews as active participants (i.e., co-designers) to provide their opinions on the accuracy of the prototypes and ideas on how to improve them. The evaluation phase was repeated in iterative cycles so that any prototypes that required modifications or improvements were re-evaluated in a later iterative cycle. By integrating the children into research processes as co-designers, they can contribute their own perspectives on the content and design of the animated assessment items. The use of iterative and participatory design approaches throughout the design and development of the ICDS supports the decisions that were made regarding the content of the animated items and substantially improved the animations that were produced. The sequence of iterative and participatory codesign phases that were integrated into the research design throughout this project are illustrated in Figure 3.2.

Figure 3.2

Sequential Iterative Participatory Co-Design Phases



Practical techniques to facilitate the co-design phases of the ICDS assessment items included the use of visual materials, storytelling (for describing potential animation scenarios), and playful game-based activities such as role play. Such activities focused the children's engagement on exploratory questioning and

generating ideas for prototype content. At each stage of the ICDS design and development process, child participants were invited to express themselves freely and were listened to by the researcher. By implementing a participatory design framework, the children's opinions were given due weight, their ideas were included as an essential component of the research strategy and their decisions had impact on the outcomes.

3.6 Psychometric Evaluation

Following the principles of classical test theory (CTT) and recommendations by DeVellis (2017), several statistical analyses as described in Chapter 2 were conducted to explore the reliability, validity, and underlying constructs that the ICDS aims to quantify. In addition, participant satisfaction and the utility of the ICDS was examined via cross-sectional survey and reported via descriptive statistics (e.g., means, standard deviations, frequencies). To conduct psychometric analyses, the complete ICDS instrument along with comparable measures was administered to a large community sample of parent and child participants. Existing literature on sample size considerations for factor analysis are somewhat conflicting, however the general rule is that 5-10 participants per measured variable is required, or any $N >$ 200 offers adequate statistical power for data analysis (Comrey, 1988; DeVellis, 2017; Hoe, 2008; Kyriazos, 2018; Reise et al., 2000; Tabachnick & Fidell, 2018). With 15 variables in the ICDS, the minimum sample size to recruit was decided a priori at 200 parent and child dyads for accurate evaluation. Specific analyses to be conducted are outlined as follows.

3.6.1 Examining the Factor Structure

The construct domains chosen for the ICDS were identified from well known, validated measures of childhood emotional and behavioural difficulties (see chapter 4; pilot feasibility study for description). Therefore, it was expected that the ICDS assessment items developed from these domains would also broadly assess emotional and behavioural distress. To determine the underlying factor structure of the ICDS, an exploratory factor analysis (EFA) will be conducted (Field et al., 2012; Floyd & Widaman, 1995). Mplus will be utilised as the statistical modelling program to compute EFA and 1) determine if the ICDS is unidimensional or if it has more than one latent variable (and if so, interpret the factors), 2) support computation of accurate reliability statistics, and 3) determine model fit statistics (e.g., $\chi 2$, RMSEA, CRI, SRMR) (Field et al., 2012). Examination of the factors will also allow the

identification of items for elimination based on how well they perform. In the case of developing this screening instrument, it is important to exclude poorly performing items in order to optimise scale length and increase fidelity of the instrument.

3.6.2 Establishing Reliability Estimates

Internal consistency of the ICDS scale will be assessed by calculating Cronbach's alpha coefficient (α) and also ordinal reliability coefficients with coefficient omega (ω) using R statistical software. Cronbach's alpha is a widely used reliability estimate however, because it assumes interval scaling and the ICDS utilises a binary response format, the omega statistic is recommended (Gadermann et al., 2012).

3.6.2 Establishing Validity

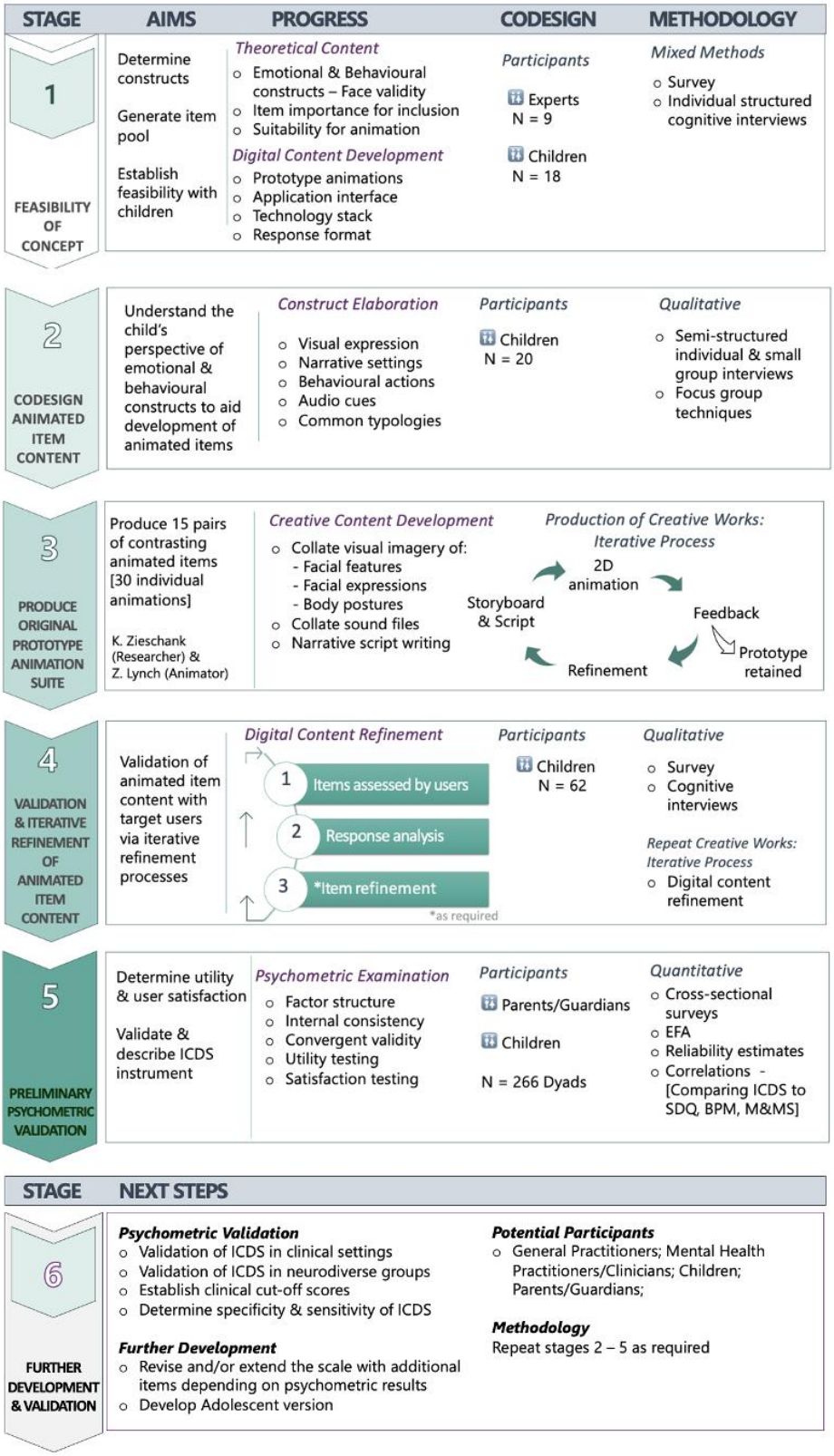
The two main forms of validity tested during this research program are content and construct validity. Qualitative content validity will be examined during item development phases of this research program. Item content validity will utilise semi-structured interviewing and expert review as described previously. This process will ensure that the item content reflects the specific construct that the animated item is meant to portray and assist with item refinement. Construct validity will be examined during the scale evaluation phase by measuring how the ICDS performs in comparison to equivalent manifest variables from the SDQ, BPM, M&MS. Parent and youth reported measures will be included where available and correlations reported for the entire sample and age-group levels. Specific details relating to methodologies for each of the studies is provided in the individual chapters.

3.7 Summary

An overview of the methodology utilised in the entire research program is provided in Figure 3.3. This figure presents a visual depiction of the studies of this thesis, including the formative pilot study and future steps. It highlights the aim of each stage of research in this program, the progress that will be made towards scale development at each stage, the participants involved in the codesign activities and the study methodology. Each of these studies will now be presented in detail in subsequent chapters of this thesis, including descriptions of methodology and results. Study 1 (Stage 1) and Study 3 (Stage 4) have been published, whilst Studies 2 (Stage 2) and 4 (Stage 5) are currently under review for publication.

Figure 3.3

Overview of Research Program Methodology



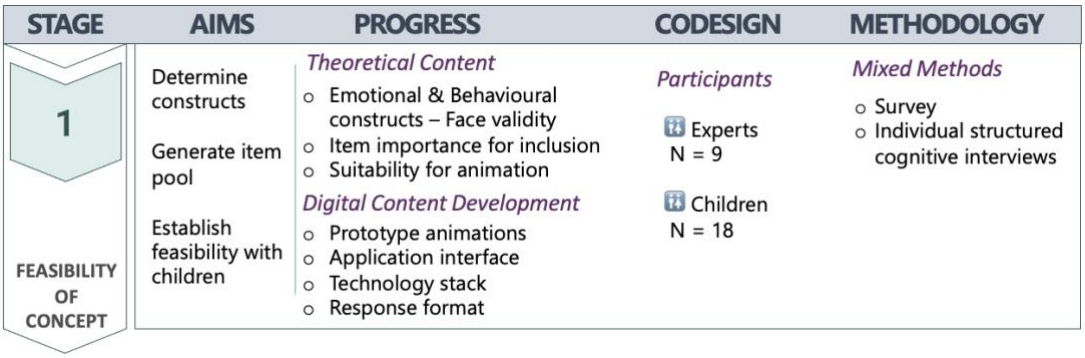
CHAPTER 4: STAGE ONE STUDY 1 FEASIBILITY OF CONCEPT

4.1 Overview of the Chapter

This chapter describes the specification of the ICDS format and structure and foundational pilot work to select item constructs and to determine acceptibility and feasibily of the concept of developing animations as assessment items. Figure 4.1 highlights the details of this pilot study which utilised a mixed methods approach in two phases. The aim of this study was twofold. First, to determine the theoretical content of the ICDS via expert panel feedback to generate an item pool, and second, to ascertain feasibility and acceptability of digital animations as potential assessment items for children.

Figure 4.1

Pilot Study 1 Outline in Brief



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4.2 The Interactive Child Distress Screener: Development and Preliminary Feasibility Testing

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4.3 Abstract

Background: Early identification of child emotional and behavioural concerns is essential for the prevention of mental health problems; however, few suitable child-reported screening measures are available. Digital tools offer an exciting opportunity for obtaining clinical information from the child's perspective.

Objective: The aim of this study was to describe the initial development and pilot testing of the Interactive Child Distress Screener (ICDS). The ICDS is a Web-based screening instrument for the early identification of emotional and behavioural problems in children aged between five and 12 years.

Methods: This paper utilised a mixed-methods approach to (1) develop and refine item content using an expert review process (Study 1) and (2) develop and refine prototype animations and an app interface using codesign with child users (Study 2). Study 1 involved an iterative process that comprised the following four steps: (1) the initial development of target constructs, (2) preliminary content validation (face validity, item importance, and suitability for animation) from an expert panel of researchers and psychologists (N = 9), (3) item refinement, and (4) a follow-up validation with the same expert panel. Study 2 also comprised four steps, which are as follows: (1) the development of prototype animations, (2) the development of the app interface and a response format, (3) child interviews to determine feasibility and obtain feedback, and (4) refinement of animations and interface. Cognitive interviews were conducted with 18 children aged between four and 12 years who tested three prototype animated items. Children were asked to describe the target behaviour, how well the animations captured the intended behaviour, and provide suggestions for improvement. Their ability to understand the wording of instructions was also assessed, as well as the general acceptability of character and sound design.

Results: In Study 1, a revised list of 15 constructs was generated from the first and second round of expert feedback. These were rated highly in terms of importance (M = 6.32, SD = 0.42) and perceived compatibility of items (M = 6.41, SD = 0.45) on a 7-point scale. In Study 2, overall feedback regarding the character design and sounds was positive. Children's ability to understand intended behaviours varied according to target items, and feedback highlighted key objectives for improvements such as adding contextual cues or improving character detail. These design changes were incorporated through an iterative process, with examples presented.

Conclusions: The ICDS has potential to obtain clinical information from the child's perspective that may otherwise be overlooked. If effective, the ICDS will provide a quick, engaging, and easy-to-use screener that can be utilised in routine care settings. This project highlights the importance of involving an expert review and user codesign in the development of digital assessment tools for children.

KEYWORDS child; preschool; mental health; symptom assessment; self-assessment (psychology)

4.4 Background

Behavioural and emotional problems are among the most common reported mental health difficulties in children younger than 12 years of age (Keenan & Wakschlag, 2000; Levitt et al., 2007; Luby & Morgan, 1997). Such problems can interfere with a child's social and academic functioning and increase the risk of developing more severe problems such as depression, anxiety, and behavioural disorders (Levitt et al., 2007; Shaw et al., 2003; Wagner et al., 2005). As early intervention can alter the trajectory of disorder development and minimize the social, emotional, and economic burden of mental illness (Druss et al., 2010; Levitt et al., 2007), universal screening for early identification is important. Dowdy et al., (2010) advocate a population-based approach to monitoring and addressing mental health difficulties in school-aged children, with universal screening as the first step in a multistage gating system. To this end, recommendations (e.g., Nordness et al., 2014) suggest that childhood screening instruments should meet three goals: (1) ability to identify behaviours that are known risk factors for further behavioural and emotional difficulties; (2) facilitate a timely assessment of children in an inexpensive manner; and (3) identify children at-risk and in need of further assessment, support, or intervention (i.e., adequate specificity and sensitivity).

The assessment of general behavioural and emotional difficulties in children routinely relies on reports from parents, caregivers, and education professionals. Although information from these key informants is important, child self-report is a valuable source of clinical information that is often overlooked. Additionally, few self-report screening instruments exist that are suitable for primary school-aged children, particularly universal screeners with a focus on early detection and prevention. For example, in a recent review of instruments for children and adolescents, Deighton et al., (2014) identified only 11 instruments that included a self-report component, with only eight of these suitable for children younger than 12 years, and five suitable for children aged 10 years and younger. Furthermore, of those measures suitable for younger ages, only two could be considered brief screeners, or containing fewer than 30 items—the KIDSCREEN 10 and 27-item versions (Ravens-Sieberer et al., 2010) and the 25-item Youth Rating Scale from the Behavioural and Emotional Rating Scale-2 (CORC, n.d.). Additionally, the Behavioural and Emotional Rating Scale is not free for research or clinical use and the European KIDSCREEN provides an index of health-related quality of life rather

than emotional and behavioural difficulties, and to our knowledge is not suitable for use with children younger than 8 years of age.

Screening directly with children may facilitate quick identification of a range of social and behavioural indicators (Deighton et al., 2014) while also having the potential to capture internalizing (emotional) difficulties that parents or caregivers have not been able to observe (Myers & Winters, 2002). However, there are numerous administrative challenges that may preclude children from responding or impact the reliability of the information collected (Arseneault et al., 2005; Manassis et al., 2013). Children may find the traditional text-based rating scales difficult because of their limited attention spans or difficulties with reading, language, and item comprehension (Arseneault et al., 2005; Manassis et al., 2013), with these issues more pronounced in younger children (e.g., 5-8 years). In addition, given there are significant developmental variations between the ages of five and 12 years, crafting items using appropriate language that is broadly suitable across various ages is a challenge for scale developers.

Despite this, researchers have demonstrated that when age-appropriate methods are used, valid and reliable self-report information can be obtained from children even as young as five or six years (e.g., Arseneault et al., 2005). Much of this work has focused on adjusting the delivery modality (e.g., clinical interviews), using novel stimuli (e.g., interacting with puppets), or enhancing the traditional response scales with pictorial elements (Beyer et al., 1992; Curvis et al., 2014; Measelle et al., 1998; Muris et al., 2003). More recently, engaging, and innovative approaches using digital technologies have been trialled. Examples include the Dominic Interactive (*Dominic Interactive*, 2009), a computer-based diagnostic assessment that utilises child-friendly (static) images, and maps onto seven Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition disorders with demonstrated reliability and construct validity (Kuijpers et al., 2014); the Mood Assessment via Animated Characters (Manassis et al., 2009), which uses digitally animated characters to assess internalised mood states (feelings) in young children aged between four and 11 years, and which has been shown to discriminate between anxious and nonanxious children (Manassis et al., 2013); and TickiT, a psychosocial screening app for adolescent youths that has been employed in hospital settings (Blander & Saewyc, 2015; Whitehouse et al., 2013). Similarly, a computer-administered, pictorial version of the Strengths and Difficulties Questionnaire (SDQ)

has also been investigated with children aged between eight and 15 years, with some evidence of clinical sensitivity (in children 11 years and older), higher user satisfaction ratings, and improved engagement compared with the standard pencil-and-paper version (Truman et al., 2003). These efforts support the feasibility of digital assessment tools for children; however, to our knowledge there are currently no digitally delivered, universal self-report screeners for emotional and behavioural difficulties that are suitable for primary-school children aged five to 12 years. There is also very little information available about how the aforementioned instruments were developed and which components were demonstrated to be effective.

4.5 Objectives

This research describes the development process of the Interactive Child Distress Screener (ICDS), a new Web-based screening instrument for early identification of emotional and behavioural problems. The ICDS is designed to be easily administered within community settings, such as general practitioner clinics or education contexts, using modern touchscreen devices that are ubiquitous and familiar to most school-age children (e.g., tablets and mobile phones), and with potential to facilitate rapid feedback to those administering the instrument (e.g., educators or primary care professionals) through automated scoring. The ICDS differs from the aforementioned digital instruments in that it aims to provide brief, universal screening for general behavioural difficulties and emotional distress (nondiagnostic) and utilises short, animated cartoons in place of text-based items to convey common childhood difficulties in a way that is familiar, engaging, and relatable for even young children (e.g., 5-6 years) while also remaining appealing to children in later primary-school (e.g., 10-12 years).

To maximize the potential effectiveness of the ICDS, a thorough initial development and feasibility-testing process was implemented and reported here. The development process utilised a mixed-methods approach incorporating expert review to formulate and develop item content, along with user involvement from children to develop and evaluate the response format and working prototypes of both animations and user interface. Item content development and refinement is described in Study 1, followed by animation and interface development and refinement which is described together in Study 2. Lessons learned from this approach are presented in the Discussion.

4.6 Methods

4.6.1 Study 1: Item Content Development and Refinement

Content for the ICDS animations was drawn from three existing validated instruments used to assess general distress in children. We initially selected two parent-report measures—the SDQ (Goodman, 1997) and the Child Behaviour Checklist (CBCL) (Achenbach et al., 1987) — because they are frequently cited and widely used instruments for assessing general behavioural and emotional difficulties in children (Goodman & Scott, 1999; Warnick et al., 2008). However, the CBCL is a longer instrument used primarily as a broad comprehensive assessment tool. Thus, we utilised its brief counterpart, the Brief Problem Monitor (BPM) (Achenbach et al., 2011), which includes original items from the CBCL. Further review of the literature revealed a brief, 16-item child self-report instrument, the Me and My School Questionnaire (M&MS) (Deighton et al., 2013). This scale has been validated with children as young as eight years (i.e., year 4 students) as well as in clinical and nonclinical samples (Patalay et al., 2014) and has demonstrated a clear two-factor structure (behavioural and emotional problems) and adequate internal consistency with both year four and year seven students.

The initial task of developing a suite of animations representing children's behavioural and emotional difficulties required that we first identify key item groupings that best represent the primary constructs or domains covered by the validated instruments. Our aim was to identify a thematically common set of domains that had proved useful in previous screening instruments. There were three issues to consider regarding the content validity of the item groups before animation development could begin. This formed the focus of Study 1. The first consideration was whether our proposed item groupings (constructs) included items that were similar enough to each other to plausibly tap a global distress construct and to check whether item subgroupings were plausible. The second consideration was whether our proposed item groupings had potential to be depicted clearly through the use of brief animations, such that the target difficulty would be understood by primary school-age children. Relatedly, it was important to evaluate whether this was likely to be feasible using a single animation or whether multiple animations would be required. The third consideration was to identify the relative importance of each construct for inclusion in a broad screener of general behavioural and emotional difficulties in children. To address these considerations, we sought a review of our

proposed construct groupings from a small panel of experts, broadly adopting a strategy outlined by Kassam-Adams et al., (2015) regarding assessment of content validity through expert panel review. Though these guidelines were provided for evaluation of eHealth interventions, their approach to systematically assessing the relevance, effectiveness, and appropriateness of activity-target pairings (i.e., item-construct pairings in our study) through mixed quantitative and qualitative expert responses was translatable to this study.

Item content development followed an iterative process and consisted of four steps, which are as follows: (1) initial construct development, (2) preliminary expert content validation, (3) item refinement, and (4) final expert validation.

Step 1: Initial Construct Development

We first collated all 60 items from the SDQ, BPM, and M&MS into an item pool. As there was a significant amount of overlap among items, these were grouped together by the first and second authors (both psychologists with prior experience in assessment with children) according to common themes. Some items had clear conceptual overlap (e.g., "I am unhappy" from the M&MS and "Often unhappy, depressed or tearful" from the SDQ). Some items described related but potentially discrete problems (e.g., the M&MS contains two sleep-related items: "I have problems sleeping" and "I wake up in the night") that we thought would be difficult to distinguish from each other through brief animations and thus were grouped together (e.g., using a broader category of "sleep difficulties"). Differences in item phrasing arising from self-report (first person) versus parent-report measures (third person) were not considered relevant to this process as it was peripheral to our goal of identifying common themes indicative of behavioural and emotional difficulties in children. The outcomes of step 1 are presented in the Results section and in detail in Table A1, Appendix A1.

Step 2: Initial Expert Review of Constructs

In step 2, we sourced nine panel respondents (78%, 7/9 female) among the professional networks of the researchers. Respondents were invited based on identified clinical experience working with children (89%, 8/9), methodological expertise in the area of clinical research (67%, 6/9), or psychological assessment and measure validation (67%, 6/9), with some participants reporting expertise across multiple areas. Overall, the median level of experience across participants was 17 years in their respective fields (range, 7-35 years).

Respondents were presented with the list of 14 proposed domains along with the individual items that were grouped to form this construct (ranging from 2-8 items, as shown in Appendix S1.2). For each grouping, respondents answered three questions using a 7-point Likert scale: (1) importance: "How important is the construct for inclusion in a brief screener of general emotional and behavioural difficulties in children?" (1 = Not at all important to 7 = Extremely important); (2) conceptual consistency: "How well do the individual items hang together as a common theme or construct?" (1 = Very poorly to 7 = Very well); and (3) identifiability: "How likely is it that a child could identify this behaviour or difficulty if depicted in an animation?" (1 = Very unlikely to 7 = Very likely). An open-ended text box was included after each conceptual group to allow respondents to provide a rationale for their ratings or any further reflections on the items or our proposed item groupings (e.g., whether a group of items should be separated into 2 constructs).

Step 3: Refinement of Item Content

In step 3, expert ratings and feedback were reviewed by the research team with special attention given to those domains that had the poorest ratings in any of the three categories (≥ 1 SD below the overall mean). Qualitative feedback was also reviewed carefully for further insight. Constructs that had low conceptual consistency or were discussed qualitatively as not "fitting" together well were candidates for division into multiple constructs or for the removal of some items from one construct to be merged into another. Item groupings with lower ratings of importance, or any that were viewed as likely to be especially difficult to depict using animations, were considered for removal. Decisions were data-informed and based on clinical relevance using an iterative process where changes were continually reviewed by the research team. This step produced a refined list of item groupings.

Step 4: Follow-Up Expert Review of Constructs

In step 4, a follow-up expert review process was utilised to collect feedback on the refined list of item-construct groupings. Of nine participants included in this study, eight provided feedback at step 2 (75% female; 6/8); median years of experience in field was 17; clinical experience working with children: 88% (7/8); methodological expertise in the area of clinical psychology research: 75% (6/8); and psychological assessment and measure validation: 63% (5/8).

The procedure was similar to the first expert panel survey. Using the same scale, respondents provided ratings for the perceived importance of the refined constructs (see Table 4.1), as well as face validity of the internal consistency (i.e., how well items "hang" together). A separate section was included containing the list of constructs that had been removed following the first round of feedback (Nervous, Low self-worth or self-esteem, Internalising, Illicit or covert behaviours, Immature, Impulsive behaviour, and Caring or helpful), with respondents asked to rate their importance for inclusion. Respondents were not asked to rate the potential identifiability of constructs through animation as this was evaluated more directly through interviews with children using prototype animations.

4.6.2 Study 2: Animation and Interface Development and Refinement

In addition to the initial expert review to confirm importance, conceptual consistency, and identifiability of items in Study 1, we also conducted research with children to test and refine sample animations and the app interface. The aim was to determine whether the intended meaning of pilot animations could be accurately identified; whether the response instructions were understood; and whether the characters, sounds, and animation style were acceptable and engaging. Similar "codesign" approaches have been used successfully in the development of innovative eHealth and mHealth technologies, where prospective users are involved collaboratively during design and development stages to provide valuable feedback and direction for ongoing development (e.g., Blander & Saewyc, 2015; Whitehouse et al., 2013). This study consisted of four steps, which are as follows: (1) development of prototype animations, (2) development of the interface and response format, (3) child interviews to determine feasibility and obtain feedback, and (4) refinement of animations and interface.

Step 1: Development of Prototype Animations

From the 15 revised constructs produced in Study 1, the three following items were selected for development of prototype animations: (1) Sad or depressed, (2) Worried, and (3) Sleep problems. The constructs Sad or depressed and Worried were selected based on expert ratings of high importance, whereas sleep problems was considered particularly amenable to animation and provided us with a broader coverage of content areas for piloting with the respondent group.

For each construct, two prototype animations were developed; 1 "negative" animation showing a child experiencing the difficulty described by that construct and

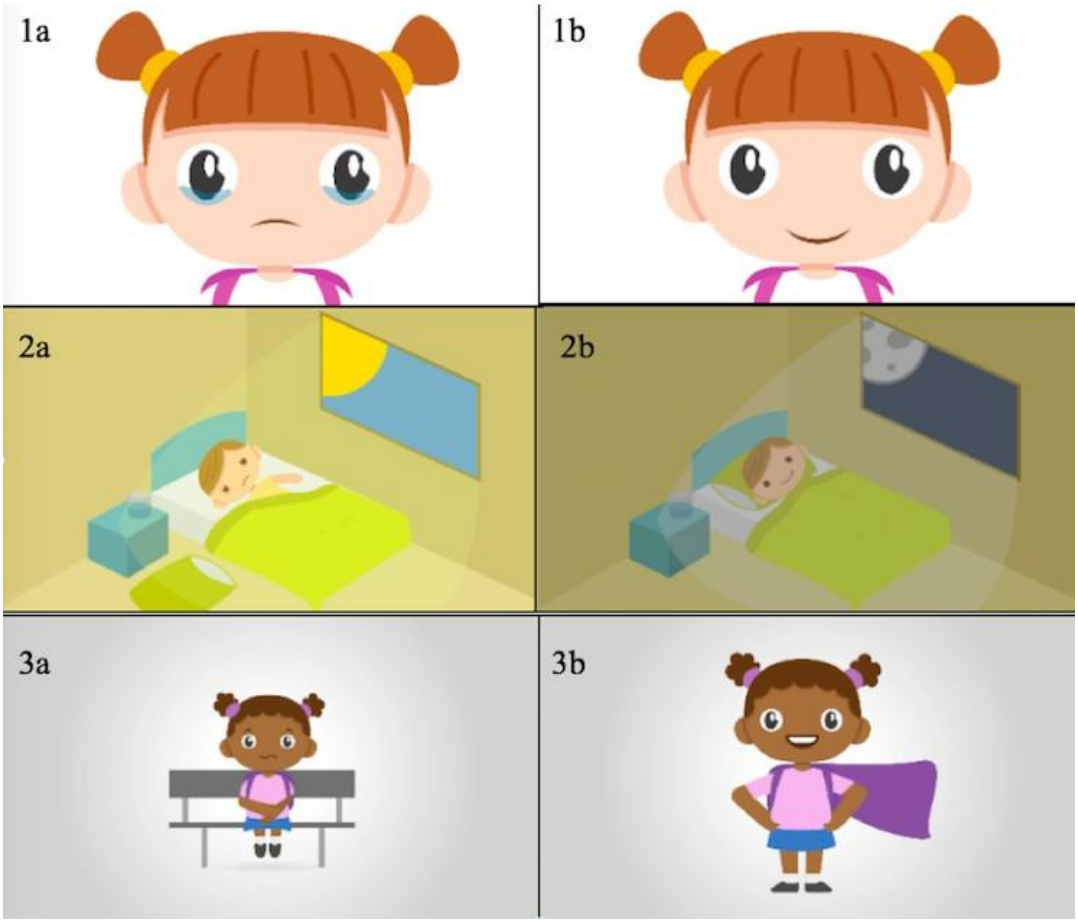
its candidate items (see Figure 4.2), and one "positive" animation indicating the absence of that difficulty or showing a child demonstrating a contrasting (i.e., positive) behaviour. This resulted in 6 pilot animations labelled: 1S (Sad) and 2H (Happy), 3SP (Sleep Poorly) and 4SW (Sleep Well), and 5W (Worried) and 6C (Not Worried). The rationale for the response format choice is explained below at step 2.

Animations were developed in consultation with an animator and a graphic designer. To encourage engagement, animations were designed to be brief (e.g., 6-10 seconds), with each demonstrating a short, focused scenario showing either the positive or negative depiction of the intended construct. A mix of genders and ethnicities was used for the characters, but the same character was used in each animation pair for consistency and to minimize distraction. Stylistically, characters featured in the animations resembled cartoon children, which are easily relatable. Characters were given simple features with large eyes for expressiveness, and warm, bright colours for clothes and backgrounds. Contextual features were kept to a minimum so that children would not be distracted by nonessential information and so the target item was not specific to a context, with background objects only included if they enhanced the intended message (e.g., an alarm clock and bed for the Sleep problems videos).

As a first step, the research team generated ideas for animating the item content based on common characteristics identified from the pooled items for each construct. A suggested storyboard was created for each animation detailing (1) the character's actions, (2) the scenery and objects to include or for the character to interact with, (3) sound effects that might enhance the message (e.g., sound of a child crying), and (4) colours and other special effects that might further convey the construct's meaning. Storyboards were then shared with the animator, who prepared a first pass of animations that was reviewed by the research team. This iterative process continued for each animation until both parties were satisfied with the pilot version. Outcomes from step 1 are provided in the Results section.

Figure 4.2

Screenshots From Early Versions of the Pilot Animations



Note: Images 1a and 1b show paired animations for the construct Sad or Depressed. Images 2a and 2b reflect the construct Sleep Problems. Images 3a and 3b reflect the construct Worried.

Step 2: Development of the Interface and Response Format

Development of the app and its interface required consideration of multiple factors, including (1) the response format, (2) the technology stack (e.g., Web-based vs native app), (3) layout and colours, and (4) audio versus text-based instructions.

Response Format. We chose to develop a 2-stage response format in light of research suggesting younger children typically tend to respond at the extreme ends of rating scales and may perform better with dichotomous, forced-choice responses (e.g., Chambers & Johnston, 2002). The app was developed such that after viewing both animations, children are asked to select one animation in response to the question "Which one is more like you?" To provide additional information, we also included a second follow-up question: "How much is this like you?" where children were asked to select either "A lot like me" or "A little like me." The aim of this

approach was to present children with simple dichotomous response options while maximizing the range of potential variability in response scores (i.e., 1-4 for each item rather than binary responses). To our knowledge, the validity of such a response format has not yet been tested within digital screening instruments. As such, we decided to pilot this approach given that it would be trivial to later eliminate the second response stage, if it proved too complex or unreliable during administration.

Technology Stack. Although native apps written using a platform-specific code (e.g., Swift for iOS, Java for Android) are typically considered to have some advantages over Web-based apps in terms of speed and access to in-built device functions, for the pilot version of the ICDS we decided to harness the capabilities of modern Web-based technologies (e.g., HTML5, JavaScript, and a responsive design) to ensure widespread accessibility. A PHP: hypertext pre-processor backend based on the open-source WordPress framework was utilised for administrative access, with data collected in a structured query language (SQL) database stored on a secure server within the host university's research infrastructure. Using this combination of technologies, the app was enabled to be viewed through the Web-browser on any modern smart-device (e.g., phone, tablet, personal computer), making it highly compatible and transferrable across testing scenarios.

Interface (Layout, Colours, and Instructions). An iterative and collaborative development process involving the research team, the Web developer, and the graphic designer was utilised to develop an early working prototype of the app interface. The flow of the initial version of the app was developed as follows. Children are asked to select an avatar (or "buddy") to accompany them through the app and then provide basic demographic information (age and gender). The following screens contain an animation pair (i.e., one "item"), with both animations (positive and negative) presented side-by-side in a randomized order. Children play the highlighted video first, followed by the second video that is only available to view after the first animation finishes. Upon the completion of the second animation, verbal instructions commence asking children to answer the question "Which one is most like you?" For the first two items, written instructions are also displayed while being spoken by the child's selected avatar that appears at the bottom of the screen. For subsequent items, instructions are not spoken or written unless the child taps the buddy helper for assistance.

After providing a response, the app automatically advances to the next item.

The interface was developed using a simple, clean design and a bold, bright colour palette. The suite of avatars (buddies) introduced at the beginning of the screening instrument was designed to promote engagement and facilitate understanding and use of the app. Examples of the resulting interface are provided in the Results section.

Step 3: Qualitative Child Interviews

Step 3 adopted a cognitive interviewing approach (Beatty & Willis, 2007) to obtain feedback from children regarding the interpretability and acceptability of the animations, instructions, and response format. A convenience sample of children was recruited through personal networks. Eighteen children (10 females) aged between four and 12 years participated in the interviews. Of the 18 participants, two were "British Caucasian," three were "South-East Asian (Philippines)," two were "New Zealand Caucasian," and 11 were "Australian Caucasian." Most ages were represented by at least one male and female (see Table 4.2 in Results). Qualitative data reached saturation at $N = 18$ and therefore, we determined that sufficient information for refining and improving prototype animations had been gathered.

Both the child and a parent were required to provide consent to participate in the interviews that lasted between 15 and 30 minutes, with children permitted as much time as they required to answer all questions. Questions were asked verbally, with answers recorded verbatim by the interviewer along with other relevant descriptive information about the child's demeanour or nonverbal responses (e.g., "child shrugged" to indicate lack of understanding of the item). The interviews included questions that checked children's understanding of animated items, understanding of instructions and response format, and acceptability of the prototype app. The interview protocol can be found in Appendix A2.

Understanding of Animated Items. Children were first shown each animation and asked "What do you think is happening for the boy or girl in this video?" Responses were noted and the interviewer made a judgment on the "correctness" of the response (i.e., whether the child's response matched the intended behaviour that was being animated). If the child's response was considered incorrect, the intended meaning of the animation was provided by the interviewer. Children were then asked to rate the pilot animation on how well they thought it captured the intended behaviour, using a coloured, cartoon visual analogue scale from 1 to 5 (1 = "NO! I HATE it. Change it completely"; 3 = "OK. I kind of like it"; 5 = "YES! I love it. It's exactly right"). Children were then prompted to provide a "better" way of

showing the intended target problem and whether they could think of a time when they (or someone they knew) felt the same as the character. The latter question was intended to determine how well children were able to relate the behaviours shown in the animations to their own experiences.

Understanding of Instructions and Response Format. To evaluate the instructions and response format, children were asked if they could explain what was meant by the instruction "which video is most like you?" We then asked children to describe what it means if the character is "a lot like you" or "a little like you."

Acceptability. Finally, we obtained general acceptability ratings of the characters, animation style, and sounds using a mix of open-ended verbal feedback (i.e., "what did you like", "what didn't you like") and quantitative ratings using the pictorial Likert scale described earlier (i.e., "show me on the chart how much you liked it"). At the end of the interview, participants were also asked an open-ended question as to whether they had any other ideas that would make the animations easier to understand. Feedback from the child interviews regarding the characters, sounds, and behaviours depicted in the animations was collated and reviewed by the research team.

Step 4: Refinement of Animations

In step 4, we focused particularly on feedback for the animations that were misinterpreted or not well-understood, along with suggestions from children that might help to improve the interpretability or likeability of animations in general. Suggestions for enhancing facial features and emotional expressiveness, along with increasing the contrast between paired animations, were deemed particularly important. In response to the feedback obtained, we developed new storyboard outlines to target the identified deficits in understanding and worked with the animator to implement these changes. Changes primarily included increasing the expressiveness of characters such as adding emphasis to the character's eyes to make them twinkle or fill with tears, more exaggerated mouth movements, and adding eyebrows to enhance expression. Other details were also added to improve the interpretability of the intended behaviour such as beads of sweat, tousled hair, and blinking eyes, whereas additional sounds and movement were incorporated such as giggling, crying, or shoulder movements to accentuate body language for laughing or sobbing.

Further context was also added by including new objects or symbols such as "thought bubbles," a dream bubble of a jumping sheep, shadow creatures to represent a nightmare, an alarm clock with a grumpy face, and lightning bolts, as well as butterflies in the stomach area to represent worried, and a red heart shape beating quickly with sound effects. These revisions resulted in three new pairs of animations.

4.7 Results

4.7.1 Study 1: Item Content Development and Refinement

Step 1: Initial Construct Development

In Step 1, we conducted a preliminary review and grouping of the 60 items from the SDQ, BPM, and M&MS instruments. This resulted in the identification of 14 domains, which are outlined in Appendix A1.

Step 2: Initial Expert Review of Constructs

Mean ratings of perceived importance, internal conceptual consistency, and interpretability provided by panel experts were computed for each of the initial domains are shown in Table 4.1, sorted in order of importance for inclusion in a screening tool as rated by the panel. The panel considered areas pertaining to feeling sad or depressed, nervous or shy in social settings, and worried or anxious as being most important for a screener of general difficulties in children, followed by noncompliance and aggressive behaviour problems. The panel also suggested that impulsive and inattentive behaviour might be the most difficult areas for children to identify through animations.

Table 4.1.

Mean Ratings for Constructs Based on Initial Expert Panel Review, Ordered From Most (7) to Least (1) Perceived Importance for a Screening Instrument.

Domain label	Importance, mean (SD)	Hangs together[a], mean (SD)	Identifiable, mean (SD)
Survey 1: Preliminary domain label			
Sad or Depressed	6.88 (0.35)	6.22 (1.09)	6.13 (0.35)
Worried or Anxious	6.63 (0.74)	6.00 (1.12)	5.00 (1.20)
Nervous or shy in social settings	6.63 (0.52)	6.11 (1.17)	4.88 (1.55)
Noncompliant behaviour	6.63 (0.74)	6.56 (0.73)	4.75 (1.49)
Aggressive behaviour	6.38 (1.06)	6.11 (1.05)	5.38 (1.30)
Irritable or argumentative or easily loses temper	6.38 (1.19)	5.56 (1.24)	6.25 (0.71)
Sleep problems	6.25 (1.16)	6.22 (1.30)	5.75 (1.39)
Hyperactive behaviour	5.88 (1.13)	6.44 (1.01)	5.25 (1.04)

Domain label	Importance, mean (SD)	Hangs together[a], mean (SD)	Identifiable, mean (SD)
Inattentive behaviour	5.88 (1.13)	5.78 (1.92)	3.75 (1.39)
Destructive behaviour	5.63 (1.30)	6.11 (0.78)	5.25 (1.67)
Social problems[b]	5.60 (1.34)	4.80 (0.84)	6.60 (0.55)
Impulsive behaviour	5.13 (1.73)	4.89 (1.69)	3.75 (1.39)
Helpful or considerate of others	5.13 (2.17)	6.44 (1.01)	5.38 (0.92)
Illicit or covert behaviour	5.00 (1.20)	4.78 (1.99)	4.75 (1.04)
Survey 2: Refined domain label			
Angry	6.88 (0.35)	6.63 (0.74)	
Sad or depressed	6.88 (0.35)	6.13 (1.13)	
Worried	6.75 (0.46)	6.63 (0.74)	
Fearful	6.63 (0.52)	6.50 (0.93)	
Noncompliance (home)	6.50 (0.76)	6.75 (0.71)	
Difficulty making friends	6.50 (0.76)	6.13 (1.36)	
Physically aggressive	6.50 (0.53)	5.50 (1.41)	
Noncompliance (school)	6.38 (1.06)	6.88 (0.35)	
Argumentative	6.38 (1.06)	6.88 (0.35)	
Bullied or teased by other children	6.25 (1.04)	6.13 (1.36)	
Hyperactive behaviour	6.00 (1.20)	6.75 (0.71)	
Inattentive behaviour	6.00 (1.20)	6.50 (0.93)	
Sleep problems	6.00 (0.76)	5.50 (1.20)	
Shy	5.75 (1.28)	6.75 (0.46)	
Physical symptoms	5.38 (1.41)	6.50 (1.07)	

Note. [a]How well individual items hang together as a common theme or construct. [b]Four responses missing from Survey 1 for Social Problems due to technical error.

Panel members provided a number of comments relating to the constructs, with the most common feedback being that some item groupings should be split into distinct constructs. For example, items originally grouped as "worried or anxious" were considered to tap into separate domains of "worried" and "fearful." Similarly, the "irritable, argumentative, easily loses temper" domain was seen to contain both outward, externalizing behaviours (e.g., "I get very angry," "Argues a lot") as well as internalised behaviours (e.g., "I am calm," "Stubborn, sullen, and irritable"), which were recommended to be considered distinct.

Step 3: Refinement of Item Content

Analysis of expert ratings and qualitative feedback produced a refined list of item groupings in step 3 (see Appendix A1 and Table 4.1). The constructs initially labelled as Impulsive behaviour, Helpful and considerate of others, and Illicit or

covert behaviour were removed due to low importance ratings (>1 *SD* below mean), along with agreement within the research team that these appeared to have less relevance for a broad, universal screener. The constructs labelled as Nervous or shy, Worried or anxious, Sad or depressed, Irritable or argumentative, and Social problems were separated into multiple groupings. For example, items originally grouped as Social problems were seen as mapping onto two converging but distinct ideas: Difficulty making friends and Bullied or teased by other children. Some items that no longer appeared to fit within any existing constructs were removed such as "feels worthless or inferior" which was previously grouped under the Sad or depressed construct.

Step 4: Follow-Up Expert Review of Constructs

Results from the follow-up expert panel survey are presented in Table 4.1. Other than Shy (*M* = 5.75) and Physical symptoms (*M* = 5.38), all constructs had a mean importance rating of at least 6 out of 7 (*overall M* = 6.32, *SD* = 0.42). One respondent commented that targeting some physical symptoms such as "sickness" may not be a good indicator of emotional difficulties in children who have chronic illness. It was decided to retain this item for testing in the full ICDS. The constructs that had been removed (not shown in the table) received the lowest mean importance ratings overall (range, 1.50-4.25; *M* = 2.75, *SD* = 0.92). In terms of perceived face validity of items informing each construct, these had high overall ratings (range, 5.50-6.88, *M* = 6.41, *SD* = 0.45).

4.7.2 Study 2: Animation and Interface Development and Refinement

Step 1: Development of Prototype Animations

Still screenshots representing the early prototypes of the 6 pilot animations developed in step 1 are shown in Figure 4.2. As an example, for the construct Sleep problems, the first iteration of the animation showed a child tossing and turning in bed at night, unable to fall asleep, throwing his pillow on the ground, and waking up tired and grumpy the next morning with lines under the eyes and a frowning face. Its paired animation demonstrated a child yawning, falling asleep peacefully at night, and then waking up happy and refreshed in the morning when the sun rises.

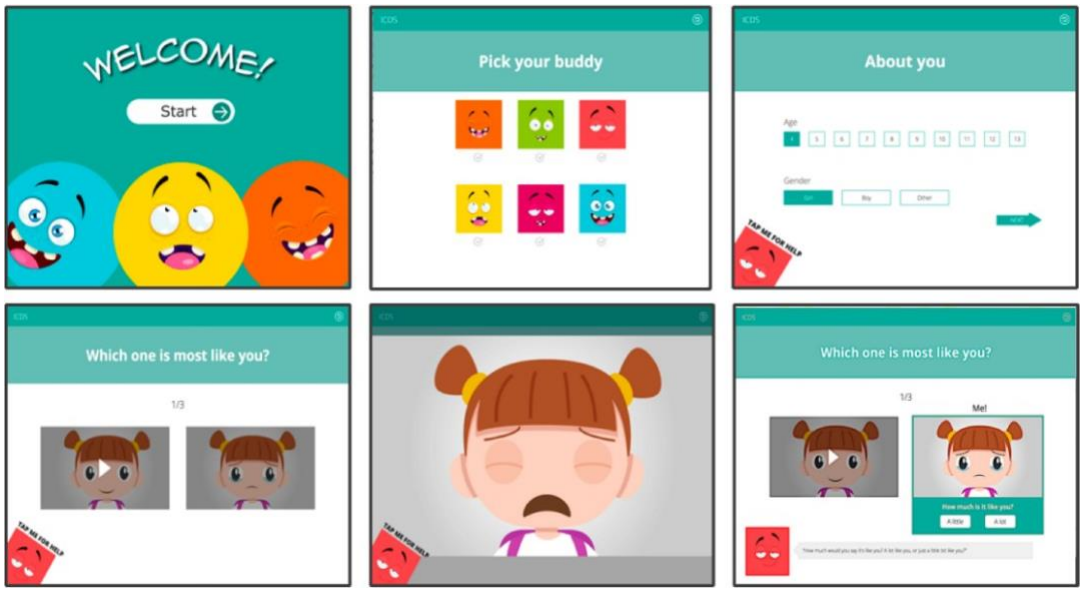
Step 2: Interface Development

Figure 4.3 provides example screenshots from the prototype version of the app developed in step 2. A number of revisions were made to early versions of the interface based on internal review and testing, with a particular focus on issues that

might limit the use and effectiveness of the app. For example, it was noted that animated videos would be clearer if presented as full screen pop-out videos rather than side-by-side animations. Thus, the app was amended so that each animation would use the full-screen window when viewed. Timing of responses was altered so that the child could not choose the response option until both videos had been played. It also became apparent that it would be beneficial to automatically play audio instructions for the first two items (rather than just the first item) to help ensure children remember what they were required to do beyond the first screen. Following the second item, the interface was further adapted such that instructions could be replayed on request by tapping on the buddy helper.

Figure 4.3

Screenshots from Early Prototype of the Interactive Child Distress Screener (ICDS) App Interface



Note. From left to right: Top row: welcome screen, avatar ("buddy") selection, and demographics. Bottom row: animation pairs, video pop-out, "How much is it like you?" selection with audio-visual instruction text spoken by the "buddy" helper.

Step 3: Qualitative Child Interviews

Understanding Animated Items. Table 4.2 summarizes the number of children considered to have correctly interpreted each of the 3 items across each age. All children were able to correctly identify happy and sad or provided a similar response (e.g., "upset"). Approximately half of the children correctly identified sleeping poorly and sleeping well, with no clear age-related pattern. Correct

responses to these items included comments such as “he had a good sleep,” “the boy didn’t get enough sleep,” and “slept badly,” whereas incorrect responses included comments such as “tired and sleepy” or “sad in his bed.” For the worried and not worried pair of videos, none of the younger children (< 8 years) were able to respond correctly, whereas the children who were wight years and older had more success (54.00%, 6 out of 11 correct for worried; 45%, 5 out of 45 correct for not worried). Younger children provided comments such as “hungry,” “just a bit sad,” and “happy”; whereas older children responded with comments such as “anxious, worried, waiting,” “alone and anxious, waiting at a bus stop,” and “confident.” When asked to rate each video on a scale of 1 to 5 for how well it captured the intended target, children tended to rate positive videos highest, suggesting their use of the rating scale in this context may have been more reflective of how “good” or “bad” the behaviour was seen to be, rather than how well our animations did at capturing that behaviour. These ratings are shown in Table 4.2.

Table 4.2

Descriptive Statistics From Child Interviews Showing Age, Gender, and Response Characteristics for Participating Children.

Variable	Child age (years)									Total (n)	Mean (SD)[a]	Choice (n)[b]
	4	5	6	7	8	9	10	11	12			
Gender (n)												
Male	1	1	1	0	1	1	0	2	1	8		
Female	1	1	1	1	0	3	0	2	1	10		
Accuracy (n correct)[c]												
1a. Sad	2	2	2	1	1	4	—[d]	4	2	18	4.24 (0.75)	0
1b. Happy	2	2	2	1	1	4	—	4	2	18	4.53 (0.80)	18
2a. Sleep Poorly	1	1	0	1	1	1	—	1	2	8	3.65 (1.27)	4
2b. Sleep Well	1	1	0	1	1	2	—	1	1	8	4.29 (0.85)	13
3a. Worried	0	0	0	0	0	2	—	3	1	6	3.71 (1.05)	4
3b. Not Worried	0	0	0	0	1	1	—	2	1	5	4.12 (0.86)	14

Note: [a]Average rating of how well the animation captured the intended behaviour (scale 1-5). [b]Total number of children endorsing the animation as “more like them” from the respective pair. [c]Number of children who correctly identified each animation. [d]Accuracy responses unavailable for 10-year-olds as no children of this age were recruited in this sample.

Regarding suggested changes to animations to better capture the intended behaviour, most responses appeared to fall into one of 3 categories. First, some suggested changes for making the animations more exaggerated to more clearly capture the emotion (e.g., “jumping up and down and looking excited”; “show him crying more”); others focused on adding more context to the videos, usually relating to a specific scenario or setting (e.g. “having fun on a playground”; “she can’t find her Mum and Dad”; “getting a high score in a math’s test”); whereas others suggested the addition of iconic cartoon elements with which they may be familiar from other media such as thought or dream bubbles, looking like a “zombie,” or dropping ice cream on the floor and crying. Abbreviated responses to questions regarding interpretation and ways to improve animations for each child are presented in Appendix A3.

In terms of children’s ability to identify personal moments and/or construct examples that portrayed the target behaviours depicted by animations, some interesting findings were noted. For example, for the Worried and Not Worried pair of videos where fewer children initially identified the target behaviour correctly, more children were able to provide examples that reflected scenarios where it might be appropriate to feel worried or not worried (confident). This suggests that though some children initially had difficulty either identifying or verbally expressing the targeted difficulty from the video (perhaps due to vocabulary limitations), their internal representation of these targeted difficulties may be more developed.

Understanding Instructions. Most children appeared to understand the question “which video is most like you” without further explanation. For example, children responded with comments such as “if you’re happy more days or not”; “what video I normally feel like”; and “what I’m feeling like most of the time.” Some younger children found it difficult to articulate a response to this question verbally. However, they were able to indicate via nonverbal means that they understood the question or were able to provide a response by pointing to one of the videos. Of all children, two children (a 6-year-old and an 11-year-old) required some rephrasing of the question (e.g., “which of these feelings do you feel most of the time?”) but then had no further difficulty. Only one child (a 4-year-old) declined to choose a video from each pair that they thought was most like them. As outlined in Table 4.2, all children selected the positive video from the Happy or Sad pair, whereas four children selected the negative video from both the Sleeping and

Worried or Confident video pairs. We note that this was a small sample of nonclinical children, so these figures are not considered representative of typical response patterns; nonetheless, they provide some indication that children may be willing to select the non-socially desirable video when prompted to choose one or the other.

As expected, older children were more successful at articulating the difference between "a lot like you" and "a little like you." Children provided responses such as "how often are you like that," "how much are you like that feeling," "is that how I am normally," "do you have a little bit of that feeling in you or a lot," and "are you always like this or only sometimes." Of all responses, two responses ("when I feel the same emotions, I will show the same expression as the cartoon"; "how you look when you're expressing that emotion—sometimes you be sad but you act happy") were less accurate, three children did not respond to this question, and the youngest children (i.e., less than 6) were more likely to repeat the language from the question, for example, "it means is she a little bit like me or not." Overall, it appeared that despite variation in their ability to articulate a response verbally, most children (13/18; 72%) responded in a way that indicated a general understanding of the question. Nonetheless, it was clear that further practical testing would be beneficial in the context of the full app and with a larger sample.

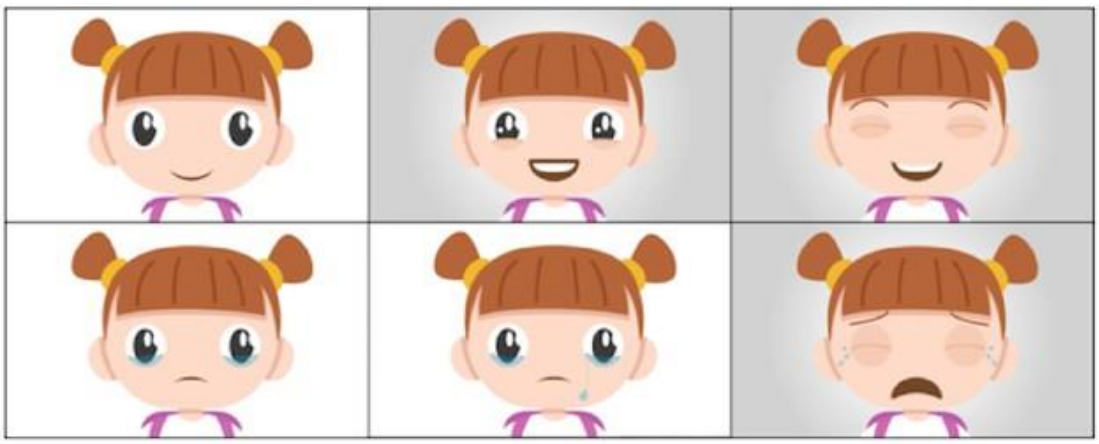
Acceptability. Responses were overall positive regarding the general acceptability of the characters, animation style, and sounds. On the 5-point scale, the mean rating for likability of characters was 4.33 (SD = 0.50) and for likeability of sounds was 4.13 (SD = 0.64) out of 5. Children reported that they liked that the characters were colourful, pretty or "cute," and enjoyed the variety of characters. The majority of children indicated that the sounds added to the videos made them easier to understand. Some children suggested adding more detail to the backgrounds to increase interest, which aligns with other suggestions that videos should include more context (e.g., giving a speech in front of a class).

Step 4: Refinement of Animations

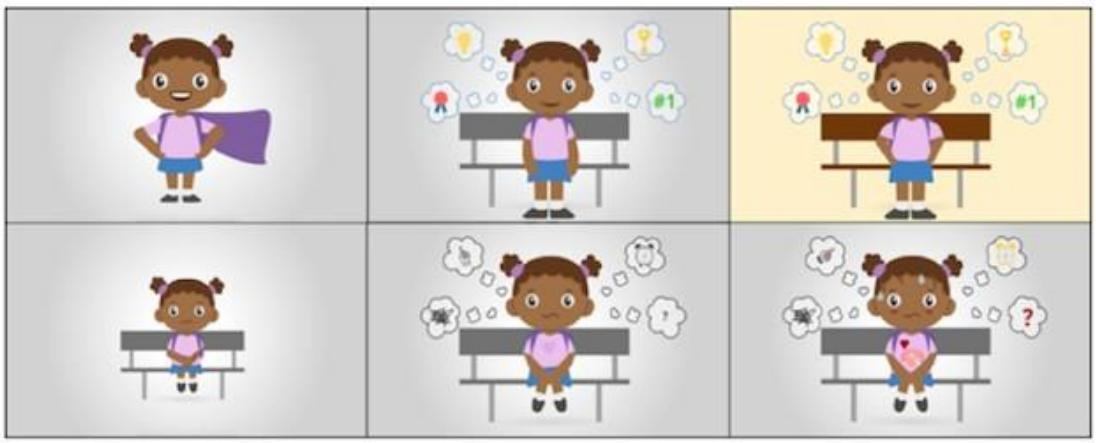
As a result of step 4, three new sets of animations were produced. Screenshots of the refined pilot animations are shown in Figure 4.4.

Figure 4.4

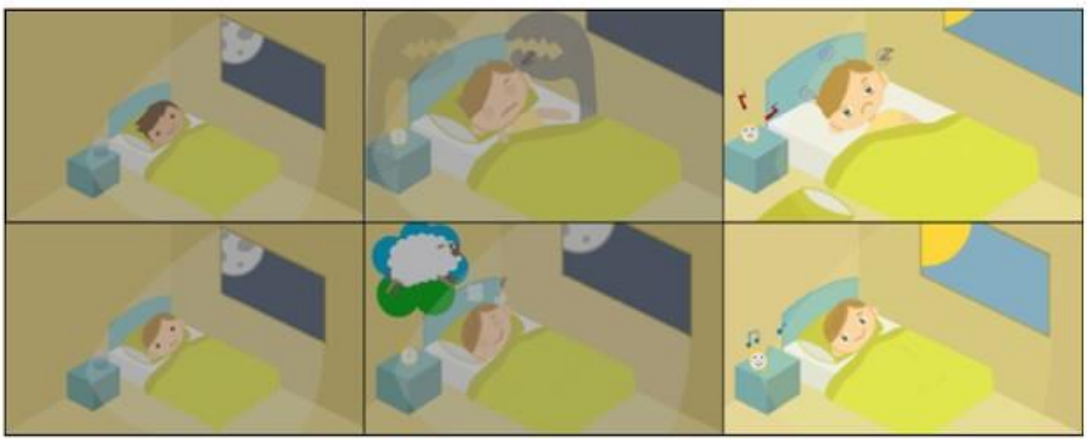
Screenshots Showing Refined Pilot Animations Based on Feedback from Child interviews



Panel A: Revised Happy/Sad animation pair



Panel B: Revised Worried/Not Worried animation pair



Panel C: Revised Sleeps Poorly/Sleeps Well animation pair

4.8 Discussion

4.8.1 Study Objectives

When identified early and appropriate interventions received, the adverse consequences of emotional and behavioural difficulties in childhood can be prevented. Universal screening has the potential to identify at-risk individuals likely to benefit from further assessment or intervention. To date, such screening instruments rely largely on parent, caregiver, or teacher report, despite evidence that children may be capable of providing valuable and accurate clinical information via self-report (e.g., Arseneault et al., 2005). This paper sought to describe the development and piloting process for an animation-based screening instrument for early identification of childhood emotional and behavioural problems. Specifically, it described the initial development and feasibility testing stages of the ICDS, utilizing the mixed-methods approach. It is hoped that this study will provide insights to inform the development of future digital instruments for young people.

4.8.2 Principal Findings

As a result of this study, we have identified 15 constructs or item groupings that will form the ICDS and that (1) are considered by experts as important for a broad emotional and behavioural distress screener, (2) are amenable to animation, (3) are distinct enough to warrant representation as a separate construct, and (4) incorporate items similar enough to plausibly tap into a global distress construct. This project further demonstrated that a child-focused, digital delivery interface and prototype animation items representing these constructs were acceptable to children and that children were able to accurately identify emotions and behaviours under the right conditions. Thus, the preliminary feasibility of the ICDS was demonstrated.

The findings of this project also demonstrate the utility of using mixed methods approaches in the development of digital assessment tools. The results of study 1 demonstrated the benefit of involving an expert panel to identify and refine the constructs necessary for inclusion in a brief screening instrument, as well as in the identification of target constructs that could be best translated into an animated and child-report format. Given that such an instrument has not yet been developed, the inclusion of the expert panel allowed us to confirm the validity of the item selection and item groupings and prompted refinement of ICDS constructs. Specifically, this process allowed us to identify items that could be grouped together in one animation pair (e.g., sad, or unhappy) and others that were required to be

captured independently (e.g., fearful and worried). It also allowed us to confirm constructs and items that were of less importance in a broad screening instrument for childhood behavioural and emotional distress (e.g., impulsive behaviour, illicit and covert behaviour). Expert review and iterative refinement in this way can be an important component in the development of new instruments, especially using new, innovative digital methods.

The second study sought to describe the development process at a step-by-step level to highlight the benefits of an iterative design and pilot testing in the end user group. Implementation of this method revealed a number of lessons regarding the development and use of digital animations in assessment tools for children. First, even at the first prototype stage, many children were able to understand the instructions and accurately identify the emotion or behaviour being targeted in the animated items. This was more likely in target emotions and behaviours that are represented by clear external features such as sadness (tears) and sleeping difficulty (restlessness, looking tired) and less likely in complex emotions such as worry, where the emotion tends to be expressed inwardly (fearful thoughts, heart racing). The latter proved particularly challenging for younger children who may not understand labels such as "worry." This highlights the careful consideration that must be given in translation of items into animated form and the necessity to review these with children of different ages. Although a strength of this study was its inclusion of a broad age range of youth, the small sample size within each age group requires these findings to be further examined in larger samples.

Second, findings suggested that even when children could not accurately label the target emotion or behaviour, they were able to provide examples of similar behaviours or scenarios that suggested a more developed internal representation of these constructs. This reinforces the notion that using instruments that rely on a child's cognitive and verbal ability to recognize and understand emotions may not provide reliable information. One benefit of a digital assessment tool such as the ICDS may be that concepts difficult for children to understand using verbal or written approaches may be more easily communicated through animations. In the ICDS, children merely need to recognize or relate to one of the visually depicted response options; this approach could be far easier than written descriptors (e.g., I worry a lot) that may be too abstract and complicated to understand.

Third, findings from this development and testing process indicated that children could understand the instructions and requirement to choose which animation was more like them; however, older children were better at articulating the difference between levels of likeness (e.g., “a lot like you” or “a little like you”). Fourth, the importance of using colourful and simple images and design was confirmed through participant acceptability and feedback. Such findings are not dissimilar to those in the child eHealth literature, which demonstrate the effectiveness of interventions that utilise eye-catching graphics, colours, stories, animations, and interactive activities (March et al., 2009; Spence et al., 2008; Wozney et al., 2017). Fifth, the importance of depicting strong, highly visible displays of the target problem was noted by many young people as a strategy for more clearly helping children to understand the target emotion or behaviour. This may indicate that children find it difficult to identify the behaviour or emotion at lower, more subtle levels of intensity.

Finally, children frequently cited the need to contextualise animations to achieve accurate understanding of target items. Contextualizing animated items presents both potential benefit and difficulty. Traditional pen-and-paper screening instruments typically remain vague and overly general in their item descriptions (e.g., “I feel sad” or “I tend to worry about things”) so as not to imply a problem specific only to a certain context (e.g., only at school, with parents). Given the known heterogeneity in which emotional and behavioural problems may manifest in children (e.g., McMahon & Frick, 2005), it is necessary to ensure that as many different representations of the target problem are represented as possible. We deliberately developed our prototype animations with sparse backgrounds to encourage children to focus on the general behaviour or feeling being targeted, rather than associating it with a specific activity or context; yet child feedback suggests that this may be necessary in digital tools. Our refined animations addressed this by incorporating contextual information, for example, a park background in our worried or confident item, without adding elements that may be associated with specific forms of worrying such as a dog or other children. Assessing the match between animations and intended item meaning will be crucial to the development of future digital instruments for children.

4.8.3 Implications and Future Research

The ICDS is intended for use as a screening instrument that can assist families and relevant professionals (e.g., family health practitioners, teachers) to identify potential difficulties and guide decision making around referrals to formal assessment or interventions. The results of this project are being used to guide and inform the development of the remaining ICDS items, which will also be developed using an iterative codesign process. Future studies will confirm the utility of the ICDS in detecting childhood emotional and behavioural distress compared with existing child- and parent-report instruments in community and clinical samples. This research will also allow the identification of "at-risk" cut-offs for different groups, which is necessary before widespread dissemination can occur. If effective, the ICDS will present a screening instrument that may be highly accepted by young people and provide valuable child clinical reports to inform further assessments and intervention referrals. An additional benefit of using modern Web-based technologies is the possibility of future over-the-air updates, allowing ongoing development to remain responsive to user feedback. Further, no specialist equipment or training will be necessary for the ICDS, thus providing a screening instrument that is easily disseminated and can have maximum prevention and early intervention capacity. Although this prototype has been developed only for English-speaking youth, future versions may be contextualised for other languages, as well as for specific emotional and behavioural disorders.

Summary

This project described the development of an animated screening instrument for childhood emotional and behavioural distress, reporting on results of expert panel review and refinement of constructs, as well as pilot testing with children. The mixed-methods approach to development and testing revealed valuable information from experts and the target child group that assisted in the iterative refinement of the screener. The ICDS has potential to obtain clinical information from the child's perspective, which may be missed through other observer report. There are very few child-reported screening instruments available for use, and if effective, the ICDS will provide a quick, engaging, and easy-to-use screener that can be utilised by families and in routine care settings. This project highlights the importance of involving expert review and user codesign in the development of digital assessments for children.

Conflicts of Interest

None declared.

Appendix A1: Preliminary and revised construct groupings, utilising items from three brief measures of child emotional and behavioural difficulties.

Appendix A2: Interview Protocol

Appendix A3: Verbatim feedback from children (by age and gender), including initial interpretation of items and whether considered correct by the interviewer; suggestions from child for improving animations to better convey intended meaning; and child's personal story, identifying a time when they have felt like the character in the animation.

Abbreviations

BPM: Brief Problem Monitor

CBCL: Child Behaviour Checklist

ICDS: Interactive Child Distress Screener

M&MS: Me and My School Questionnaire

SDQ: Strengths and Difficulties Questionnaire

SQL: structured query language

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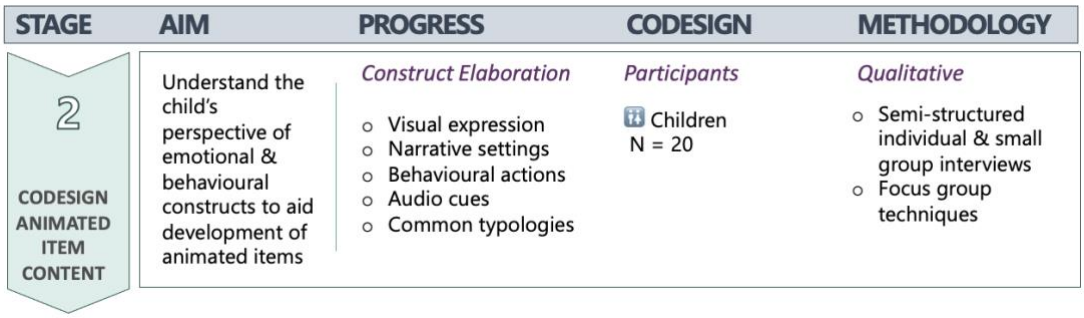
CHAPTER 5: STAGE TWO STUDY 2 CODESIGN OF ITEMS

5.1 Overview of the Chapter

This chapter describes Study 2 of this research program which is Stage 2 of the ICDS development plan. The purpose of this study was for the research team to gain an understanding of the Child's perspective of emotional and behavioural constructs. Specifically, of the 15 pairs of target and contrasting emotional and behavioural constructs to be animated as assessment items in the ICDS. Figure 5.1 provides an outline in brief of the details of this study.

Figure 5.1

Study 2 Outline in Brief



The manuscript describing this study was accepted for publication in the Journal of Child and Family Studies. The full manuscript is inserted as submitted to the journal prior to final publication.

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5.2 Children's Perspectives on Emotions Informing a Child-Reported Screening Instrument

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Conflict of Interest: The authors declare that they have no conflict of interest.

5.3 Abstract

To accurately assess children's emotional and behavioral distress via self-report, we must design instruments that are meaningful to them. This study was an essential first step in co-designing digitally animated assessment items for a new self-reported screening instrument for children: the Interactive Child Distress Screener (ICDS). Twenty children aged five to 11 years participated in semi-structured small group interviews to discuss 15 pairs of contrasting emotional and behavioral constructs. Interview questions were designed to determine how children comprehend, express, and recognize these Emotional and behavioural constructs and were correlated to the following five categories to aid the development of the animated items: lexical understanding, visual expression, narrative settings, behavioral actions, and audio cues. Data were analysed by a) cataloguing common responses for each emotional and behavioural construct across the five categories and b) examining whether age-specific response typologies were apparent. Except for lexical labelling abilities, results indicated a distinct lack of age-related differences in children's comprehension of physical and expressive displays of Emotional and behavioural constructs between age group levels. This highlights the importance of audio-visual depictions of Emotional and behavioural constructs over written text. Typology tables for each of the construct pairs were produced describing corresponding visual demonstrations, narrative contexts, behavioral actions, and audio cues shared by all children. These typologies provide insight into the child's perspective of socio-emotional and behavioral archetypes and were utilised to inform the development of the animated items for the ICDS. This study utilised co-design methodologies and produced datasets that may inform the development of mental health tools, interventions, or activities for children concerning emotional and behavioral concepts.

KEY WORDS: child perspective, emotions, behaviours, screening instruments, assessment

HIGHLIGHTS

- Audio-visual depictions of emotions and behaviours are promising assessment items for collecting child reported data
- Narrative contexts and visually expressive movements enhance children's understanding of emotions and behaviours
- Age differences in verbal labelling ability does not constrain emotion understanding when multisensory data is integrated

5.4 Background

Psychosocial problems can begin in very early childhood and include internalizing (e.g., worry, anxiety, sadness, and social withdrawal) and externalizing (e.g., aggression, noncompliance, and disruptive behaviour) presentations (Egger & Angold, 2006; Smart, 2011). Such problems often go undetected, and if left untreated may intensify and continue into adulthood (Humphrey & Wigelsworth, 2016; Johnson et al., 2016; Kessler et al., 2007; Kim-Cohen et al., 2009). Early intervention is more efficient and cost-effective than treatment, and with growing evidence supporting childhood intervention programs, the importance of early detection is apparent (Bagner et al., 2012; Jones et al., 2002; Newman, 2012). Cost-effective, population-level screening for self-reported emotional and behavioral distress in school-aged children (i.e., aged 5 – 11 years) could increase opportunities to intervene early and before problems reach clinical levels. However, there are few highly accessible and valid self-report instruments fit for this purpose.

Prevailing pen-and-paper instruments rely heavily on verbal and cognitive abilities with text-based questions and complex response formats such as 5-point Likert scales that require an average reading ability above the 6th-grade level (Jensen et al., 2006). Consequently, self-report screening options are predominantly aimed at adolescents and exclude younger children completely. The self-report versions of the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) and the Brief Problem Monitor (BPM; Achenbach & Rescorla, 2011), are two commonly utilised and validated screening tools for broad emotional and behavioral distress that are aimed at children aged 11 years and older. Only the Me and My School Questionnaire (M&MS) by Deighton et al., (2013) fits the parameters of a brief, English-language, self-reported emotional and behavioral screening instrument for children under the age of 11. The M&MS is validated for children as young as eight years, but its format possibly impedes its use for five- to seven-year-old children who may not possess the necessary cognitive or reading abilities.

Increasing evidence exists to show that children can provide meaningful and accurate accounts of their problems (Jeffrey et al., 2020; Moffa et al., 2019; Stiffler & Dever, 2015; Varni et al., 2007). Despite this, screening and assessment of children's mental health typically relies on parent and teacher reports. Whilst proxy responders certainly provide necessary and important clinical data from an observer viewpoint; multiple studies demonstrate discrepancies between adult- and child-

reported information (Baca et al., 2010; Choudhury et al., 2003; Foley et al., 2004; Niditch & Varela, 2011). Eiser and Morse (2001) described lower agreement ratings ($r < .30$) between parents and children on social and emotional domains in particular, and variability between parent and teacher ratings is not uncommon (Darling-Churchill & Lippman, 2016; De Los Reyes et al., 2015, 2019). Lagattuta et al., (2012) revealed parent perception of child wellbeing and optimism is inconsistent with child reports of the same and that parents significantly underestimate their child's worry and anxiety. Due to the hidden nature of internalizing symptoms and the ease of them being overlooked or misunderstood by proxies, the inclusion of both adult and child perspectives needs to be standard. Such information is critical to gaining a comprehensive conceptualization of the child's difficulties and subsequently ensuring that the most appropriate interventions are selected (Jensen et al., 1999).

The literature describing measures of emotional and behavioural distress demonstrate there is a paucity of instruments designed for school-aged children to provide self-reported information (American Academy of Pediatrics Task Force on Mental Health, 2010; Childs et al., 2013; Deighton et al., 2014; Humphrey et al., 2011; McCrae & Brown, 2018). While there are many publications of relevance to item development describing 'what' needs to be done (e.g., define constructs, generate items, pilot items) there is less information on 'how' items should be crafted for different populations. Historically, psychological measures have been based on authors clinical judgement via top-down theory-to-item generation and validation processes grounded on refinement through statistical analysis (Heffer et al., 2009; Rescorla, 2009). When items for youth are crafted to match adult measures based on theory or diagnostic criteria with little to no input from children, we fail to take into account the child's perspective. For example, when designing the self-rated SDQ for adolescents, the developers simply adjusted the parent rated SDQ statements from the third person to first person (Goodman et al., 2003). Measures stemming from adult conceptions of socio-emotional constructs cannot be assumed to have the same connotations for children. Novel approaches are needed to develop measurement items and response formats that are meaningful to children and allow for the collection of reliable self-reports.

There has been much progress over the past two decades in understanding children's abilities to recognize and communicate emotions. Discrete theories of

emotion suggest that basic emotions (i.e., anger, disgust, happiness) are biologically determined emotional responses conveyed via facial expressions that are universally recognized by even very young children (Ekman, 1992, 2016). However, other research evidence shows that the ability to differentiate emotions via facial expressions is initially relatively poor and develops gradually over time (Widen, 2013; Widen & Russell, 2008). Such perspectives also show that children's understanding of emotion begins with direct experience through learning the cause and consequences of actions (Bagner et al., 2012; Briggs-Gowan et al., 2006). In support of this, behavioural studies examining emotion-processing development and facial expression recognition have found that children's accuracy on recognition tasks is predicted by increasing age; however, facial expression intensity and emotion category is a stimulus (Herba et al., 2006; Rodger et al., 2018). If children's accuracy on emotion recognition is dependent on emotion types and enhanced through the greater intensity of facial expressions, then written assessment questions that are typical of existing instruments are less likely to elicit accurate self-reports from children. An important consideration when designing measurement items that aim to elicit accurate self-reports may be to incorporate visual cues to boost recognition and understanding.

Further evidence from neuro- and cognitive-scientists suggest that emotion perception is grounded in social perspectives and simultaneously formed from (a) past experiences, (b) inferences made from incoming multisensory information (e.g., other peoples' reactions, sights, sounds, and smells experienced), and (c) situation-specific predictions about expected facial expressions and actions that occur during events (Barrett et al., 2011; Gendron & Barrett, 2018). This notion follows a biopsychosocial constructionist approach and suggests that making meaning of sensory input is a predictive activity created from memories of prior experiences (Barrett & Satpute, 2019). With regard to child emotional development, the 'emotion scripts' view or 'story superiority effect' is valuable (Widen et al., 2015; Widen & Russell, 2008). Emotion scripts provide stronger cues in facilitating children's overall understanding of specific discrete emotions than facial expressions alone and are described as narratives involving situational causes, postures, vocalizations, and behavioural consequences (Widen, 2013; Widen et al., 2015; Widen & Russell, 2010).

Based on the theoretical perspectives and evidence described, we hypothesized that recognition and interpretation of affective experiences by children are better facilitated by multisensory and narrative depictions of emotions and behaviours. Specifically, that digitally animated scenarios comprised of recognizable visual, auditory, and narrative cues could more effortlessly capture meaningful self-reports from children when compared to still images or descriptive text. These theories provided further guidance as to the distinct categories of evidence required prior to developing assessment item content for such a digitally animated instrument. These categories concern the specific physiological expressions, actions, and sounds that children consistently associate with discrete emotions and behaviours, children's lexical understanding of emotional and behavioural constructs, and the types of stories (or narratives) that will best conceptualise each construct of interest within an instrument.

Thus, the authors planned a program of research to develop a self-reported, digitally animated screening tool for child emotional and behavioural distress. To test the feasibility of this hypothesis, the authors conducted a pilot study and reviewed three commonly used parent-report screening instruments: the Brief Problem Monitor (Achenbach et al., 2011), the Strengths and Difficulties Questionnaire (Goodman, 1997) and the Me and My School questionnaire (Deighton et al., 2013). From these instruments, target assessment domains were generated and then refined via expert Delphi consultation to 15 theoretical constructs considered most important for inclusion in a screening instrument (March, Day et al., 2018). Prototype digital animations of children experiencing three pairs of contrasting emotional or behavioural states were created (i.e., happy and sad; worried and not worried; poor sleep and quality sleep) and scrutinized by a group of young participants March, Day et al., 2018). The results of this pilot study revealed several findings relevant to test construction for children. First, children aged between five and 12 years can identify audio-visual depictions of socio-emotional constructs. This reinforced the utility of animated depictions of emotions and behaviours as assessment items. Second, adult assumptions of how children would recognize emotions and behaviours were inaccurate (i.e., our research team's original interpretation of the prototype animated items). Third, intensified visual and audio cues were necessary to increase meaningful recognition of the animated socio-emotional scenarios across all ages. Thus, to develop recognizable assessment items for children, it was evident that

cataloguing children's perspectives of emotions and behaviours via co-design methodologies would be fundamental to developing item content.

The broad purpose of the present study was to establish how school children (aged 5–11 years) typically perceive, exhibit, and describe emotions and behaviours included in a new screening instrument. Specific objectives were to (a) catalogue the children's perspectives on 15 pairs of contrasting emotional and behavioural constructs according to age-group level (i.e., 5–6 years, 7–9 years, and 10–11 years) and according to five descriptive categories (lexical labelling, visual expression, behavioural actions, audio cues, and narrative contexts); and (b) to determine if participants perceptions varied across the age group levels (i.e., 5–11 years). In doing so we aimed to produce child-informed typologies for each of the contrasting emotional and behavioural constructs to inform the development of digitally animated assessment items for a new self-reported screening instrument for children: the Interactive Child Distress Screener. Semi-structured small group interviews were conducted using a focus group approach to facilitate rich interaction amongst participants and to maximize the amount of data gathered from multiple sources in one session (Ritchie et al., 2014). This study is the first step in creating assessment items for a highly accessible, rapid, and cost-effective animated screening instrument that is meaningful to children and able to capture self-reported distress.

5.5 Method

5.5.1 Participants

Participants were twenty primary school children (55% female) from Queensland, Australia. Table 5.1 outlines the participant's ages and sex. Sixteen participants (80%) identified as White Australians, two as Pacific Islanders, one as Colombian and one as Iranian. A mean Socio-Economic Indexes for Areas (SEIFA) percentile of 58.35 (*SD* 25.29) was calculated from parent postcode to determine approximate socio-economic status of participants (Australian Bureau of Statistics, 2016). Sixty-five percent of participants were from middle quartiles in terms of socio-economic advantage, 10% fell within the lowest quartile, and 25% fell within the highest quartile.

Table 5.1

Number of Participants as a Function of Age and Gender (N = 20)

	Child age (years)							
Sex	5	6	7	8	9	10	11	n
Male	1	1	1	1	1	2	2	9
Female	1	1	2	2	2	1	2	11

5.5.2 Materials

Recording Equipment

Closed-circuit video monitoring ran continuously from two vantage points within the session room. Recordings were downloaded into Mp4 format for visual analysis. An iPhone was used to record audio using the inbuilt Voice Memos application (Apple Inc., 2018) and to take individual still photographs. Audio recordings captured sound descriptions and demonstrations and photographs were used to capture accurate representations of the children's facial expressions and body movements to aid analyses and inform typology development.

Construct Stimuli

Fifteen pencils labelled with the paired primary and contrasting target items listed in Table 5.2. Each participant randomly chose a pencil, and each of the constructs was discussed in turn until all were completed.

Picture Prompts

Large colourful cartoon posters of children demonstrating a variety of emotional expressions and behaviours were displayed around the walls of the session room to aid or prompt discussion as required.

Interview Questions

The following interview questions were utilised when discussing each construct item (e.g., angry). Questions focused around the five response categories required to elicit data from the child's perspective necessary to inform conceptualization of animated item content.

Lexical Understanding and Labelling. Children were asked to provide a verbal definition for each of the construct items plus equivalent descriptive substitutes to determine their linguistic knowledge (e.g., "What does the word angry mean?" and "What other words also mean angry"). If no child in the group was able to provide a definition, then the facilitator explained it verbally.

Visual Cues: Facial Expressions. To determine the children's perception of how each emotion or behaviour might be visually expressed, they were asked to describe or physically demonstrate (act out) each construct. They were asked to think about the changes that can be seen happening to one's face when experiencing each emotion or behaviour. Example questions included "How does your face move when you're angry?", "What does your face look like when you are angry?", and "What do angry eyes look like?". The latter question was asked for individual facial features, including forehead, brows, mouth, and nose.

Visual Cues: Behavioral Actions. To assess what behavioral actions children perceived to be associated with each item, the participants were asked to verbally describe or physically demonstrate body positioning, postures, or movements typically performed when experiencing the target emotions and behaviours. Example questions included "How does your body move when you are angry?", "How do you stand when you are angry?" "What is your posture like when you are angry?", and "How do you move your arms or legs or head or hands when you are angry?".

Audio Cues. To understand whether there might be characteristic sounds that children associate with emotions and behaviours, they were asked to describe or demonstrate audibly the sounds they believed would communicate each item. Example questions included "What do you hear when someone is feeling angry?", "What sounds might you make when you are angry?" "How does your voice change when you are angry?".

Narrative and Contextual Information. To assess children's understanding of the context surrounding emotions and behaviours, they were asked to verbally describe why or when children might feel or behave a particular way. Example questions included "Why would you feel angry or behave angrily?", "When might you feel angry?" "What situation makes you feel angry?". Further, children were asked to recount a personal story of a time they or someone they knew felt or acted like the construct item under discussion.

5.5.3 Procedure

Twenty participants were recruited via their parents through the research teams' professional networks and via advertisements on social media platforms. Participants were required to be between five and 11 years of age, and we aimed to recruit an equivalent number of males and females across each age level. There were

no exclusion criteria. Parent and child versions of information leaflets were provided outlining the purpose of the study, involvement requirements, and risks and benefits of participation. Written consent for their children to participate was obtained from parents and assent from child participants. Seventeen participants took part in small group interviews involving two to four children at a time, and three participants preferred individual interviews. All interviews took place at the University of Southern Queensland and were conducted by the first author. Children were advised they could leave the interview at any time, although none chose to do so. As a requirement of ethics, any photographic data was to be edited in an animated (or sketched) style before publication, and additional informed consent obtained from parents to publish.

The interview groups were stratified according to three age levels; 5–6 years, 7–9 years, and 10–11 years and were each comprised of two to four friends or siblings to optimize children's participation. These strategies were employed because (a) children are more likely to talk freely in established groups, (b) it allows the facilitator to match each group's attention spans, developmental, and linguistic capacities, and (c) it is mindful of each participant's comfort (Hennessy & Heary., 2005; Carter & Ford, 2013; Hill, 1997). The facilitator spent fifteen minutes with each participant group before their interview session to build rapport, discuss the participant information sheet, and confirm their assent to participate. Mothers attended three individual interviews and two out of the seven group interviews at the request of their child; otherwise, family members remained in a waiting room just outside the session room.

The semi-structured interview sessions utilised participatory, child-focused methods to reduce power imbalances and promote inclusion (Hennessy & Heary., 2005; Hill, 1997). For example, in consideration of the youngest participants (i.e., five- and six-year-olds) child-sized furniture was used, and during each group session the facilitator sat alongside the children in a circle and the jar of pencils labelled with the construct items was placed in the middle. The children took turns to randomly choose a pencil from the jar and either the facilitator or a child, read the item label out loud to the group. Then all children were encouraged by the facilitator to define and demonstrate the current emotional or behavioral construct under discussion guided by the interview questions. Picture prompts were displayed to stimulate discussion, assist children with recall through recognition, and to provide

an option for non-verbal expression for those children who did not want to role play or did not possess the vocabulary to respond verbally. The posters were not referred to by the facilitator specifically but were displayed decoratively to allow children to comment on, refute, point to, or ignore if they chose to. Incorporating multiple response methods recognizes that participants have preferred ways of communicating, demonstrates regard, and builds trust and rapport between researchers and participants (Groundwater-Smith et al., 2015). Photographs were taken by the facilitator whenever participants demonstrated an emotion or behaviour that the group considered an exemplar by majority consensus and if the participant was agreeable to a photograph being taken.

To encourage engagement and discursive elaboration from the children, the facilitator continually used minimal interjections such as: “Do you think that too?”, “Is that right?” “Can you tell me more about that?” “Can you show me?”, and “What a great example!”. Such questions stimulated discussion and prompted participants to share personal narratives. Interview sessions took approximately 60 minutes and ended when discussion about each of the 15 construct item pairs had been exhausted. Children were then offered a $20 cash gift card as a token of appreciation. All sessions were conducted by one facilitator (first author) who has a background in paediatric nursing and psychology. The facilitator was trained in qualitative interviewing techniques and engaged in weekly supervision with the supervising Psychologist.

5.5.3.1 Data Management and Coding

Raw Data Preparation. Excluding unrelated chatter and fillers such as “um” and “ah”, verbatim transcriptions of the audio recordings were completed by the first author. Relevant features of delivery (intonation, pace, volume, emphasis) were included when transcribing data related to any vocalizations made to accentuate an emotion or behaviour. Video recordings of each interview session were downloaded and formatted for viewing to enable analysis. Photographs were collated according to target construct pairs and converted to cartoon style images using Prisma Photo Editor (Prisma Labs Inc., 2019) per the ethical requirements of this study.

Data Coding. The first and second author created a set of coding rules to facilitate systematic analysis. Points of difference were discussed with the research team, per recommendations for best practice when coding data (Given, 2008) and a

final codebook generated. The codebook is outlined in Table 5.3 to provide clear inclusion criteria for subsequent comparative content analysis.

Analytic Strategy. The constant comparison method (CCM) is a core qualitative analysis approach based on grounded theory research (Olson et al., 2016; Patton, 2002). This method provides guidelines for accessing and organizing data from initial unitizing and assigning early labels, through to organizing categories into theoretical or practical findings (Butler-Kisber, 2018). Interview data were unitized per construct item and participant response type (e.g., verbal or visual) and sorted by participant age-group level and category of interest. To increase the validity of our findings, we applied a triangulation method to test for consistency across the different data sources when considering common responses. Triangulation requires examining multiple data sources and strengthens suppositions about phenomena or experiences when findings converge (Boeije, 2002; Olson et al., 2016). For example, the photographic and video evidence obtained from each interview group were compared and examined for similarities or discrepancies both across and between participant age-group levels. Each level of analysis was completed by the first and second authors independently and then in comparative consultation. Points of difference were reviewed and discussed by all team members, with these final decisions presented as the results.

Level 1 Analysis. Level one analysis focused on addressing the first aim of this study, which was to catalogue the information provided by participants (stratified by the three age-group levels) from all audio-visual data sources (photographs, video files, and audio transcripts) for each of the 30 items from constructs pairs 1 to 15 outlined in Table 5.2. The manifest content of all verbal and visual responses from each interview group was individually and systematically examined and common responses collated. A common response was accepted as any verbalised description or demonstrated physical action or expression acknowledged by participants within an interview group as most representative of that target item. Level 1 data is attached in Appendix C.

Level 2 Analysis. Level two data analysis focused on a more in-depth examination of Level 1 results to address the second aim of this study; to determine if separate response typologies were required for children of different developmental ages or if one typology was applicable for each construct across the ages 5-11 years. This analysis involved comparing the participant responses across age group levels

per construct pairing. Data were examined for consistency or meaningful difference within each category: lexical labelling, visual cues, narrative context, behavioral actions, and audio cues. A meaningful difference was defined as any response that appeared in one age group level only. Consistent data were retained, and differences excluded from the resulting typology.

Table 5.2

Assessment Domains and Derived Primary and Contrasting Target Items

Pair	Assessment Domain	Primary Target Item	Contrasting Target Item
1	Sadness and depression	Sad	Happy
2	Anxiety and worry	Worried	Not worried
3	Sleep problems	Sleeps poorly	Sleeps well
4	Anger	Angry	Not angry
5	Noncompliance (school context)	Disobedient at school	Obedient at school
6	Nervous or shy in social settings	Shy	Confident
7	Argumentative, irritable	Argumentative	Not argumentative
8	Hyperactive behaviour	Hyperactive behaviour	Calm behaviour
9	Difficulty making friends	Lonely and alone	Sociable and has friends
10	Victimized by others	Bullied or excluded	Not bullied and included
11	Fearful	Fearful	Brave
12	Noncompliance (home context)	Disobedient at home	Obedient at home
13	Inattentive behaviour	Inattentive	Focused
14	Physical aggression	Physically aggressive	Kind or peaceful
15	Physical symptoms	Feel sickly - physical symptoms experienced	Feel well - no physical symptoms experienced

5.6 Results

5.6.1 Level 1 Results: Cataloguing Common Participant Responses

From Level 1 data analysis the characteristics that were considered by participants as important for recognizing target emotional and behavioral constructs

were catalogued to form a series of participant response tables as reported within age-group levels for each construct item according to the codebook parameters presented in Table 5.3. The number of participants within each age group level were: 5–6-years (n = 4, 50% male), 7–9-years (n = 9, 33% male), and 10–11-years (n = 7, 57% male).

5.6.2 Level 2 Results: Creating Child-Informed Typologies of Emotions and Behaviours

The results of Level 2 analysis are reported in two ways. First, an overview of the age-based responses for each of the five categories of interest is described. Following this are summaries of each of the primary target construct items. Typology tables detailing the consistent participant responses across ages for each of the construct pairs including photographic exemplars are provided in Appendix B supplementary material. Lexical labelling is excluded from these tables as there were not consistent responses across all ages.

Table 5.3

Codebook Rules Detailing Inclusion Criteria for Content Analysis

Category	Interview Question Guideline	Rule and Data Source
1. Lexical labelling understanding	Define the item label and provide an equivalent substitute word.	An accurate synonym or antonym for the item label Source: audio transcripts & field notes
2. Visual cues	Describe verbally what happens to their body when they experience each of the target emotions and behaviours or demonstrate physically what these emotions and behaviours look like through facial expressions, body postures and movements.	What can be seen by an observer: an expression or action that can be seen when a still photo is taken. Source: still photographs
3. Narrative context	Describe verbally why or when children might feel or behave a particular way to explore perceived causes that trigger the target emotions and behaviours to define the constructs further and apply a contextual story.	Causation – why/when: a verbal rationalization for a feeling or behaviour Source: audio transcripts
4. Behavioral actions	Display physically or describe verbally the expected/typical active behaviours that children display when they feel or behave in a particular way.	Predictable actions: any moving action that could be ambiguous via a still image; emphasizes the intention Source: video data

Category	Interview Question Guideline	Rule and Data Source
5. Audio cues	Verbally describe or audibly demonstrate what sounds are typically affiliated with certain emotions and behaviours and promote recognition according to social contextual cues.	Audible noise: heard by an observer; expressed audibly by an individual; emphasizes an emotion or behaviour Source: video and audio data

Overview of Age-Based Responses Per Category

Lexical Labelling Category. There was variation in lexical labelling ability as a function of developmental age characteristics as some of the words were novel to some of the children. The younger participants (e.g., <8-year-olds) were less verbally expressive than older children and listed fewer synonyms. Younger children typically chose to act out the emotion or behaviour physically and responded verbally with prompting. None of the younger children recognized the word argumentative, though they did identify what an argument looked like when it was acted out for them, labelling the interaction as shouting or "shouty fighting". Other labels that were difficult for younger children to provide definitions for were disobedient, hyperactive, aggressive, inattentive, focused, and sociable. Younger children more frequently provided phrases that included an accurate antonym such as "when you're not scared" to explain the item brave; "not naughty" to explain obedient; "having listening ears" to explain focused; and "not sick" to explain feeling well. As participants age increased so did the quality and diversity of verbal responses with older children able to provide accurate synonyms such as "courageous" for brave, "chilled out" for not angry and not worried, "well behaved" for obedient, and "unhealthy" for sick.

In general, all participants more frequently listed developmentally age-appropriate narrative-based explanations for the constructs rather than an equivalent lexical label (e.g., "do what the teacher or mum says" for the obedient item, and "when you chat with everyone at playtime" for the sociable and has friends' item). Overall, verbal labelling ability differed across ages, and cognitive understanding only improved with the addition of physical expression. Younger participants who were unable to provide an equivalent lexical label at all for some of the constructs were typically able to recognize and then demonstrate their understanding of a construct via physical expression and then provide a narrative explanation. Despite

similarity across all other categories, due to the differentiation in verbal ability between age groups, lexical labels could not be included in the item typologies.

Visual Cues Category. Less verbally expressive participants were generally less likely to perform visual demonstrations unprompted, whilst bolder, more extroverted children performed very expressive demonstrations without hesitation. Despite variations in the overt expressiveness of their demonstrations, all children performed comparable facial expressions, movements, and postures for the same items, irrespective of age or disposition. For example, all children demonstrated shyness by lowering their head and eyes, avoiding eye contact, and folding or bringing their arms inwards towards their body (e.g., holding their hands together or hugging themselves). Children who demonstrated anger and confidence by placing both hands on their hips all displayed the same subtle difference between angry hands-on-hips and confident hands-on-hips. That is, the children's elbows and shoulders were angled forwards and inwards, creating a tight, closed posture and aggressive stance when demonstrating anger. When expressing confidence, the children's elbows and shoulders were angled backwards, creating an open posture and upright stance. These corresponding movements were observed across all ages for each of the construct pairs.

Narrative Context Category. The causative information provided by participants when describing their feelings and behaviours revealed fundamental similarities across ages. The descriptive language used was unique between age-group levels; however, the content of all responses was consistent when developmental verbal ability was considered. Younger children's responses were often directly personalised, and older children's more generalised and inclusive of others. For example, the youngest children (e.g., 5–6-year-olds) explained the context of kindness as "sharing my toys", "when I have a sore tummy" as a context for sickly, and "when friends won't play with me" as a context for feeling bullied. Similarly, older children described kindness as "being nice to others", feeling sick as an "illness or virus that you catch" and "excluding or being mean to others" as bullying. Such findings were consistent across all item-pairs. Thus, while slight differences were apparent in the specific verbal examples given, a shared typology of the narrative context of emotions and behaviours was indicated.

Behavioral Actions Category. Comparing video and photographic data revealed many commonalities across age group levels regarding how each of the

emotional and behavioral constructs were physically portrayed. For example, when demonstrating the item shy all children displayed combinations of the following actions: avoiding eye contact, a closed-in posture, their head lowered and looking off to the side, eyes downcast, arms protective (hugging self or crossed), shoulders hunched over, biting their fingernail, placing a finger or thumb in their mouth, or hiding behind a parent or object. These common postures and movements were not only expressed within the age group levels but consistently expressed across age group levels for all items.

Audio Cues Category. Children of all ages agreed that certain sounds are associated with specific emotions and behaviours. As expected, all participants associated the sound of laughter with happiness and the sound of crying with sadness. Other sounds were more ambiguous and difficult to associate with a specific emotion. In such cases, visual cues strengthened or confirmed recognition. For example, a loud sigh could be perceived as evidence of someone feeling angry, sad, lonely, or shy. When it was accompanied with visual cues of a child seen alone with downcast eyes, a lowered head, and a frown, it was reported to enhance recognition and confirmation of loneliness. Narrative context provided the additional information required to confirm ambiguous sounds and no age variations were noted.

Overall, analysis of the data failed to reveal any meaningful differences in responses between children of different ages in this sample, apart from the lexical labelling category. Therefore, the data suggests a shared typology of emotional and behavioral constructs across five to eleven-year-olds may be appropriate when audio-visual and narrative contexts are combined.

Response Typology Summaries

Summaries of the shared participant responses across ages five through 11 for the primary target item from each construct item-pair are described. From these, typology tables consisting of key visual cues, narrative contexts, behavioral actions, and audio cues, were developed for each construct pair.

Construct Pair 1: Sad and Happy. As expected, all children easily defined and demonstrated sadness. Displays of sadness involved limp and loose arms with drooping postures and simulations of sniffling, crying or overt sobbing sounds. Exaggerated frowns and pouts were frequently shown, and all participants lowered their heads and looked down at some point. All children provided multiple narrative explanations for feeling sad. The photographic exemplar (Figure 5.2) and typology

example (Table 5.4) which outlines the common response typology for the first construct pair ‘sad and happy’ are included here. The complete set of typology tables, along with photographs of the participants that best illustrated the target items are presented in Appendix B.

Figure 5.2

Children Demonstrating the Target Item ‘Sad’

Table 5.4

Common Response Typology for Children Aged 5–11 Years Regarding Sad and Happy Items (N = 20)

Category	Target Item Sad	Contrasting Item Happy
Visual cues		
Eyes	Downcast, teary, avoid or no eye contact, blinking, closed tight	Wide open, relaxed, direct gaze, crinkled
Forehead	Wrinkled, furrowed	Neutral, relaxed, raised
Brows	Drawn down and in	Natural position, raised
Mouth	Frowning, pouting, bottom lip out/wobbling, bite lip, tight line	Smiling, ("big" smile) showing teeth, mouth open/closed/relaxed
Nose	Sniffling, runny nose	Neutral
Face	Scrunched up when crying	Neutral
Body	Head lowered, looking down, shoulders slump and shake when you cry, scrunched in a ball, rocking, covering face with hands	Open relaxed posture

Narrative Context (when or why)	When someone is doing something to you that you don't want to happen, when you have to do something that you don't want to do, when you don't get something that you want, something is happening that you don't like (to person or property), lose something, a pet dies/hear bad news	When things are good, when you're having fun, at a party, getting presents, when nothing is wrong
Behavioral Actions	Cry, go to be alone or seek comfort from parent/family/friend, rub your eyes, hug yourself (arms around your own body), curl up in a ball, go to bed	Playing, taking part in activities, relaxing, smiling, laughing
Sound cues	Audible breathing, crying sounds – sobbing, sniffling	Laughing, chatting, giggling

Construct Pair 2: Worried and Not Worried. Worry was demonstrated mostly through the children's eyes which were open, unblinking, and scanning from side to side with minimal head movement. Though postures were typically closed and quite stiff, many of the children also raised their hands to their mouths, biting their lower lip or fingernails. They described feeling sick when they felt worried and talked about feeling "butterflies" in their "tummy", their hearts "beating fast" and having trouble breathing or breathing faster as typical associations of worry.

Construct Pair 3: Sleeps Poorly and Sleeps Well. Children demonstrated sleeping poorly by laying on the floor and pretending to toss and turn in imaginary beds or slumping in their chairs as if exhausted. Most children demonstrated exaggerated yawning along with stretching their arms up high and out wide, and slow blinking with half-closed eyes. They explained that "nightmares that wake you up" and "lying awake for ages" or "having trouble going to sleep" would make them feel very tired in the morning, all of which might leave them with "red eyes with dark shadows" underneath.

Construct Pair 4: Angry and Not Angry. Anger was demonstrated by children most obviously through facial expressions, particularly around the eyes with a direct gaze and somewhat narrowed eyes observed in all children. Their forehead was often furrowed, and their nose scrunched up. Their mouths were typically closed and in a tight pursed line or sneer. Most children remained quite still with tense, stiff

postures and held their hands in fists (raised or at their sides). Others placed both of their hands on their hips with elbows jutting forward or crossed their arms.

Construct Pair 5 And 12 Combined: Disobedient and Obedient (School and Home Contexts). The typologies produced for Item Pairs 5 and 8 (general noncompliance at school and home respectively) were indistinguishable from each other, so these were collapsed to form a single non-compliant behaviour typology. According to the children, non-compliant (i.e., disobedient) behaviour in any context (home or school) may be due to internal feelings of frustration, impatience, or indifference, or in response to an external expectation that they do not want to meet. Visual findings revealed children pulled silly faces, poked their tongues out, rolled their eyes, crossed their arms in defiance and typically had relaxed, dismissive postures.

Construct Pair 6: Shy and Confident. Children reported feeling shy or behaving shyly in the context of situational discomfort due to nervousness or lacking confidence when encountering new situations or unfamiliar people. The overall visual representation of shy behaviour was one of avoiding direct eye contact; that is averting their gaze, lowering their head and eyes to look down, physically turning their body away from the source of discomfort, and hiding behind any item that could offer security such as a parent, book, or device (e.g., mobile phone). Postures appeared closed off, and their shoulders tended to be pulled inwards in a self-protective manner which also simulated hiding by making themselves smaller and less noticeable. Their arms were typically held close to the body. Actions such as biting fingernails, thumb sucking, and clasping hands was observed.

Construct Pair 7: Argumentative and Not Argumentative. Argumentative behaviours involved facing off against another person, mirroring the other's actions, along with confronting postures. Arguing was associated with anger and "wanting to be right" or to "prove a point". Aggressive posturing involved leaning towards or over the other person with a tense upper body, their head and chin thrust forward and crossed arms or finger-pointing. Voices were often raised, and eye contact was strong and direct. Their eyes were narrowed and glaring or involved eye-rolling coupled with a sneer and raised lip. Any movements made were sharp and quick (e.g., finger-pointing) with close but no actual physical contact.

Construct Pair 8: Hyperactive and Calm Behaviours. Children identified hyperactive behaviour as synonymous with lively, exaggerated, and frenetic

movements. For example, children's demonstrations included running in circles, wiggling their heads side-to-side, waving their arms in the air, pulling dynamic silly faces with very wide-open eyes, or crossed eyes and wide grins, whilst making loud or non-sensical noises. They reported the cause of hyperactive behaviour could be quite variable from "feeling bored and acting hyper for fun" to entertain themselves, to being overstimulated and overexcited, with an acknowledged lack of control over their behaviour because they "just can't stay still".

Construct Pair 9: Lonely and Alone and Sociable and Has Friends. Children recognized that sometimes they wanted to be by themselves and distinguished that there was a difference between feeling lonely and alone because they "don't have any friends" and sometimes wanting to be alone by choice despite having friends. When children were lonely and alone, they saw it as an undesirable state reporting feeling "sad" and "left out" (exclusion) and occurring in the context of lacking friends because they were unlikable. Demonstrations showed frowning faces with downcast eyes, drooping shoulders and slumping postures. Children who were alone by choice mimicked solo activities such as reading a book, listening to music, drawing, and playing games on devices with relaxed demeanours and neutral or smiling, calm faces.

Construct Pair 10: Victimized and Excluded, Perpetrator, and Not Victimized and Included. The children had powerful ideas about how it appears when a child is bullied and feels victimized and how a bully or perpetrator behaves. Therefore, the typology for Item Pair 10 (bullied and not bullied) was expanded to include cues related to the bully or perpetrator of bullying behaviours resulting in a victimized and excluded, perpetrator, not victimized and included typology. Children reported that the most predictable action to take when being bullied was wanting to "get away" or escape from the situation as soon as possible. Findings revealed that the overwhelming response to being bullied was one of sadness resulting in displays of pouting frowns, downcast eyes, lowered heads, and slumping, defeated postures. Children stated that these expressions might occur during episodes of bullying and later when remembering episodes of bullying.

In contrast, a bully appears intimidating, with a steady, confronting posture and a direct hostile gaze. Children stated that they typically lean over their victim in displays comparable to that of physically aggressive and argumentative behaviours. Excluding others was described as another less direct action of a bully, as well as

their being verbally and physically intimidating or abusive. Being "laughed at" and having "pranks played on you" was also considered bullying behaviour by children who felt victimized by such actions.

Construct Pair 11: Fearful and Brave. The most common features of fearful displays involved dramatic performances of a fast-moving startle reflex involving a jump backwards whilst simultaneously opening their eyes and mouth wide open (i.e., into an 'O' shape), raising their eyebrows and forehead and then freezing in that pose. Along with this action, most children took a loud, sharp intake of breath, and some younger children made a high-pitched squeal. Children also typically performed a quick, shrug-like motion but remained with their shoulders in this tensed-up position without relaxing. The children raised their hands in various poses, and some covered their cheeks or mouths with their hands, whilst looking around quickly in anticipation of the feared object or situation.

Construct Pair 13: Inattentive and Focused. When children are inattentive, they perceived the cause as due to either a lack of interest in a current situation and "feeling bored" or because "something else is more interesting" than to what the child should be paying attention. Displays of inattention showed children leaning back or forward in comfortable, relaxed postures, with all gazing upwards or off into the distance without any specific focus and providing no eye-contact; often this was described as "like when you're daydreaming". Their faces remained soft and neutral in natural, relaxed positions.

Construct Pair 14: Physically Aggressive and Kind or Peaceful. The difference between simple anger and actual physical aggression appeared to be a readiness for movement to enable attack (e.g., to push or strike another) or defensive actions for self-protection. Aggressive stances revealed heads lowered slightly, with narrowed eyes looking up with a direct gaze and full eye contact. When identifying aggression, children reported that the person's mouth might appear pursed in a "tight line", or a sneer that often involved a scrunched nose. A distinct posture identified as forward-leaning, tight and stiff, and with hands clenched tightly or raised in fists at readiness to attack was the most common across all ages.

Construct Pair 15: Physical Symptoms (Feel Sickly) and No Physical Symptoms (Feel Well). The contrasting item from pair 15 feel well was often described by children as simply "feeling normal" and lacked any distinct characteristics that were dissimilar from many of the other contrasting construct

items, therefore, it was excluded from the Pair 15 typology. Children's perceptions of the appearance of physical symptoms of illness or feeling sickly depended on the type of illness they imagined they were experiencing and were mostly related to the stomach and head. Depictions of stomach discomfort incorporated grabbing their mid-section and doubling over as if in pain, screwing up their eyes, furrowing their brow and puffing out their cheeks to mimic vomiting. Children appeared sad with frowns and slightly closed eyes, placing one hand on their head to portray head pain, headaches, or "having a temperature".

5.7 Discussion

Early detection of emotional or behavioral problems in childhood is crucial to facilitate early intervention and can be achieved through universal screening. However, historically, children's perspectives or reports of their own mental health have been largely neglected, with instruments favouring parent- or teacher-report. These approaches risk misunderstanding the needs and interests of children, which can be particularly problematic when attempting to detect emotional distress. This study aimed to understand, from the young person's perspective, how children perceived, recognized, and expressed emotional states, behaviours, and social situations, to inform child-focused assessment and intervention practices. In particular, this study aimed to explore children's multisensory perspective of emotional and behavioral constructs and to produce child-informed typologies of lexical labelling, visual and audio cues, behavioral actions and contextual factors.

There were several main findings in the current study. First, the importance of multisensory expressions over verbal and lexical labelling was evident. All participants, irrespective of age, predominantly responded to questions by physically expressing the emotions and behaviours, using vocalizations, appropriate facial expressions, body movements, and gestures, implying that vocabulary is secondary to sound and movement. That is, it appeared more natural for children to convey their understanding via audio-visual-behavioral depictions than through verbally descriptive means. Further, children explained contextually appropriate circumstances that would justify behaviour or source of an emotional state more readily than they provided alternative lexical labels for the target emotions and behaviours. The spontaneous provision of narrative stories in concert with the physical demonstrations provided by all children in this study indicates that movement, along with context, are crucial to their emotional expression and

therefore, their understanding. These results support the notions of Kayyal, Widen, & Russell, (2015), Widen & Russell (2010, 2015) and Herba et al., (2006) who assert the importance of context and intensity of expression in facilitating emotion understanding in children. They are also consistent with the view that emotions are grounded in social perspectives and best understood through inferences from multisensory information (Herba et al., 2006; Rodger et al., 2018; Schreuder et al., 2016).

Second, the results of this study also highlight that using pictorial images alone to elicit comprehension of constructs may be unreliable. This was especially evident where static visual cues of different emotions or behaviours were indistinguishable. For example, an averted gaze, looking down, frowning, and a drooping posture were all evident in images of children demonstrating sadness, shyness, loneliness and feeling bullied (seen in figures B2, B7, B10, and B11 respectively in Appendix B) and could collectively depict sadness. However, with the addition of sound, movement, and context such as crying and burying their head in their hands (i.e., sad) or shouting "leave me alone" while raising their arms to ward off an attack (i.e., bullied), the distinction between the two constructs was obvious. Such findings are in line with the 'emotion scripts' view posited by Widen and colleagues and empirical evidence emphasizing emotion recognition accuracy improves with the addition of narrative accounts (Widen et al., 2015; Widen & Russell, 2010). Thus, while visual images may provide additional value to written statements, alone, they are unlikely to facilitate accuracy in emotion recognition.

Third, age differences in recognition and expression of emotions and behaviours were only evident in lexical labelling or the words used to describe narrative contexts associated with the construct. Importantly, no age differences were noted across other response categories, and these labelling difficulties did not constrain cognitive understanding of the emotions themselves when multisensory information was integrated. That is, all children identified common facial expressions, physical movements, vocalizations, and narrative contexts, allowing for a mutual understanding across the ages. The noted age differences in lexical labelling of emotions and behaviours are in line with previous research that has identified enhanced emotion recognition with increasing age or expression intensity (Herba et al., 2006; Rodger et al., 2018). Cognitive and verbal abilities, which increase with age, are likely crucial in a young person being able to understand and recognize

complex emotions and behaviours. In this study, the ability to label complex emotions (e.g., argumentative, worried, disobedient) was particularly problematic for younger children compared to basic emotions (e.g., sad, fear). Importantly, these results highlight the potential challenges of obtaining self-report from children under 11 years of age via written report or statements that utilise lexical labels such as 'I feel worried' or 'I feel angry'. Traditional pen-and-paper style instruments then are unlikely to obtain accurate self-report from this age group. However, the results of this study indicate that devices that utilise audio-visual or contextual-based items would likely be able to overcome such age barriers, especially for more complex emotional and behavioral constructs.

5.7.1 Implications

The findings of this study highlight the potential for novel assessment and intervention tools that utilise multisensory stimuli. Specifically, tools that provide narrative accounts and depictions of emotions and behaviours via audio-visual means such as short film clips or brief animations (as intended for the ICDS). It is conceivable that such means would increase the accuracy of self-reported information from primary-school children and could further extend to therapeutic interventions which are focused on emotion recognition and management. Indeed, the current study has produced comprehensive audio-visual and contextual typologies for emotional and behavioral domains (Appendix A). Clinicians, researchers, and educators could use these to create resources or tools that relate to socio-emotional and behavioral concepts from the child's perspective. They are also relevant to anyone working with children who would benefit from understanding how children understand and perceive emotions.

5.7.2 Strengths and Limitations

The major strength of this study was the flexible, co-design approach used to elicit the data. The child-driven participatory method ensured children were given a voice and allowed the generation of specific typologies of emotions and behaviours that were derived from children themselves rather than from preconceived adult notions about how children's emotions or behaviours are expected to be displayed. The inclusive design of the small group interviews provided opportunities for all children with a range of different dispositions and preferences to engage and respond instinctively. Further, the utilization of triangulated data sources (e.g., photography, video recordings, transcriptions) was an effective way to capture the minutiae of the

children's facial and physical expressions and allowed for constant comparison to check that these interpretations were accurate. Obtaining responses from children regarding multiple categories (lexical, visual, narrative, behavioral, and audio) provided a broad spectrum of data to draw on in terms of understanding how children view emotions and behaviours in everyday social situations.

Notwithstanding these methodological strengths, there were also some limitations. The typologies described in this study emerged inductively from the data and represent new conceptualizations of emotional and behavioral constructs from the child's perspective. However, these require cross-validation in independent samples and investigations to increase confidence in generalisability and before they can be confirmed. Age-related differences were explored in this study; however, gender differences within the age groups were not able to be analysed. It would be valuable to examine whether the presentation of emotions and physical expression of behaviours differ according to gender in future research. Whilst the overall sample size was sufficient to determine common response themes and to examine age differences across age-groups (e.g., 5–6 years, 7–9 years, 10–11 years), it did not allow for fine-level age comparisons (e.g., at each age year). Considering the sample was predominantly White Australian, results might broadly generalise to Western children aged between five and 11 years but may not apply cross-culturally or to children with neurodevelopmental differences. Further validation will be needed, and future research should focus on more diverse participants, as ethnicity and neurodevelopmental distinctions might influence the expression of these emotions and behaviours within these groups of children. Finally, although three-quarters of the sample was unknown to the facilitator and primary researcher, recruitment via personal networks may have led to sampling bias.

5.7.3 Future Directions

Data (still images, descriptions, emotion scripts) and typologies resulting from this study will be utilised to create animated items for the ICDS in collaboration with animation artists. An iterative, mixed-method and co-design methodology will be employed throughout the creative process with larger samples of children in future studies to validate the animated item content and increase confidence in generalisability across the specified age range. Once the content validity of the animated items is determined to be satisfactory, the next stage of the research will examine the psychometric properties of this animated instrument in assessing

emotional and behavioral distress compared to existing screening instruments in both community and clinical samples.

5.7.4 Conclusion

As a first step in developing a new child-reported, animated instrument to rapidly screen for emotional and behavioral distress in young children, we catalogued how children identify and express core emotional and behavioral constructs. The results showed that young children have a sophisticated understanding of socio-emotional and behavioral constructs when encouraged to express their comprehension in a manner that is meaningful to them. The use of lexical or written labels in isolation appeared to be less suitable for younger children (5 – 9 years), compared to older children (<10 years), especially for anything other than basic-level emotions (e.g., happy, sad, angry). This study suggests that children across a range of development periods can understand, recognize, and express complex emotions (e.g., anxious, confident) and behaviours when they involve facial, vocal, and action-oriented expressions and when embedded in relevant contexts and scenarios. Future development of emotion and behaviour-related assessment instruments, interventions, and resources for young children can be enhanced through consideration of the typologies provided by children in this study.

Ethical approval: “All procedures performed in studies involving human participants were in accordance with the ethical standards of the University of Southern Queensland Human Research Ethics Committee H16REA003 and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.”

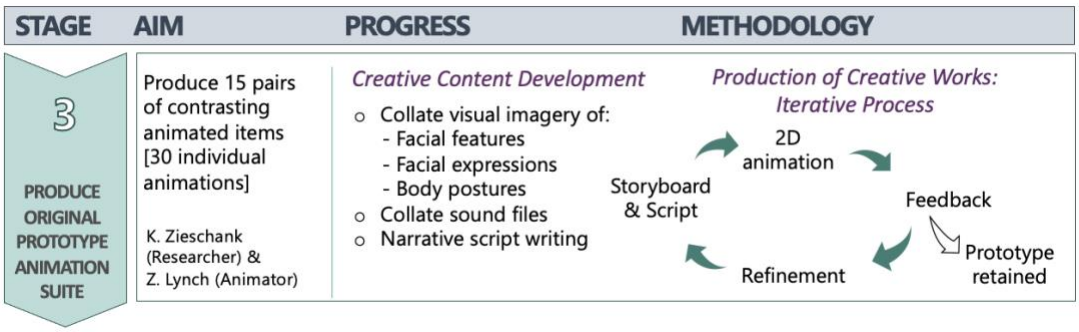
CHAPTER 6: STAGE 3 PRODUCTION OF ANIMATION PROTOTYPES

6.1 Overview of the Chapter

The purpose of this chapter is to describe the practical steps taken to create the animation suite that would form the ICDS assessment items. To translate the child informed emotional and behavioural typologies and visual exemplars into the final 2D audio-visual animated items presented within the ICDS, this required an iterative development and refinement process. Iterative refinements were made to the animations throughout the initial prototype stage before they were presented to participants in Study 3. Initial prototyping involved the research team and the animation artist, followed by user testing with child participants. The step-by-step production process is outlined in brief in Figure 6.1 and in detail throughout this chapter.

Figure 6.1

Assessment Item Production in Brief



6.2 Animation Production

The process of creating animations that accurately represented the target and contrasting emotional and behavioural constructs assessed via the ICDS required a basic understanding of 2D vector-based animation and involved working closely with an animation artist throughout production stages. The objective for each animation was to translate the data collected from child participants about each construct (i.e., verbal descriptions, narrative stories, photographic exemplars, and video evidence demonstrating facial expressions, body movements, and sounds) and create brief, engaging, and meaningful animations. To construct the animations, we procured the expertise of a digital media artist proficient in two-dimensional (2D) vector-based animation style. 2D animation is a widely utilised form of animation characterised by objects that have width and height but no thickness. Vector based

animation refers to the compilation of graphic images that are resolution independent. That is, they are not made up of individual pixels that lose resolution when resized, but of mathematical paths that form complex, scalable shapes, and lines (Sanders, 2021). Such shapes can be combined to produce images that can be copied and resized without losing any resolution and allows for smooth animation. Vector based animation was chosen as the most practical technique to create the ICDS animations because the technique does not require multiple hand drawn illustrations and was also the most cost effective. To further reduce production time on various animations, additional sets of vector graphics were purchased from the website iStock by Getty Images (istockphoto.com), so that the artist did not have to create all the individual shape and line components herself. iStock by Getty Images is a company that offers downloadable stock media including vector illustrations freely or under license. Adobe Animate (www.adobe.com).
is an industry standard computer program used to create 2D vector based animations and was the software used by the artist contracted to produce the ICDS animations.

6.3 Preproduction Stage

The pre-production process is the first stage of creating any animation series. This stage involved choosing characters and creating directive storyboards. storyboarding involves writing scripts, determining background scenery layouts, planning the dynamic animation (actions), and noting where any sounds or dialogue are required. The storyboard becomes the directions for the artist and implies all visual elements, actions, and events that will take place within an animation. Individual storyboards were created by the researcher for each animation pair and incorporated participant data from Study 2 (described in Chapter 4), model cartoon images collated from the internet, and vector animated images purchased from iStock by Getty Images.

Step 1. Character Design

The five character avatars seen in Figure 6.2 were chosen in consultation with the artist as appropriate for the intended age group of the ICDS (5-11 years) and most practical to animate. The characters featured a variety of skin tones and hair styles, carried backpacks familiar to school children, and were dressed alike in simple uniforms so as not to detract from the overall concepts. The same character was the protagonist within each pair of animations, but the hero changed between pairs. The characters were purchased as a Vector image from iStock by Getty

Images. One important change was made to the original eyes of the characters to augment the artist's ability to produce more realistic and meaningful facial expressions. Figure 6.3 demonstrates the addition of typical eye features such as pupils, white space, and eyelids to each character.

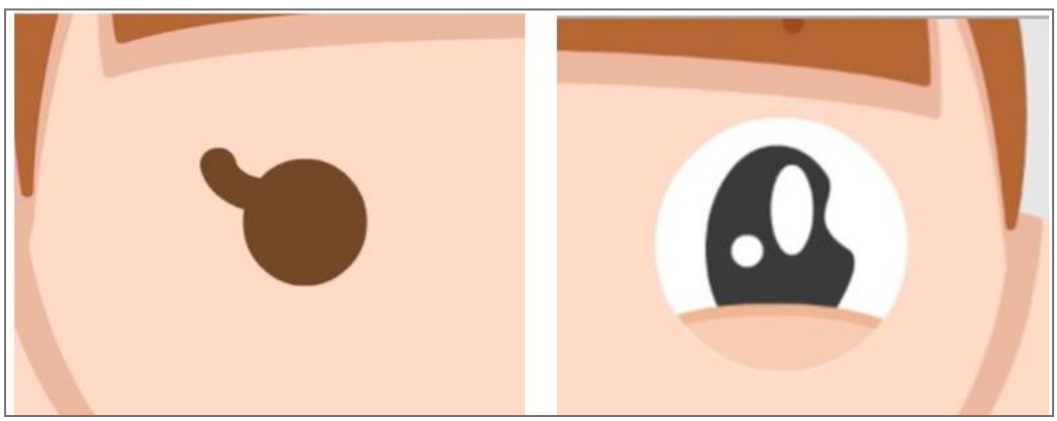
Figure 6.2

ICDS Character Avatars

Note: iStock vector image ID:481215850 Upload date: July 16, 2015. Artist: Sudowoodo.

Figure 6.3

Character Eye Elaboration to Enhance Facial Expression Accuracy



Step 2. Planning the Animation

Table 6.1 shows the original animation plan provided to the artist. This plan describes the avatar to be used as the 'hero' character who was to be seen experiencing the target or contrasting emotion or behaviour within each animation, the assessment item domain, a brief outline of the target animation story including

the setting and any elements likely to be included, and the original target and contrasting item labels. The contrasting animation was to portray the opposite of the scene depicted in the target item.

Table 6.1

Animation Outline Provided to Artist

Item and Hero	Domain	Target Animation Story Brief	Target Item Contrasting Item
1 	Sadness	Child crying emotionally Setting: plain background, focus on face Elements: tears	**Sad** Happy
2 	Anxiety Worry	Child sitting on a bench by herself Setting: plain background, full body Elements: thought bubbles with 'worries', sweat beads	**Anxious** Confident
3 	Sleep Difficulties	Child in bed having an obvious nightmare Setting: bedroom Elements: bed, clock, window with moon	**Sleeps poorly** Sleeps well
4 	Angry	Child loses her temper after dropping her drink Setting: inside house Elements: table, schoolbag. drink	**Angry** Relaxed
5 	General non-compliance school context	Child misbehaving at school Setting: classroom, Elements: desk, books, schoolbag, blackboard, teacher,	**Disobedient at school** Obedient at school
6 	Shy	Child is too shy to join friends playing with a ball Setting: park Elements: book, ball, friends.	**Shy** Outgoing
7 	Argumentative	Child arguing with mother in a playground Setting: playground Elements: playground equipment, mother	**Argumentative** Polite
8 	Hyperactive behaviour	Child fidgeting/overactive in class, Setting: classroom Elements: desks, blackboard, school items	**Hyperactive** Calm

Item and Hero	Domain	Target Animation Story Brief	Target Item Contrasting Item
9 	Social problems/ Difficulty making friends	Child eating lunch alone Setting: lunch tables at school Elements: tables, lunch, school items	**Alone (Alone and lonely)** Friends (Happy alone)
10 	Social problems/ Bullied/ Picked on	Child being excluded and demonstrating sadness Setting: park Elements: bullies, speech bubbles,	**Bullied by others** Not bullied
11 	Fearful	Screen to be sectioned off with the child superimposed over the middle of the screen – each section will show something children might be afraid of e.g., spider, lightning, dog, swimming, monster, shadows, ghost etc.	**Afraid** Not Afraid
12 	General non-compliance home context	Child jumping on furniture Home setting: living room Elements: home furniture - couch, mother	**Disobedient at home** Obedient at home
13 	Inattentive behaviour	Child daydreaming, not paying attention School setting: similar to Item 5 Elements: dream bubbles, teacher, desks	**Distracted & inattentive** Focused
14 	Physically Aggressive/ Destructive	Child fighting with other children Setting: park Elements: playground, Bam Biff Pow comic book style words to emphasise the punches	**Physically Aggressive** Peaceful
15 	Physical symptoms	Four images of children experiencing various types of sickness Setting: Possible bedroom setting for sick child or plain background./Park setting for well child Elements: different coloured faces (green/red) cold pack, vomit, sweat beads	**Feels Sickly** Feels Well

Note: Target item in bold

Step 3. Collating Data Sources

Multiple sources of data were collated and synthesised to aid animation production. To ensure accurate translation of the target emotions and behaviours

regarding facial expressions and body language it was important for the artist and the author to continuously refer back to the data resulting from Study 2 which is described in Chapter 5 (Zieschank, Machin, et al., 2020.). The still images and common response typologies resulting from Study 2 were provided to the artist as primary exemplars for each construct. A sample of exemplar images (photographs of child participants who took part in Study 2) demonstrating the target item 'anger' and 'worry' are shown in Figure 6.4 and 6.5. The corresponding typology table for Figure 6.4 is shown in Table 6.2. As described in Chapter 5, the complete set of typology tables, along with photographs of the participants that best illustrated the target items are presented in Appendix B.

Figure 6.4

Children Demonstrating the Target Item 'Angry'

Note: All images of children are reproduced with participant approval and parent consent within this thesis but may not be reproduced elsewhere without approval.

Figure 6.5

Children Demonstrating the Target Item 'Worried'

Note: All images of children are reproduced with participant approval and parent consent within this thesis but may not be reproduced elsewhere without approval.

Table 6.2

Common Response Typology for Children Aged 5-11 Years Regarding 'Angry' and 'Not Angry' Items

Category	Target Item Angry	Contrasting Item Not Angry
Visual cues		
Eyes	Glare, squint, narrowed, direct gaze, scanning	Open and relaxed, gaze less direct
Forehead	Wrinkled, furrowed	Neutral, relaxed
Brows	Eyebrows go down, mad' v' shape, drawn down and in	Natural position
Mouth	Showing small amount of teeth with upper lip curled, tight line, sneer, wide open (if shouting), frown	Smiling, relaxed, closed smile, slightly open
Nose	Scrunched up (squeezed or bent so no longer in natural shape)	Neutral
Face	Scrunched, red	Neutral
Body	Tense, crossed arms, hands on hips with elbows forward, head slightly lowered	Open relaxed, any comfortable position
Narrative Context (when or why)	Someone is doing something to you that you don't want to happen, when you have to do something that you don't want to do, when you don't get something that you want, something is happening that you don't like (to person or property)	When you don't mind/ care, you don't want to fight, feel chilled out, you're happy chilled out, think 'so what'
Behavioral Actions	Stamp feet, kick, lash out, stand over others, heaving chest, pointing finger at 'other', break property, slam doors, clench hands in fists	Shrug shoulders, hands in pockets walk away from/ignore others, are politely behaved
Sound cues	Audible/ heavy breathing, shout/yell "grrr, growl, ughh, aargh", cry, swear	Inaudible breathing; say words/phrases like "meh, oh well, whatever, pffft".

In addition to the data images and typology tables outlined previously, the artist was also supplied with cartoon models that matched the ideas or descriptions provided by the child participants. These images were sourced by the researcher so that more explicit reproductions of specific cartoon facial expressions were more easily rendered by the artist. Any element added within an animation by an artist (e.g., colour to cheeks, a book, sweat beads) is time consuming and laborious. Therefore, to assist with timely production of the prototypes the researcher also sourced vector images that that could be inserted into the animations for use as backgrounds or as feature elements within the animations. For example, park

scenery, playground equipment, food, and drink images, thought bubbles, furniture, school items, and play items etc. Multiple vector images were sourced from iStock by Getty Images and provided to the artist for this purpose. All vector images used within the ICDS were either purchased under license or are royalty free. A selection of purchased images are shown in Figure 6.6. Any individual parts of these images were able to be selected by the artist using Adobe Animate and rescaled within an animation without losing resolution and without the need to be redrawn. A selection of cartoon models used as sources of stimuli for the artist are shown in Figure 6.7

Figure 6.6

A Selection of Vector Images Utilised in ICDS Animations

Note: iStock vector images purchased under license

Figure 6.7

A Selection of Cartoon Models for ICDS Animation Artist

***Note*:** Model illustrations only – not for reproduction

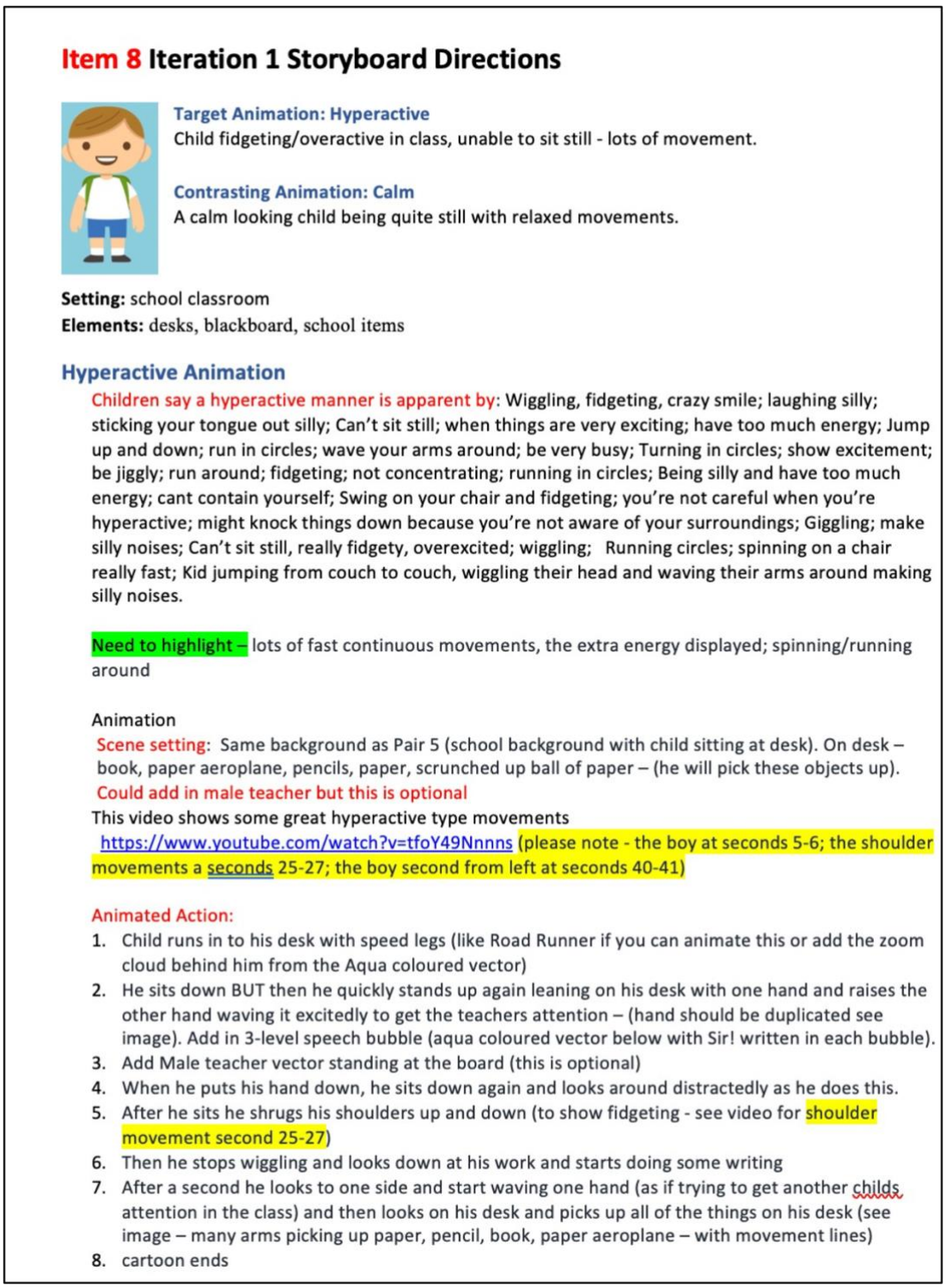
Step 4. Drafting Directive Storyboards

The purpose of creating storyboards was to consolidate all data sources and provide the artist with animation directions and sufficient details from which the first iteration of each animation prototype could be developed. Individual storyboard directions were created by the researcher for each animation pair and included descriptive information from the child's perspective, important aspects to highlight within each animation, an outline of the scene setting and a step-by-step description of the animated action to be incorporated. Also included were specific vector images that might be useful and additional cartoon models with written notes on the precise elements to incorporate. Once a storyboard was completed by the researcher it was

left with the artist and the animation was moved to production stage. Figures 6.8 through 6.10 show the directive storyboard that was provided to the artist for Item 8 animations (Hyperactive and Calm).

Figure 6.8

Storyboard for First Iteration of Item 8 Target Animation Hyperactive



Item 8 Iteration 1 Storyboard Directions

Target Animation: Hyperactive
Child fidgeting/overactive in class, unable to sit still - lots of movement.

Contrasting Animation: Calm
A calm looking child being quite still with relaxed movements.

Setting: school classroom
Elements: desks, blackboard, school items

Hyperactive Animation

Children say a hyperactive manner is apparent by: Wiggling, fidgeting, crazy smile; laughing silly; sticking your tongue out silly; Can't sit still; when things are very exciting; have too much energy; Jump up and down; run in circles; wave your arms around; be very busy; Turning in circles; show excitement; be jiggly; run around; fidgeting; not concentrating; running in circles; Being silly and have too much energy; cant contain yourself; Swing on your chair and fidgeting; you're not careful when you're hyperactive; might knock things down because you're not aware of your surroundings; Giggling; make silly noises; Can't sit still, really fidgety, overexcited; wiggling; Running circles; spinning on a chair really fast; Kid jumping from couch to couch, wiggling their head and waving their arms around making silly noises.

Need to highlight – lots of fast continuous movements, the extra energy displayed; spinning/running around

Animation

Scene setting: Same background as Pair 5 (school background with child sitting at desk). On desk – book, paper aeroplane, pencils, paper, scrunched up ball of paper – (he will pick these objects up).
Could add in male teacher but this is optional
This video shows some great hyperactive type movements
https://www.youtube.com/watch?v=tfoY49Nnnns (please note - the boy at seconds 5-6; the shoulder movements a seconds 25-27; the boy second from left at seconds 40-41)

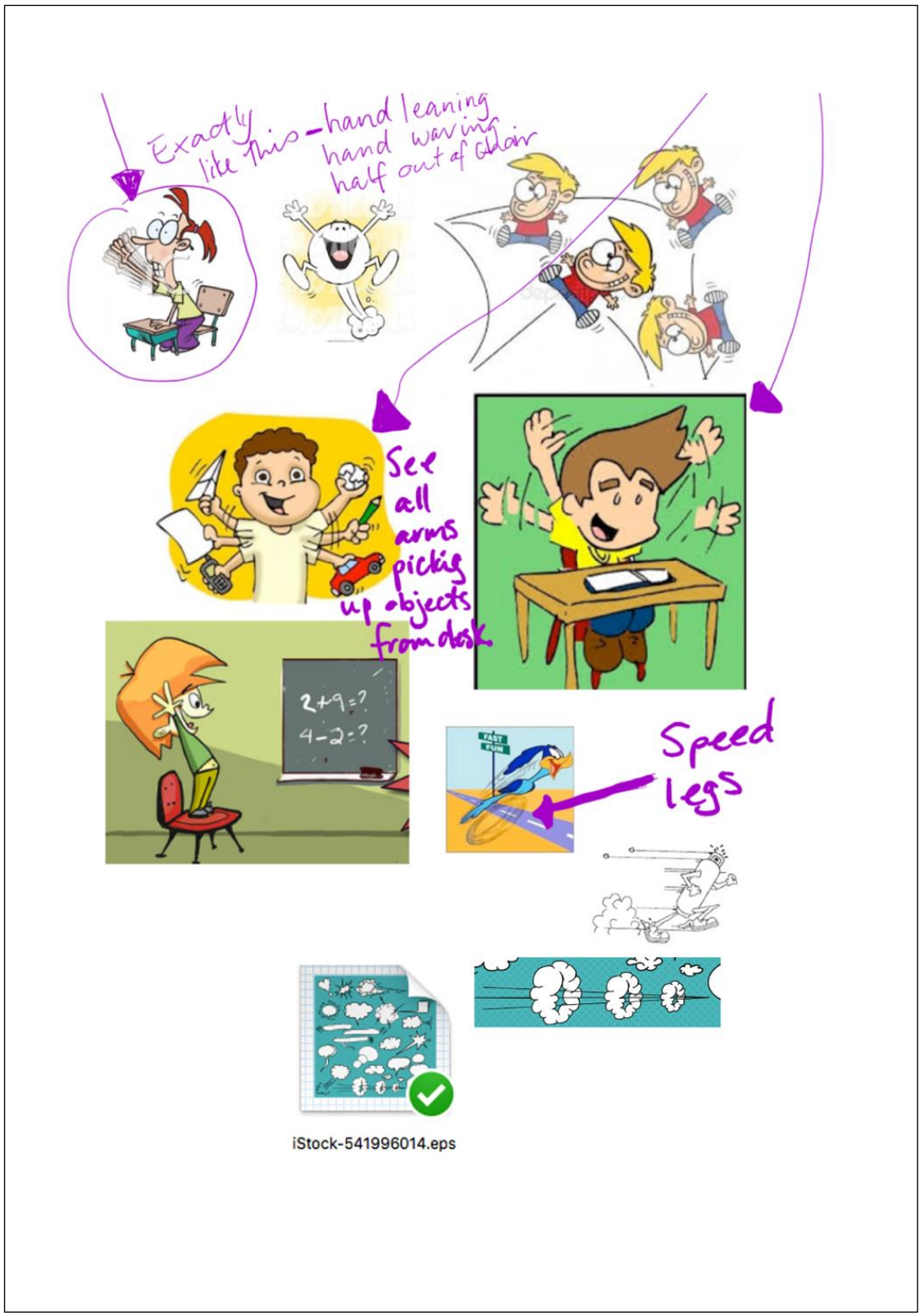
Animated Action:

1. Child runs in to his desk with speed legs (like Road Runner if you can animate this or add the zoom cloud behind him from the Aqua coloured vector)
2. He sits down BUT then he quickly stands up again leaning on his desk with one hand and raises the other hand waving it excitedly to get the teachers attention – (hand should be duplicated see image). Add in 3-level speech bubble (aqua coloured vector below with Sir! written in each bubble).
3. Add Male teacher vector standing at the board (this is optional)
4. When he puts his hand down, he sits down again and looks around distractedly as he does this.
5. After he sits he shrugs his shoulders up and down (to show fidgeting - see video for shoulder movement second 25-27)
6. Then he stops wiggling and looks down at his work and starts doing some writing
7. After a second he looks to one side and start waving one hand (as if trying to get another childs attention in the class) and then looks on his desk and picks up all of the things on his desk (see image – many arms picking up paper, pencil, book, paper aeroplane – with movement lines)
8. cartoon ends

Note. Page 1 of 2

Figure 6.9

Storyboard for First Iteration of Item 8 Target Animation Hyperactive



Note. Page 2 of 2

Figure 6.10

Storyboard for First Iteration of Item 8 Contrasting Animation Calm

Calm Animation

Children say a calm manner is apparent by: Leaning back and sitting with legs crossed; Meditating pose to relax; Sit back and close your eyes; take some big deep breaths; Whistling a happy tune; When you meditate; just chilling out; sit cross legged and going ommmm; Listening to music; being still; you are in control when you're calm and can contain yourself; Happy sigh, deep slow breaths; show someone laying out on the grass relaxed; Relaxed; meditation pose*** Read a book; you have your legs crossed meditating

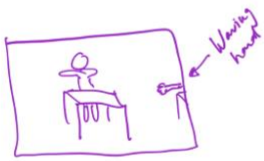
Need to highlight – slower movements, breathing in and out slowly,

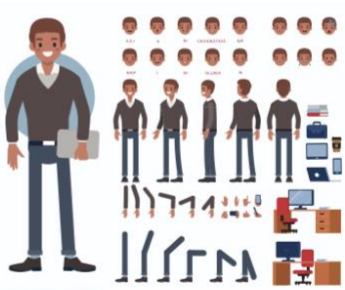
Animation

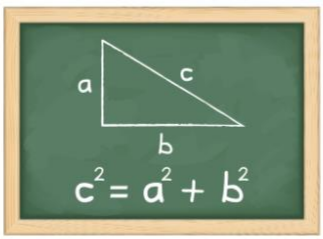
Scene setting: Same background as Pair 5 (school background with child sitting at desk). On desk – book, paper aeroplane, pencils, paper, scrunched up ball of paper – (he will pick one of these objects up)

Animated Action:

1. Child walks to his desk and then sits down
2. He raises his hand while seated to get the teachers attention – (hand is still and remains for a second)
3. Then he sits down and looks at the teacher
4. Then he picks up his pencil and starts doing some writing
5. After a second we see a hand appear from the side - as if from a child sitting at a desk off screen. A speech bubble appears with a pencil and a question mark in it.
6. The boy looks at the hand and then looks on his desk and picks up a pencil from his desk and puts it in the other persons hand (hand takes pencil and disappears)
7. boy turns back to his work and keeps writing







6.4 Production Stage

This stage required the artist to render each pair of animations based on the items storyboard directions. The artist utilised Adobe Animate software and created the animation renderings using frame-by-frame animation techniques. When a first draft of an animation had been completed by the artist it was reviewed by the researcher and feedback was drafted. Any refinements made to animations at this stage (prior to collecting child feedback) were based on discussions between the researcher and the researcher's supervisory team and then in collaboration with the artist. It was essential to include the artist regarding refinements to ensure all refinement requests were possible from a practical standpoint. When animations were considered to be at prototype stage sound files were collated or created by the researcher to match each animations storyline and actions. Refinement storyboards drafted for any animation based on feedback from users were made in the same manner after postproduction stage.

The number of refinements made to an animation was dependant on successful data translation, time constraints, and level of difficulty to animate specific elements. Figures 6.11 and 6.12 show second, third, and fourth refinement storyboards for Item 8 animations. Table 6.3 outlines the number of refinements required for each animation in the full suite throughout the entire development process and the stage at which refinements took place (i.e., pre or post qualitative validation). Pre-validation production refinements were research team directed and took place prior to Study 3 (qualitative validation). Postproduction stage refinements were user directed and took place post user testing and were based solely on participant's qualitative feedback. The majority of refinements (92.5%) took place during the initial production process where the researcher and artist worked closely together to translate the typologies and raw data from Study 2 into animated format. Only ten refinements were made postproduction based on user feedback. This suggests that translation of the data collected during Study 2 was quite true to the construct typologies (described in Chapter 4) and that many of the original prototypes were acceptable to child users who examined the animation content in Study 3 (described next in Chapter 7).

Figure 6.11

Storyboard for Second Iterations of Item 8 Animations Hyperactive and Calm

Iteration 2: Refinements

1. Revisions to file: Hyperactive_V1.mp4 Animation

To make more time for the 'many arms' section cut the first bit of him running in - it doesn't come across as hyperactive and also cut the bit with the shoulder shrugs.

1. When he's got his hands raised can you change his mouth to move like it's saying sir, sir, sir.
2. While he's seated throughout also add in him alternating between swinging his legs backwards and forwards and then side to side (i.e. ankles moving out and in to meet each other).
3. Instead of the bit where just his eyes move/look around, he needs to move his head as well – smile is ok here

Then continue with direction no. 7. "He then looks to one side and start waving one hand (as if trying to get another child's attention in the class) and then looks on his desk and picks up all of the things on his desk (see image – many arms picking up paper, pencil, book, paper aeroplane – with movement lines)."

Also, can you change the blackboard this vector with all of the writing on it – I think it suits this scenario

2. Revisions to file: Calm_V1.mp4

a) At the end of second 2 just before he puts his hand down **nod his head** as if he's been listening to the teacher and understood what he has to do, **reduce size of smile down to a smaller line smile** for the rest of the cartoon and then continue with the animation where he puts his hand down and starts to write.

a) **remove whole section with the pencil hand over**

b) **Have him open the top book where it is and leave it open, and then look in the book and then look down at his paper to continue writing**

c) **Look back to the book and paper again**

Figure 6.12

Storyboard for Third and Fourth Iterations of Item 8 Hyperactive Animation

Iteration 3: Refinements

1. Revisions to file: Hyperactive_V3.mp4

Overall, there needs to be much more movement (fidgeting/wiggling) in this cartoon.

a) **Remove the section at the beginning where there's no movement** (about the first half second). We want it to start with movements immediately.
b) Just after the 'sir, sir, sir' speech bubble disappears at second 3 **have him stand up and sit down** (this might look better and be more realistic if you reduce the size of the furniture and move the floor level down so that his feet are closer to touching the floor).
c) While he's seated throughout also add in him alternating between swinging his legs backwards and forwards and then side to side (i.e. ankles moving out and in to meet each other). **Continue this leg movement whenever he's seated.**
d) From 7 seconds his smile is too big – make it a smaller smile please -> just a line smile is fine.
e) At second 8 when he picks up the ball of paper instead of dropping it straight away can he **throw the paper ball up and down two more times** (i.e. paper bounces off his hand twice more before he drops it) and then he
f) **Have him stand up and sit down again, legs wiggling while looking off to the right** to end the cartoon

Iteration 4: Refinements

1. Revisions to file: Hyperactive_V4.mp4

a) "Just after the 'sir, sir, sir' speech bubble disappears at second 3 **have him stand up and sit down"** (**what you've done here is good, but it all needs to occur faster - can you simply speed up this section of the video?**
b) After the new part where he bounces the paper ball 3 times please **add the last second back in from Version 3** (where he builds things with his books and pencil) so that the cartoon ends with this sequence again. You can also speed up the paper ball bounce section, so that part takes less time if necessary.

Table 6.3

Frequency of Animation Refinements Required During Production (Translation) and Postproduction (Refinement) Stages

Item Pair	Animation Title	Production	Postproduction
1	Sad/Depressed	3	0
	Happy	4	0
2	Worried/Anxious	5	0
	Not worried/Confident	5	1
3	Sleeps Poorly	3	1
	Sleeps Well	3	0
4	Angry	4	0
	Not angry/Impassive	4	0
5	Disobedient (school)	6	1
	Obedient (school)	8	1
6	Shy	4	1
	Not shy/Outgoing	6	0
7	Argumentative	6	2
	Not argumentative	5	2
8	Hyperactive behaviour	6	1
	Calm/Sensible	3	0
9	Lonely/Alone	4	0
	Sociable/Alone by choice	2	0
10	Bullied/Excluded	3	0
	Not bullied/Included	2	0
11	Fearful/scared	4	0
	Not scared/Brave	3	0
12	Disobedient (home)	3	0
	Obedient (home)	4	0
13	Distracted/Inattentive	3	0
	Focused/Pays attention	2	0
14	Physically aggressive	7	0
	Kind/Peaceful	3	0
15	Physical symptoms/Feel sickly	4	0
	No symptoms/Feel well	5	0
Total refinements		124	10

Note. Production stage refinements were research team directed. Postproduction stage refinements were child directed.

Step 5. Collating and Creating Audio

To increase engagement and enhance children's understanding of the animation item content it was important to add sound to the animations. Ninety individual audio files were either collated by the researcher using purchased sound

effects from Storyblocks website (https://www.storyblocks.com) or created by the author personally from recordings made on an iPhone using the voice memo application. Storyblocks is a stock media subscription service that offers audio files that are either royalty free or may be purchased under licence. All sound files sourced from Storyblocks were purchased under licence as these files are the most unrestricted. That is, they are royalty-free in perpetuity on unlimited projects and there is no requirement to track how many times the assets are used. Further, the license is valid worldwide with no geographic restrictions and covers both personal and commercial project use which satisfies the potential future use of the ICDS application. The majority of audio files were used only once in specific animations, but others were used multiple times (e.g., sighs, ambient park sounds).

6.5 Postproduction Stage

The postproduction stage involves adding audio files to enhance the animated action as well as final editing. Spoken statements were kept to a minimum within the animations and the majority of audio included ambient sounds and Final editing ensures the animation looks sharp (i.e., not blurry) and flows seamlessly without any glitches or stoppages during the video playback. Final editing was completed by the artist in collaboration with the researcher. Once this stage was finished all prototype animations were exported into individual Mp4 video files and uploaded into the ICDS website for user testing. To refine animations in postproduction stage, steps from pre-production stage step 3 onwards were repeated. Examples of final animations may be accessed by completing the ICDS application via the following website https://animated-screening-project.herokuapp.com/?Admin_ID=KZieschank&_t=1569304213965.

6.6 Finalisation of ICDS Technology Stack

From a technological point of view the ICDS was written utilising an app-centric approach via the Heroku Platform. The Heroku Platform is a managed container-based cloud system with integrated data services for deploying and running software (Salesforce Developers, 2021). This system enabled our research team to create the ICDS as a web-based ‘app’ that could be viewed on any web-browser via any modern smart-device (e.g., phones, tablets, personal computers) without requiring a separate download or later updates. Therefore, a user simply opens the ICDS website on their device via a weblink and is able to complete the assessment immediately. At each use the animations will appear in a sequencial order however

the first animation to be seen in each pair is randomised. Therefore the negative/deficit vs positive/strength based animation is random to avoid an order effect.

The website is currently only available for use within research projects and accessible to the research team. As an administrator of the website only the author has access to identifiable data via a separate PHP: hypertext preprocessor backend that is based on the open-source WordPress framework. This data is collected in a structured query language (SQL) database and stored on a secure server within the University of Southern Queenslands research infrastructure. Future development could see the app made available as an open-source tool to caregivers for in-home use but only after further psychometric examination is complete, cut-off levels are confirmed, and interpretations of scores are established.

6.7 Conclusion

Multiple animations were at different stages of production and user testing throughout this time. Figure 6.13 depicts a screenshot of the opening scene in each of the final animations included in the ICDS application.

Figure 6.13

Screenshot of Each Animation Video File (N = 30)

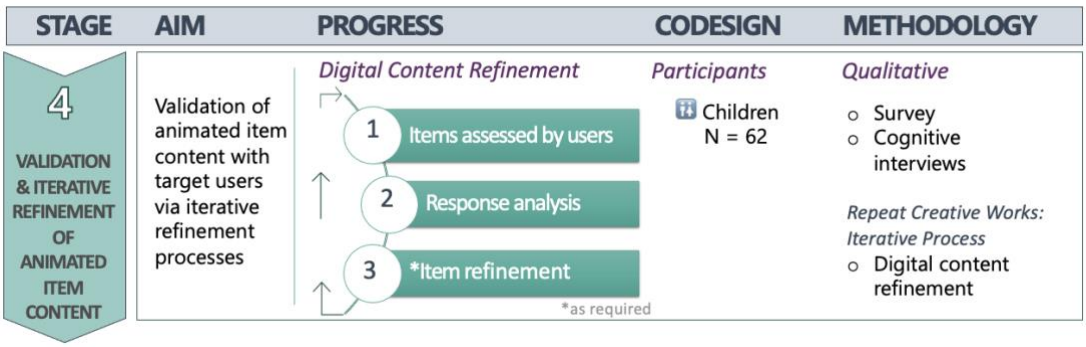
CHAPTER 7: STAGE FOUR STUDY 3 ITEM CONTENT VALIDATION AND REFINEMENT

7.1 Overview of the Chapter

This chapter describes Stage 4, Study 3 of this research program. The purpose of this study was to qualitatively validate the item content of each of the 30 animations from the child's perspective. In addition, the children's satisfaction with the items and understanding of the items was examined. To improve any animations that were deemed unsatisfactory or where meaning was unclear, we conducted iterative refinement processes with the animator until consensus was reached. Figure 7.1 provides an overview of the study.

Figure 7.1

Study 3 Outline in Brief



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7.2 Co-Design and Qualitative Validation of Animated Assessment Item Content for a Child-Reported Digital Distress Screener

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7.3 Abstract

Purpose: The *Interactive Child Distress Screener* (*ICDS*) is a novel, digital assessment tool that is currently under development and aims to broadly assess self-reported emotional and behavioural distress in children aged five to 11 years. This study implemented a generative participatory codesign and iterative refinement process to qualitatively validate the content of 30 animated assessment items developed for the ICDS by assessing their acceptability and accuracy from the child's perspective.

Methods: The participants (N = 62) were five to 11-year-old children. Individual interviews were conducted with each child to determine acceptability and validity of animated items and facilitate the co-design refinement process of the animated assessment items.

Results*:* Twenty-two out of 30 (73%) items met ≥80% satisfaction and accuracy consensus in their original format, six items (20%) required one round of refinement before meeting consensus, and two items (7%) required two rounds of refinements. Combined acceptability of animated items was high, ranging from 4.1 to 5 out of 5 across all items.

Conclusion: Participants were able to accurately identify and understand socio-emotional and behavioural constructs when depicted as animated items. Acceptability was high, even in first iterations when accuracy of understanding required refinement. This study highlighted the importance and benefits of iterative participatory design methodology in ensuring assessment items developed for children are understood, accepted and likely to be effective in obtaining accurate self-report.

7.4 Background

According to national mental health surveys (Lawrence et al., 2015; Sawyer et al., 2001) emotional and behavioural disorders remain the most commonly diagnosed among children under the age of 12 years and include attention deficit/hyperactivity disorder (ADHD, 7.4%), anxiety disorder (6.9%), major depressive disorder (MDD, 2.8%), and conduct disorder (2.1%). Comorbid disorders are frequent, with one third of the children diagnosed with ADHD or conduct disorder also suffering from anxiety and/or depression (Achenbach & Rescorla, 2003; Johnson et al., 2016; Wood & McDaniel, 2020). Undetected and untreated mental illness during childhood causes suffering, impedes healthy development, has detrimental effects on educational progress and opportunities through to adolescence, and also increases the probability of enduring psychosocial disorders in adulthood (Caspi et al., 1995; Moreira et al., 2013; The Royal Australian and New Zealand College of Psychiatrists, 2010). The early detection of symptoms of distress is key, as many emotional and behavioural difficulties can be treated effectively if identified early and before they develop in intensity (Jacka & Reavley, 2014).

Universal and targeted mental health screening as a first step in early intervention for children has long been a priority recommended by Government and professional mental health bodies, but in practice, is not broadly implemented (Children's Health Queensland, 2018; Royal Australian and New Zealand College of Psychiatrists (RANZCP), 2017). Pre-emptive screening provides the means to identify those children showing early symptoms: initially for the purposes of referral for comprehensive assessment which facilitates early intervention, and ultimately to reduce substantial mental health and financial cost burdens before they begin. However, there are distinct challenges to this. To have full impact, mental health screening must be equitably accessible and gather perspectives from multiple responders including the child.

The conventional approach to examining children's experiences has been to observe them and make subjective judgements or rely primarily on proxies such as parents, clinicians, or teachers to respond on their behalf (Darbyshire et al., 2005). This is despite support in the literature establishing the reliability and validity of children's ability to self-report, particularly as related to their internal subjective experiences which are more easily hidden (Cree et al., 2002; Hudziak et al., 2007; Kirk, 2007; Riley, 2004). Parent reports may be influenced by their predominant

concerns, their level of involvement in primary caregiving, and their own mental health and wellbeing, whilst clinician and teacher perspectives are restricted to the settings in which they see the child (Eiser & Morse, 2001). To ensure that a comprehensive picture is obtained, it is important to have screening tools that offer children a self-report option. Yet, screeners that have sufficient evidence base to warrant widespread use are costly and/or require professional administration which limits their accessibility or offer self-report options for adolescents only which overlooks younger children's perspectives. For example, the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) and the Brief Problem Monitor-Youth Form (BPM-Y; Achenbach et al., 2011) are two well validated screening tools that are restricted to clinical settings and do not have a self-report option for children <11 years.

Further, there is growing evidence demonstrating discrepancies between parent-child agreement ratings across multiple measures and particularly within emotional and psychosocial domains (Jardine et al., 2014). Riley, (2004) reported a meta-analysis of 119 studies that found the average correlation between parent and teacher reports and parent and child reports (when the option was available) were 0.28 and 0.22 respectively. A systematic review examining agreement between self- and proxy-reported quality of life (e.g., anxiety, pain, depression, coping) in young children aged <12 years found that the child's perception frequently differed from their parents in both positive and negative directions (Jardine et al., 2014). Such discrepancies might be associated with the mode of delivery or the way in which measures have been written for children. To meet such challenges, new methods for developing and delivering screening instruments for children are needed to increase accessibility and to supplement proxy reports so that a more comprehensive understanding of a child's mental health status might be consistently obtained.

7.4.1 Instrument Development for Children

Despite assessment being an integral component of clinical psychology practice, there is no 'gold standard' approach for developing measurement instruments for children (Bergeron et al., 2013). Screening instruments developed for emotional and behavioural assessment are typically modified adult, pen-and-paper, text-based measures and contain words that may be problematic for younger children to understand (e.g., depressed, inferior, self-conscious, stubborn). Further, they often utilise Likert-style response formats with three or more response options. Mellor and

Moore (2014) found that dichotomous response formats were more reliable than Likert scales with children aged 6–13 years, especially when used with questions concerning emotional or behavioural states.

Understanding how children internalise and comprehend assessment item content and formulate responses is an imperative first step in designing sound instruments for children for two key reasons. First, this maximizes item response accuracy; and second, it increases clinical interpretability of test results and informs how these results are used to make clinical recommendations. Therefore, self-report measures for children must incorporate new methodological approaches that emphasize the active participation of young people (i.e., co-design methods) to accurately capture the child's perspective.

7.4.2 Obtaining the Child's Perspective via Participatory Methods

The practical-methodological justification for including children in child-focused research is because they know most about their lives and are therefore, the best sources of information (Soffer & Ben-Arieh, 2014). Generative, participatory research design means children are involved in all creative development activities that facilitates their contribution as research partners, and not simply as observed subjects or testers of a final product (Stålberg et al., 2016; Vandekerckhove et al., 2020). In relation to research involving digital technology, understanding the child's perspective benefits from participatory co-design approaches that are characterized by iterative phases (Mummah et al., 2016; Stålberg et al., 2016; Stoyanov et al., 2016). A true iterative process requires cyclical inquiry where evaluations, revisions, and improvements are the outcome of each iteration until a conclusion is reached (Cockburn, 2008; Farcic, 2014; Patrick et al., 2016). In iterative methodologies involving children, the child's perspective is valued throughout the development process because their input is essential at each improvement phase, and ultimately increases the likelihood of their engagement with the end-product (Edwards et al., 2016; Stålberg et al., 2016).

Though this approach is still quite unique with respect to the development of child mental health assessment instruments, the use of participatory and iterative development techniques has been employed with children in positive psychology research and with adolescents when composing questionnaires, (Ten Brummelaar et al., 2014; Yarosh & Schueller, 2017). In the case of developing digital tools, this type of methodology involves drawing on a range of interviewing techniques that

include prompting spontaneous narratives, soliciting responses to scenarios and vignettes, using visual and audible stimuli, and obtaining consultative feedback (Greene & Hogan, 2005).

7.4.3 The Digital Opportunity

Low-cost internet has made digital health and psychological treatment interventions via website and contemporary mobile application software increasingly accessible over the past ten years (Cugelman, 2013; Marsac et al., 2015; Newton et al., 2016). It follows that digital technology will also increase mental health screening opportunities and overcome many inherent challenges of widespread screening of young populations. Attempts have previously been made to improve on traditional paper-and-pencil assessments for children via the addition of digital images alongside written questions. For example, desktop computer-based versions of the Dominic Interactive (DI), Strengths and Difficulties Questionnaire (SDQ), and Mood Assessment via Animated Characters (MAAC), were all trialled in the decade preceding 2010 to increase user engagement and understanding (Manassis et al., 2009; Truman et al., 2003; Valla et al., 2000). Limited psychometric data and information on the development of these measures is available and none appear to be in use today. Initial studies variously reported high user satisfaction and some clinical utility (i.e., computerized SDQ), moderate convergent validity (i.e., DI), and discrimination between anxious and nonanxious children (i.e., MAAC). Notably, all demonstrated improved engagement compared to standard pencil-and-paper versions suggesting visual, digital formats are favoured by children (Bergeron et al., 2013; Linares Scott et al., 2006; Manassis et al., 2013; Truman et al., 2003).

The current generation of children are exposed to digital technologies from a very young age and learn to independently access and operate websites and programs by simply tapping and swiping on touchscreen devices with a finger (Wrobel, 2019). Consequently, we propose that digital instruments comprised of child-friendly assessment items and response modalities that children are already accustomed to will obtain reliable clinical information and provide means for accessible and rapid screening. Modern animation techniques offer a novel and promising approach to improve on the static images used in previous efforts. Audio-visual assessment items might better facilitate accurate child-report, particularly in contexts where standard written question and answer assessments are unsuitable or self-report options are currently non-existent for children under 12 years of age. To ensure that animated

item content is meaningful to children and accurately demonstrates socio-emotional and behavioural concepts from the child perspective, we further propose that children must be involved in item development using generative participatory research methodologies.

7.4.4 The Interactive Child Distress Screener (ICDS)

It is intended that the ICDS will be delivered via a user-friendly web-based app and utilised as a broad screening instrument designed to detect self-reported emotional and behavioural difficulties in children aged five to 11 years. A prototype version that includes three pairs of original animated cartoon assessment items has been tested by children, with results highlighting the acceptability and feasibility of the animated format (March, Day et al., 2018). Ultimately, the ICDS will utilise up to 15 pairs of contrasting digital animations as assessment items: each representing different socio-emotional or behavioural situations. The broad social-emotional and behavioural domains and 15 associated constructs were selected by an expert panel in an original pilot study (March, Day et al., 2018) and formed Study 1 of this research program.

A follow-on qualitative focus-group study was conducted with 20 children to explore how they understood, visualised, and expressed each of the 15 emotional and behavioural constructs that the proposed ICDS would measure (Zieschank, Machin et al., 2021). Participatory methodologies were implemented to engage children in role play and discussion to provide visual, verbal, and physical interpretations of each construct item to capture the child's perspective. Comprehensive typologies of each emotion and behaviour were created from this data to guide the translation of the children's collective viewpoint into 15 pairs of animated prototype assessment items. Results of this study also demonstrated the importance of audio-visual depiction over simple lexical labelling and a lack of distinct developmental differences in emotion comprehension and expression between younger and older participants (Zieschank, Machin et al., 2021).

7.5 Aims

This paper describes the generative participatory methodology and iterative process that was implemented to develop 30 prototype cartoon animations (i.e., 15 contrasting pairs) to be used as assessment items in the ICDS instrument. The broad objective of the present study was to co-design and refine the animated items with children (5–11 years) via qualitative interviews. Specific aims were to 1) determine

the acceptability of the prototype animations to children via satisfaction ratings and 2) to conduct qualitative validation of animation content by assessing the accuracy of children's understanding and recognition of the target and contrasting social, emotional, and behavioural constructs. Participatory and iterative methodologies were utilised to conduct this research until optimal acceptability and accuracy of animated item content was reached. This study received approval from The University of Southern Queensland's Human Research Ethics Committee (Ref: H16REA003).

7.6. Materials and Methods

7.6.1 30 Prototype Digital Animations (ICDS Items)

A set of 30 audio-visual animations displayed in MPEG-4 AVC video file format (Mp4) was created using 2D Vector-based animation techniques. The findings from previous focus groups with children (Zieschank, Machin et al., 2021) were used to inform the original scenario content for each of the items. The contrasting animation pairs that form each assessment item are listed in Table 7.1. Target animations depict a child experiencing a difficult emotional or behavioural experience (e.g., sadness) whilst the contrasting item depicts the opposite of each target construct (e.g., happiness).

Table 7.1

Target and Contrasting Constructs for Which 15 Animated Assessment Item Pairs Were Created

Item	Target construct	Item	Contrasting construct
1a	Sad – Depressed	1b	Happy
2a	Worried – Anxious	2b	Not worried – Confident
3a	Sleeps poorly	3b	Sleeps well
4a	Angry	4b	Not angry – Impassive
5a	Disobedient (at School)	5b	Obedient (at School)
6a	Shy	6b	Not Shy – Outgoing
7a	Argumentative	7b	Not argumentative
8a	Hyperactive behaviour	8b	Calm – Sensible
9a	Lonely – Alone	9b	Sociable – Alone by choice
10a	Bullied – Excluded	10b	Not bullied – Included
11a	Fearful – Scared	11b	Not Scared – Brave
12a	Disobedient (at Home)	12b	Obedient (at Home)
13a	Distracted – Inattentive	13b	Focused – Pays attention
14a	Physically aggressive	14b	Kind – Peaceful
15a	Physical symptoms – Feel sickly	15b	No physical symptoms – Feel well

7.6.2 Interview Script

The interview script was developed specifically for this study and comprised a series of questions to qualitatively examine the acceptability and content accuracy of the animated items and invite refinement suggestions for improvement. The interview protocol is attached in Appendix D.

Animation Acceptability Questions

Participants' acceptability of each animation was determined via satisfaction ratings obtained using a 4-item author-developed survey. For each animation, participants were asked to rate how much they liked 1) the sounds heard during each animation (audio appeal), 2) the animated characters (character appeal), 3) the actual animated scene (animated action and context), and 4) the animation overall (viewing appeal). Responses were elicited using a 5-point visual Likert scale which utilised stars rather than numbers and labels. A greater number of stars equated to higher satisfaction, such that one star indicated the lowest satisfaction (scored as one point), and five stars indicated the highest satisfaction (scored as five points). Scores for each animation were averaged across the four categories to provide a total acceptability rating out of five. The higher the score, the higher the satisfaction and therefore the acceptability of the animation to the participant. Average satisfaction scores (out of five) were calculated for each of the acceptability questions.

Animation Accuracy Questions

The intended emotion or behaviour being conveyed in each animation was not divulged to the participant until they had answered the first two accuracy questions. The aim of accuracy questions was to ascertain the participants' ability to correctly understand the intended construct depicted in the animation in four ways. To determine if each participant could: 1) accurately understand the intention of the animation, 2) accurately identify the construct depicted in the animation by verbally labelling it, 3) judge whether they believed the animation content accurately represented the construct as intended, and 4) judge whether the audio soundtrack accurately enhanced the animation content. Based on aggregated participant responses, the animation content was refined at each round.

Question 1. Understanding. To determine how accurately the children understood the content of each animation they were asked to recall a personal account equivalent to the animation content with the question "Tell me a story about a time when you or someone you know felt the same as the child in this cartoon?".

To be rated as correct, the investigator considered whether a participant's narrative example was comparable to the emotion or behaviour depicted in the animation. For example, a narrative about a beloved pet dying and a parent being hospitalised were recognized as scenarios that would elicit sadness and worry. These narrative examples were deemed comparable, internalised understandings of animations 1a (sad-depressed) and 2a (worried-anxious) and scored as correct. All responses were recorded verbatim on the response sheet and coded as either correct (1) or incorrect (0). A correct response indicated that the child understood the animation content and that the animation was accurate in its depiction, and an incorrect response meant they misunderstood the intention of the animation which might require refinement. Two assessors independently reviewed participants narratives to evaluate if the child's internal representation (understanding) accurately aligned with the intended construct. Any discrepancies were discussed until consensus was reached.

Question 2. Identification. To determine how accurately children identified the construct depicted in each animation they were asked to verbally label the emotion or behaviour with the question "Can you tell me how the child is feeling or behaving in this cartoon?". Participants' labelling ability was verbally affirmed if accurate or corrected if their interpretation was inaccurate. For example, responses such as 'sad', 'upset', or 'unhappy' were scored as accurately identifying item 1a (sad-depressed). Responses were recorded verbatim and coded as correct (1) or incorrect (0). Two assessors independently reviewed all participant responses to evaluate if the child's lexical descriptor accurately identified each animation as intended. Any inconsistency between investigator ratings was discussed between assessors until consensus was reached.

Question 3. Representation. To determine if participants believed the animation in question was an accurate representation of the intended construct, they were asked the question "Is this animation good or bad at showing someone feeling (e.g., sad)?". To answer this question participants were provided with a sheet of paper displaying a large red cross symbol and a large green tick symbol. Children responded by pointing to their chosen symbol or by saying yes, no, tick, or cross. This question was asked after the child was informed of the construct that the animation was meant to portray. If a participant responded in the affirmative and deemed the animation to be 'good', it was coded (1) as an accurate representation. If they deemed the animation to be 'bad' and responded negatively, the animation was

considered to be inaccurate representation of the intended construct and was coded (0).

Question 4. Audio Soundtrack. To determine if the audio soundtrack accurately enhanced their understanding of the emotion, behaviour, or scenario depicted in each animation, participants were asked "Did the sounds help you to understand how the child was feeling and what was happening in the cartoon?" A "yes" response was coded (1) for helpful sounds that aided understanding of the animation, and "no" was coded (0) for sounds that were not helpful or confused their understanding of the animation.

Item Refinement Questions

To aid refinement of items, participants were asked to first offer a 'better idea' or 'different story' for any animation they believed inaccurately represented a construct by responding to the question "What could we do in this cartoon so that it does show 'x' feeling or behaviour?". Participants were asked to provide qualitative feedback about the scenario and discuss suggestions on how to change the animation to increase the accuracy of the content. They were asked about adding, removing, enhancing, or changing the story, action, background scene, or sounds. Responses were recorded verbatim onto an answer sheet and assigned according to the participants', 'add', 'remove', or 'change' recommendations. Any item identified as requiring refinement was redeveloped based on this feedback in conjunction with discussion with the animator.

7.7 Sample

Data were collected from a community sample of 62 children (50% male, M_{age} = 8.10 years, *SD* = 2.00) living in South-East Queensland, Australia. Participants were contacted via their parents through the research team's personal networks and via advertisements on social media. Inclusion criteria was that children were aged from five to 11 years, spoke English, and were able to attend an in-person interview. No inclusion or exclusion criteria around ethnicity, mental health difficulties or emotional or behavioural symptoms were included or assessed. Gender ratios were roughly equivalent across ages, as outlined in Table 7.2. All children were born in Australia.

Table 7.2

Total Number of Participants as a Function of Age and Gender (N = 62)

	Child age (years)							
Gender	5	6	7	8	9	10	11	Total (*n*)
Male	4	3	5	4	3	3	3	31
Female	5	4	4	6	4	9	5	31

7.8 Procedure

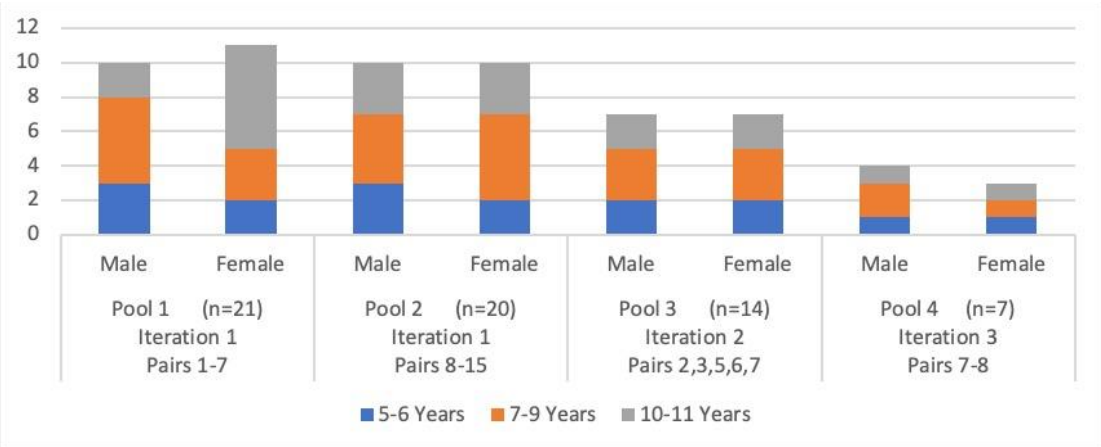
Parents who responded favourably to advertisements were emailed comprehensive information sheets describing the purpose of the study, their child's right to decline or withdraw their consent to participate at any time and the confidentiality of their child's responses. With parents' written consent, the first author met with each child individually, reiterated the content of the information sheet, and obtained their written assent to participate. Structured, individual interviews took place at the University of Southern Queensland or at the child's own home at the preference of the participant's parent. The interviews were conducted using a semi-structured script. Participants were asked to watch a single animation and then answer the interview questions in order. This process was repeated until each animation had been viewed and examined by the participant and responses recorded. Acceptability and accuracy questions were asked verbatim to ensure standardization across participant interviews, whilst animation refinement discussions were less structured. Participants were able to take breaks and could view any animation multiple times, therefore the length of interviews varied between participants. All children were provided with a store gift card to the value of $20AU at the completion of each interview to thank them for their time. Children had no prior knowledge that a reward would be provided.

To ensure young participants were not unduly burdened by overly lengthy interviews, the maximum number of animations that an individual participant examined was eight pairs (16 discrete animations). This was achieved by splitting participants into pools within each round of interviews. Every attempt was made to ensure similar age and gender representations within each participant pool. However, given that it was a convenience sample, this was dependent on the availability of participants at the time the interviews were conducted. Figure 7.2 describes the group characteristics of each interview pool and the iterative development phase they were

involved in. Interviews were conducted over a six-month timeframe to allow for refinement of animations by the animator between interview rounds. All refinements to animations were completed by a digital animation artist based on updated storyboards and their ability to be accurately animated. Refinements were grounded in aggregated participant feedback suggestions. At least 80% of participants perceived evaluated animations to be accurate in their original prototype format, therefore fewer participants were required for following iterations.

Figure 7.2

Age and Gender Characteristics of Participants per Interview Pool and Iteration Round (N=62)



7.8.1 Analytic Approach

To determine if an animation required refinement, acceptability ratings, accuracy consensus ratings, and participant refinement suggestions were examined per participant pool. Satisfaction ratings and interview responses (coded as correct or incorrect) were analysed after each interview round to determine which animations were accurately interpreted and acceptable to participants across all ages (5-11-years) and within age group levels (i.e., level one = 5-6-years, level two = 7-9-years, and level three = 10-11-years). A consensus method was applied (determined a priori) such that for an animation to be retained, it needed to: a) receive at least four stars on average (out of five) on total average satisfaction scores to be deemed acceptable, and b) achieve at least an 80% rating consensus across the whole sample (5-11-years) within ‘understanding’, ‘identification’, ‘representation’, and ‘audio’ accuracy assessment response categories. Any animations that failed to reach consensus across the whole sample in any response category were identified for refinement and further

examination in a following iteration. Animations that reached consensus across the sample as a whole but failed within age-group levels in one or more categories were considered for refinement based on individual responses and participant refinement suggestions. Further, if participants gave substantial suggestions for improvements to an animation despite high satisfaction and accuracy ratings, then the animation was likewise considered for refinement to increase acceptability.

Refined animations were then presented to a new participant pool in a subsequent interview round for re-evaluation. Refined animations were always presented with their paired contrasting animation (even if this animation had not been refined) to ensure context was preserved and so that all participants viewed animations consistently across participant pools.

7.9 Results

Results are reported sequentially by interview iteration and participant pool. The specific protype animated items being examined are reported, followed by acceptability rating results, accuracy consensus ratings, and refinement suggestions. A results summery details which animated items were retained, and which were marked for refinement and examination in a following interview round.

7.9.1 First Iteration Results

The 15 original pairs of animations were divided amongst two interview pools in round one interviews. Pool one participants (n = 21, 52.4% female, M_{age} = 8.14 years, SD = 1.96) examined 14 individual animations (i.e., item pairs 1 to 7) and pool two participants (n = 20, 50% female, M_{age} = 8.10 years, SD = 2.10) examined 16 animations (i.e., item pairs 8 to 15).

Animation Acceptability

The acceptability of all animations was high with 100% rated ≥4.0 stars. The average satisfaction ratings for each item out of five stars are reported in Table 7.3. In participant pool one, the average star-rating across all animations for each response category was 4.1 for audio appeal, 4.3 for character appeal, 4.2 for animated action and context, and 4.4 for viewing appeal. Combined ratings were high across all animations with an average total satisfaction score of 4.3 representing positive acceptability. From participant pool two, the average star-rating across all animations for each category was 3.7 for audio appeal, 4.3 for character appeal, 4.2 for animated action and context, and 4.5 for viewing appeal. The average rating for audio appeal was lower across all animations in this pool due to one participant

consistently rating the audio appeal of most items as one star. Despite this, the combined satisfaction ratings were high across all animations with an average total satisfaction score of ≥4.1.

Animation Accuracy

Five items failed to reach consensus (i.e., ≥80% accuracy) across the whole sample in one or more response categories and therefore immediately identified for refinement. These were items 5b, 6a, 7a, 7b, and 8a. The poorest performing item was 7b (not argumentative) with 43% of participants misunderstanding the intended behaviour and responding with inaccurate personal examples, and 66% incorrectly identifying the item, with the majority labelling the scenario as "being a good girl" and representative of a child demonstrating 'good' behaviour.

Though all other items achieved ≥80% accuracy consensus across the sample as a whole in each response category, there were variations within age-group levels. Items 4b, 6b, 8b, 10a, 11b, 12a, and 13a failed to reach consensus within the 'understanding' response category in one or more age-group levels (i.e., item 4b, age-group levels 1 and 2; item 6b, level 3; items 8b and 13a, level 1; and items 10a, 11b, and 12a, level 2). Closer examination of individual participant responses regarding these animations showed that discrepancies were predominantly due to children not being able to think of an equivalent personal example and replying with statements such as "I don't know" and "I don't act like that" or shrugging their shoulders, rather than incorrect responses. Consensus was achieved in all other response categories for these animations with 96.5% of participants providing accurate labels (i.e., 'identification' category), 98.6% of participants agreeing the animations accurately portrayed the constructs ('representation' category), and 100% of participants agreeing the sounds were accurate ('audio' category). No suggestions were made for refinements; therefore, a decision was made to retain these seven animations in their original form.

Item 2b (not worried – confident) achieved ≥87.5% consensus in the 'audio' category but failed to achieve consensus within age group level 2 (75%) in the 'understanding' and 'representation' categories, and age group level 3 (75%) in the 'identification' category along with numerous refinement suggestions. Item 5a (disobedient at school) achieved 100% consensus in the 'audio' category, and ≥80% consensus in 'understanding' and identification categories but failed to achieve consensus within age group level 3 (50%) in the 'representation' category along with

several refinement suggestions. Therefore, items 2b and 5a were also targeted for refinement. Table 7.4 identifies accuracy ratings across the whole sample (5–11-years) for each accuracy response category (i.e., understanding, identification, representation, and audio accuracy) during Iteration One. Table 7.5 specifies accuracy rating variations between age group levels (level 1 = 5–6 years, level 2 = 7–9 years, and level 3 = 10–11 years).

Refinement Feedback for Identified Animations

The majority of suggestions to improve items were to exaggerate components of the current animation or add in creative details. If a suggestion could not be animated effectively it was not incorporated. Any suggestions to add substantial dialogue between characters were disregarded due to the brevity of the animations and due to our prior commitment to develop measurement items that were not contingent on language (written or spoken). Though item 3a (sleeps poorly) achieved >90% consensus in each accuracy response category it received substantial creative refinement recommendations. An alternative storyline was proposed for Pair 7 (i.e., argumentative and not argumentative) to improve understanding. For these animations, participants recommended changing the scenario significantly from a mother arguing with her child about leaving a playground to having two child characters arguing over toys instead. It was apparent that the presence of the mother figure gave the impression that the scenario was about ‘obedience’ rather than argumentative behaviour. All refinement suggestions reported by participants in round 1 interviews are listed in Table 7.6.

First Iteration Results Summary

Based on combined acceptability and accuracy ratings and refinement suggestions, twenty-two original items (73%) were retained and eight required refinements after the first round of interviews. Seven individual animations were retained from pool one (i.e., items 1a and b, 2a, 3b, 4a and b, and 6b) and seven required further refinement. Those requiring refinement were items 2b (not worried), 3a (sleeps poorly), 5a (disobedient at school), 5b (obedient at school), 6a (shy), 7a (argumentative), and 7b (not argumentative). From pool two participant responses, 15 individual animations were retained (i.e., items 8b, 9a and b, 10a and b, 11a and b, 12a and b, 13a and b, 14a and b, and 15a and b), and one item (8a, hyperactive) required refinement.

Table 7.3

Iteration One: Average Satisfaction Ratings Out of 5 Per Item

Animated Item	Audio Appeal	Character Appeal	Animated Action Context	Viewing Appeal	Total Average Satisfaction
Pool 1 (*N* = 21)					
1a	4.0	4.3	4.0	4.4	4.2
1b	3.9	4.0	4.4	4.5	4.2
2a	4.1	4.1	4.2	4.2	4.2
2b	3.9	4.1	4.1	4.4	4.1
3a	4.2	4.3	4.4	4.6	4.4
3b	4.2	4.4	4.1	4.4	4.3
4a	4.4	4.3	4.4	4.4	4.4
4b	4.0	4.1	4.1	4.1	4.1
5a	4.3	4.2	4.3	4.6	4.4
5b	4.1	4.3	4.2	4.4	4.3
6a	4.0	4.2	4.4	4.4	4.3
6b	4.0	4.7	4.2	4.6	4.4
7a	4.2	4.2	4.2	4.7	4.3
7b	3.8	4.3	4.1	4.5	4.2
Pool 2 (*N* = 20)					
8a	3.6	4.1	4.1	4.4	4.0
8b	3.5	4.2	4.1	4.4	4.0
9a	3.7	4.3	4.1	4.4	4.1
9b	3.6	4.2	4.1	4.4	4.1
10a	3.5	4.2	4.0	4.4	4.0
10b	3.5	4.1	4.0	4.4	4.0
11a	3.5	4.2	4.1	4.4	4.0
11b	3.5	4.2	4.1	4.4	4.0
12a	3.6	4.3	4.2	4.6	4.2
12b	3.7	4.3	4.2	4.5	4.2
13a	3.8	4.3	4.2	4.6	4.2
13b	3.8	4.4	4.3	4.5	4.2
14a	3.9	4.3	4.3	4.6	4.3
14b	3.9	4.3	4.2	4.5	4.3
15a	3.9	4.3	4.2	4.5	4.2
15b	3.9	4.3	4.3	4.6	4.3

Table 7.4

Iteration One: Number and Proportion of Correct Responses Assessing Original Item Accuracy

Animated Item	Understanding N (%)	Identification N (%)	Representation N (%)	Audio N (%)	Total correct N (%)
Participant Pool 1 (N=21)					
1a Sad – Depressed	21 (100)	20 (95.3)	21 (100)	21 (100)	83 (98.8)
1b Happy	21 (100)	20 (95.3)	21 (100)	20 (95.3)	82 (97.6)
2a Worried – Anxious	20 (95.3)	20 (95.3)	21 (100)	20 (95.3)	81 (96.4)
2b Not worried – Confident	19 (90.5)	18 (85.7)	18 (85.7)	20 (95.3)	75 (89.4)
3a Sleeps poorly	19 (90.5)	19 (90.5)	21 (100)	21 (100)	80 (95.2)
3b Sleeps well	19 (90.5)	20 (95.3)	21 (100)	21 (100)	81 (96.4)
4a Angry	20 (95.3)	19 (90.5)	21 (100)	21 (100)	81 (96.4)
4b Not angry – Impassive	17 (80.9)	21 (100)	21 (100)	21 (100)	80 (95.2)
5a Disobedient (School)	18 (85.7)	18 (85.7)	17 (80.9)	21 (100)	74 (88.1)
5b Obedient (School)	6 (28.6)	10 (47.6)	16 (76.2)	20 (95.3)	52 (61.9)
6a Shy	17 (80.9)	16 (76.2)	19 (90.5)	20 (95.3)	72 (85.7)
6b Not Shy – Outgoing	18 (85.7)	19 (90.5)	21 (100)	21 (100)	79 (94)
7a Argumentative	14 (66.7)	14 (66.7)	18 (85.7)	21 (100)	67 (79.8)
7b Not argumentative	12 (57)	7 (33)	18 (85.7)	21 (100)	58 (69)
Participant Pool 2 (N=20)					
8a Hyperactive behaviour	12 (60)	11 (55)	12 (60)	20 (100)	55 (68.8)
8b Calm – Sensible	17 (85)	19 (95)	19 (95)	20 (100)	75 (93.8)
9a Lonely – Alone	19 (95)	19 (95)	19 (95)	20 (100)	77 (96.3)
9b Sociable – Alone by choice	19 (95)	19 (95)	20 (100)	20 (100)	78 (97.5)
10a Bullied – Excluded	18 (90)	20 (100)	20 (100)	20 (100)	78 (97.5)
10b Not bullied – Included	20 (100)	20 (100)	20 (100)	20 (100)	80 (100)
11a Fearful – Scared	19 (95)	20 (100)	20 (100)	20 (100)	79 (98.8)
11b Not Scared – Brave	18 (90)	20 (100)	20 (100)	20 (100)	78 (97.5)
12a Disobedient (Home)	16 (80)	20 (100)	20 (100)	20 (100)	76 (95)
12b Obedient (Home)	20 (100)	20 (100)	20 (100)	20 (100)	80 (100)

Animated Item	Understanding N (%)	Identification N (%)	Representation N (%)	Audio N (%)	Total correct N (%)
13a Distracted – Inattentive	18 (90)	18 (90)	20 (100)	19 (95)	75 (93.8)
13b Focused – Pays attention	19 (95)	19 (95)	19 (95)	20 (100)	77 (96.3)
14a Physically aggressive	18 (90)	19 (95)	19 (95)	20 (100)	76 (95)
14b Kind – Peaceful	18 (90)	20 (100)	20 (100)	20 (100)	78 (97.5)
15a Physical symptoms – Feel sickly	20 (100)	20 (100)	20 (100)	20 (100)	80 (100)
15b No physical symptoms – Feel well	18 (90)	20 (100)	20 (100)	20 (100)	78 (97.5)

Note. Bold denotes items with <80% accuracy consensus targeted for refinement

Table 7.5

Iteration One: Items with Accuracy Rating Variations <80% as a Function of Age Group Level in Years

Item		Correct Understanding n(%)			Correct Identification n(%)			Correct Representation n(%)		
		5-6	7-9	10-11	5-6	7-9	10-11	5-6	7-9	10-11
Participant Pool 1 (N=21)		n = 5	n = 8	n = 8	n = 5	n = 8	n = 8	n = 5	n = 8	n = 8
2b	Not Worried Confident	5(100)	6(75)	8(100)	5(100)	7(87.5)	6(75)	5(100)	6(75)	7(87.5)
4b	Not Angry - Impassive	3(60)	6(75)	8(100)	5(100)	8(100)	8(100)	5(100)	8(100)	8(100)
5a	Disobedient (School)	4(80)	7(87.5)	7(87.5)	4(80)	7(87.5)	7(87.5)	5(100)	8(100)	4(50)
5b	Obedient (School)	5(100)	1(12.5)	0(0%)	4(80)	3(37.5)	3(37.5)	5(100)	5(62.5)	6(75)
6a	Shy	5(100)	7(87.5)	5(62.5)	4(80)	6(75)	6(75)	5(100)	7(87.5)	7(87.5)
6b	Not Shy Outgoing	5(100)	7(87.5)	6(75)	5(100)	7(87.5)	7(87.5)	5(100)	8(100)	8(100)
7a	Argumentative	3(60)	7(87.5)	4(50)	4(80)	5(62.5)	5(62.4)	5(100)	6(75)	7(87.5)
7b	Not Argumentative	2(40)	6(75)	4(50)	3(60)	1(12.5)	3(37.5)	5(100)	7(87.5)	6(75)
Participant Pool 2 (N=20)		n = 5	n = 9	n = 6	n = 5	n = 9	n = 6	n = 5	n = 9	n = 6
8a	Hyperactive	2(40)	5(55.6)	5(83.3)	1(20)	6(66.7)	4(66.7)	1(20)	8(88.9)	3(50)
8b	Calm Sensible	2(40)	9(100)	6(100)	4(80)	9(100)	6(100)	4(80)	9(100)	6(100)
10a	Bullied Excluded	5(100)	7(77.8)	6(100)	5(100)	9(100)	6(100)	5(100)	9(100)	6(100)
11b	Not Scared Brave	5 (100)	7(77.8)	6 (100)	5 (100)	9 (100)	6 (100)	5 (100)	9 (100)	6(100)
12a	Disobedient (Home)	4(80)	7(77.8)	5(83.3)	5(100)	9(100)	6(100)	5(100)	9(100)	6(100)
13a	Distracted Inattentive	3(60)	9(100)	6(100)	4(80)	8(88.9)	6(100)	5(100)	8(88.9)	6(100)

Note. Bold denotes items with <80% accuracy consensus

Table 7.6

Iteration One: Participants' Suggestions for Items Requiring Refinement

Item		Add, remove or change animation action, sound, scenario,
2b	Not worried – Confident	make the 'ding' sound louder*; have her say "aw yeah". add a fist pump*; add a thumbs-up*; put her hands on her hips, make her wink bigger*. remove the #1 symbol from the thought bubble
3a	Sleeps poorly	add moaning*, add a big sigh*; make the yawn louder; add footstep sounds, put an angry face on the clock; put eyes on the claws, make the monsters bigger*scarier*. change the monsters to rude/mean people
5a	Disobedient (School)	make boy poke out his tongue* teacher needs to say something; say "no" out loud*; make him wear his hat on backwards and play with a ball; have the teacher yell at him; have boy say "no" and teacher say "behave"; put a toy on his desk
5b	Obedient (School)	remove the stars 'ding' sound*; make teacher clap hands to get his attention; remove the star*; nod the boys head as if saying "yes" to the teacher; have boy say "okay"; add 'ok' to bubble; remove math from the bubble. add boy saying, "yes miss"; have teacher say "yes " when he puts his hand up.
6a	Shy	have her face away from the kids instead of having her head down girl mumbles "no thank you"; change mm mm to uh uh. remove "mm mmm" said by the girl; have her picking grass; remove the book; don't cover her face as much. make her look sadder.
7a	Argumentative	add some voices*; arguing sounds*; arguing sounds back and forth*. show more angry faces*; show them both arguing; add 'swirly' symbols above her head* and exclamation marks; start it in the sandpit*; make it two kids instead*. make it shorter; take the mum out*, have them arguing/fighting over toys*
7b	Not argumentative	add some voices*; add friendly sounds*; talking nicely sounds back and forth*. show happy faces*; start it in the sandpit*; make it two kids*. make it shorter; take the mum out*, have them arguing/fighting over toys*
8a	Hyperactive behaviour	have him running* spinning around*; swing on his chair*; build a fort with books; run around his desk fast*; say "sir, sir, sir"; more fiddling around*; throw paper; run around in a circle and act sillier*; add silly head movement; more active*, more silly type stuff with a cheeky face; add pencil sounds, book thuds.

Note. * = suggestion made multiple times by multiple children

7.9.2 Second Iteration Results

The second round of interviews were conducted with a third and fourth pool of participants. Pool three participants (n = 14, 50% female, M_{age} = 8 years) examined five pairs of animations. Of the ten individual animations they reviewed, seven had been refined (i.e., items 2b, 3a, 5a, 5b, 6a, 7a, and 7b). Animation 8a (i.e., hyperactive) required multiple technical refinements due to the difficulty of

animating some of the actions before it was acceptable and was not finalised in time for examination by pool three participants. Therefore, the refined version of this animation along with its pair (i.e., animation, 8b calm and sensible) was examined by pool four participants (n = 7, 42.9% female, M_{age} = 8.00 years, SD = 2.20).

Animation Acceptability

Acceptability of the animations was again high with 100% rated ≥4.0 stars. The average satisfaction ratings out of five stars are reported in Table 7.7 for each animation. In participant pool three, the average star-rating across all animations was 4.5 for audio appeal, 4.6 for character appeal, 4.6 for animated action and context, and 4.8 for viewing appeal. These all increased on the ratings given in round one interviews. Combined satisfaction ratings were high across all animations with an average total satisfaction score of 4.6. The average star-rating for both items viewed by pool four participants was 4.4 for audio appeal, 5.0 for character appeal, 4.9 for animated action and context, and 5.0 for viewing appeal. Combined satisfaction ratings were high with an average total satisfaction score of 4.9. No refinements were warranted based on these satisfaction ratings.

Animation Accuracy

Accuracy was again examined across the whole participant pool and within age group levels for each response category. Across the sample, all items reviewed by pool three participants reached at least 92.9% accuracy consensus ratings in each response category (i.e., 'understanding', 'identification', 'representation', and 'audio') with 60% of items achieving 100% accuracy in each category. However, there were still discrepancies within age group level one participants regarding the accuracy of items 5a and 5b (disobedient and obedient: school context), and 7a and 7b (argumentative and not argumentative).

Items 5a and 5b failed to reach 80% consensus in the 'understanding' response category for age group level one. On examination of individual responses, it was noted that this was due to one participant (25%) aged five years being unable to provide an equivalent personal example for items 5a and 5b because he did not yet attend school. Items 5a and 5b reached 100% consensus in all age group levels (including level one) in all other response categories, therefore these animations were retained. Items 7a (argumentative) and 7b (not argumentative) again failed to reach 80% consensus within the 5-6-year age group level in both 'understanding' and 'identification' categories. Half of these younger participants could not provide a

personal example equivalent to the target argumentative behaviour in animation 7a; 25% could not for the contrasting animation (7b); and 25% could not identify (i.e., label) either animation. For this reason, items 7a and 7b were targeted for refinement to improve their accuracy for younger ages.

The second iteration of animation 8a (hyperactive) reviewed by pool four participants attained an accuracy rating of 100% (for all response categories) both across the whole sample and within age group levels. Table 7.8 identifies accuracy ratings across the whole sample (5-11-years) for each animation accuracy response category for all items examined during Iteration Two.

Refinement Feedback for Identified Animations

Refinement suggestions offered by participants to improve the understanding of animations 7a and 7b predominantly related to adding dialogue between characters, increasing the length of the animation, and increasing the intensity of the demonstrated 'argument'. No participants proposed an alternative animation story or scenario that they thought would improve either animation. Specific suggestions for animation 7a (argumentative) were to "make the whole thing longer", "make the girls car pink and boys car blue", "make the boy talk", "remove high pitch talking and have real words", "add a bit more arguing back to each other", and "make them angrier". "Use real words" and "make them more friendly" were the only suggestions given for animation 7b (not argumentative) in this round.

Second Iteration Results Summary

After the second round of interviews were completed and combined acceptability and accuracy rating and refinement suggestions analysed, six items out of eight were retained (i.e., items 2b, 3a, 5a, 5b, and 6a). Though animations 7a (argumentative) and 7b (not argumentative) had high accuracy ratings and high acceptability overall, these two animations were identified for further refinement and examination in a third interview round. Firstly, because they had been substantially refined after round one and thus the researchers deemed it would be prudent to trial these items again with another pool of participants. Secondly, we wanted to incorporate as many improvement suggestions required from round two feedback to increase the understanding and identification accuracy ratings of younger participants. Therefore, excluding the addition of "real word" dialogue, all participant suggestions were incorporated into third versions of these animations.

Table 7.7

Iteration Two: Average Satisfaction Ratings Out of 5 Per Item

Animated Item	Audio Appeal	Character appeal	Animated Action Context	Viewing Appeal	Total Average Satisfaction
Pool 3 (*N* = 14)					
2a	4.1	4.5	4.6	4.9	4.5
2b*	4.0	4.2	4.1	4.6	4.3
3a*	4.6	5.0	4.8	4.9	4.8
3b	4.6	4.9	4.8	4.7	4.8
5a*	4.6	4.7	4.9	5.0	4.8
5b*	5.0	4.5	4.6	4.9	4.8
6a*	4.8	4.9	4.9	5.0	4.9
6b	4.5	4.6	4.7	4.8	4.6
7a*	4.4	4.7	4.6	4.9	4.6
7b*	4.4	4.6	4.7	4.9	4.6
Pool 4 (*N* = 7)					
8a*	4.4	5.0	5.0	5.0	4.9
8b	4.3	5.0	4.7	5.0	4.8

Note. * Refined animation

Table 7.8

Iteration Two: Number and Proportion of Correct Responses Assessing Accuracy of Refined Items

Animated Item	Correct Understanding *N* (%)	Correct Identification *N* (%)	Correct Representation *N* (%)	Correct Audio *N* (%)	Total correct *N* (%)
Participant Pool 3 (*N* = 14)					
2b Not worried – Confident	14 (100)	14 (100)	14 (100)	14 (100)	56 (100)
3a Sleeps poorly	14 (100)	14 (100)	14 (100)	14 (100)	56 (100)
5a Disobedient (School)	13 (92.9)	14 (100)	14 (100)	14 (100)	55 (98.2)
5b Obedient (School)	13 (92.9)	14 (100)	14 (100)	14 (100)	55 (98.2)
6a Shy	14 (100)	14 (100)	14 (100)	14 (100)	56 (100)
7a Argumentative	12 (92.9)	13 (92.9)	14 (100)	14 (100)	53 (94.6)
7b Not argumentative	13 (92.9)	13 (92.9)	14 (100)	14 (100)	54 (96.4)
Participant Pool 4 (*N* = 7)					
8a Hyperactive behaviour	7 (100)	7 (100)	7 (100)	7 (100)	28 (100)

7.9.3 Third and Final Iteration Results

Participant pool four *(n* = 7, 42.9% female, M_{age} = 8.00 years, *SD* = 2.20) examined refined items 7a (argumentative) and 7b (not argumentative) in a third and final round of interviews.

Combined Animation Acceptability, Animation Accuracy and Refinement Suggestions

The acceptability of both animations was high. Item 7a and 7b rated 4.9 and 4.8 out of 5 respectively for character appeal. Both rated 5 out of 5 in all other categories: audio and viewing appeal, animated action context and total average satisfaction ratings in this final version. Both items reached accuracy ratings of 100% in 'understanding', 'identification', 'representative', and 'audio' accuracy categories, across the whole sample and within age group levels and no refinement suggestions were provided.

Final Iteration Results Summary

After the third round of interviews were completed and responses analysed, items 7a and 7b were retained. Thus, by the third and final iteration, all 15 item pairs (30 individual animations) were retained and deemed to be accurate and acceptable to participants.

7.9.4 Overall Results

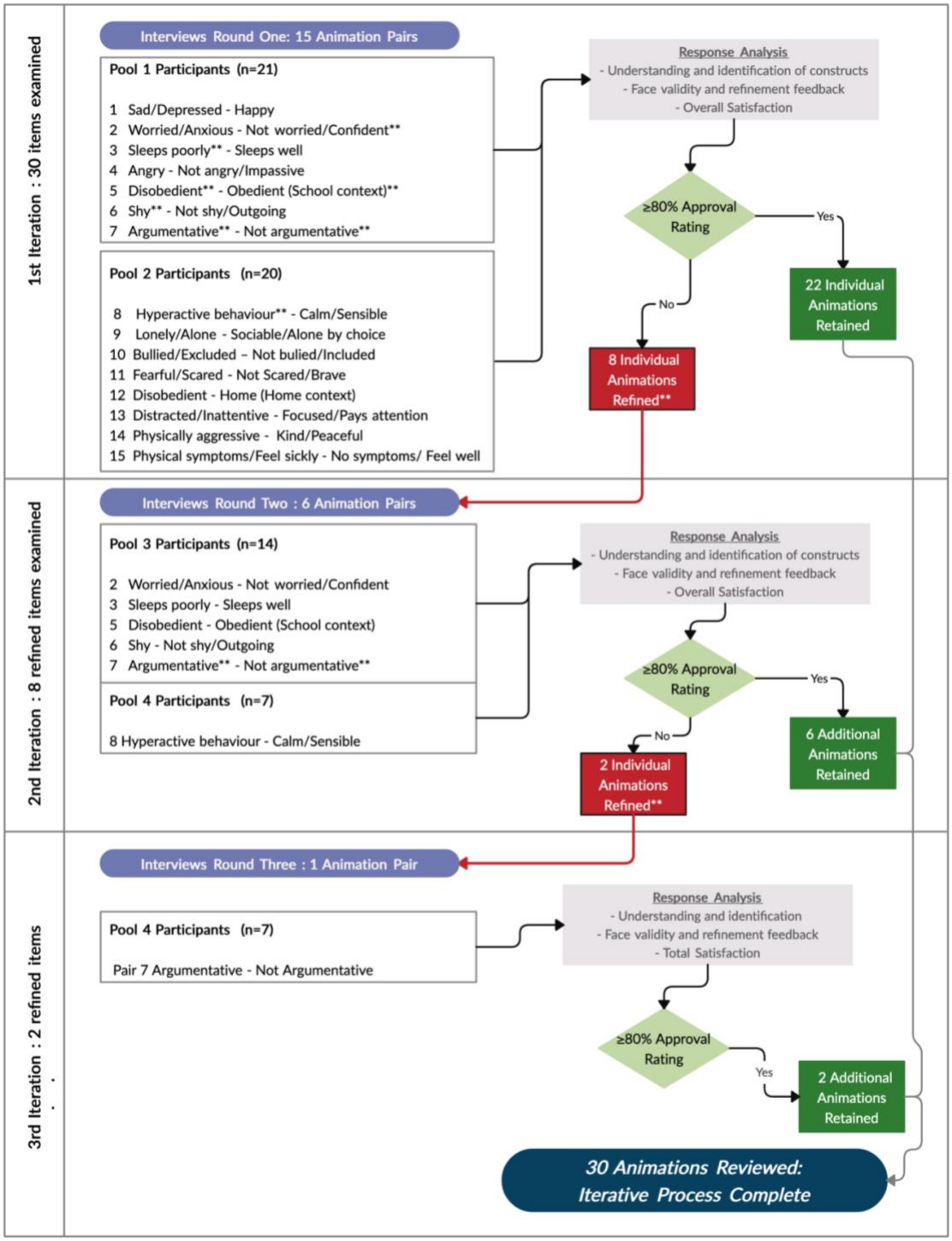
In total, 25 individual animations (83%) achieved minimum accuracy requirements (at least 80% correct) in their original prototype format in every category (15 of which achieved >95% accuracy). Five failed to reached minimum accuracy requirements with ratings ranging between 28.6–76.2%. These five items were targeted for refinement along with a further three animations that received multiple refinement suggestions (despite high acceptability and accuracy ratings. Of these eight items, six (20%) required at least one round of refinements and two (7%) required two rounds of refinements before acceptability and accuracy ratings were greater than 80%. Still images from each of the final 30 animated items are shown in Figure 7.3. A flowchart outlining the complete iterative item development and refinement process is presented in Figure 7.4.

Figure 7.3

Still Images from Each of the Target and Contrasting Animated Items (N = 30)

Figure 7.4

Iterative Item Development and Refinement Process and Results



Note. ** indicates the specific animations that required refinement and were moved to a following interview round for evaluation and potential refinement.

7.10 Discussion

In the current study we sought to qualitatively confirm digitally animated assessment item content for inclusion in the ICDS with the target audience of the measure: that is children aged between five and 11 years. A major focus of this research was the utilization of participatory methodologies that included children as co-designers of the animated item content. First to determine how acceptable the digital animations were to them and second to assess the accuracy of the content of the animations and increase accuracy where required via iterative refinement processes to promote optimal recognition and understanding.

7.10.1 Principal Findings

Our study revealed two key findings. First, that digitally animated items were acceptable to all participants in this study. Satisfaction ratings were high, even for those items that were later identified by children as requiring refinement. This was evident across audio, character, and scenario appeal and the overall viewing appeal of each animation. Satisfaction ratings were further improved with the second and third iterations and averaged 4.8 out of 5. Thus, we conclude that animated item content depicting emotional and behavioural issues is an acceptable format to children aged 5 through 11 years.

These results echo previous efforts at digitizing measures for children and including pictorial representations such as the Dominic-R (Valla et al., 2000) and MAAC (Manassis et al., 2013) which demonstrated that children showed favourable opinions of digital assessments that incorporated visual images. However, these instruments tended to utilise only static images and characters to deliver assessment items and still relied on written words or a professional to read assessment questions. Importantly, no other instrument has assessed full animations as a means of demonstrating emotional or behavioural constructs. The results of this study, along with the high acceptability demonstrated in our original feasibility study (March, Day et al., 2018) show that this approach is highly acceptable to children. It is worth noting that the ICDS instrument has been developed following a co-design and generative participatory design process throughout all stages (March, Day et al., 2018; Zieschank, Machin et al., 2021), and it seems likely that this has contributed to the overall high appeal of the animations.

Second, through a generative participatory design and iterative refinement process, this study was able to produce 15 pairs of contrasting animations depicting

common emotional and behavioural constructs, for which children aged 5-11 years showed excellent understanding and identification. There were some challenges in understanding and identification accuracy in early animation iterations, typically for more complex constructs. We were able to use iterative co-design processes to effectively advance items that were originally difficult for young children to understand, to a point where accuracy was equivalent across age groups. This highlights the utility and importance of involving children of all ages and persisting with iterative development until accuracy and understanding is achieved.

Importantly, the findings from this study revealed that a lack of verbal labelling ability (e.g., being able to accurately label 'worry' or 'argumentative') did not necessarily indicate misunderstanding by participants. Some children were able to demonstrate accurate internal representations of the animated emotional and behavioural constructs more easily than they were able to produce accurate lexical labels for them. That is, children could describe a similar scenario in which they or others had felt or behaved like the depicted construct even when they could not name it. This provides further support for the notion that focusing on written or verbal labels of emotions and behaviours may be difficult for children with less advanced vocabularies, but that through visual stimuli, children as young as five appear able to understand the same constructs. For example, in written question items such as "I often feel hyperactive," being unable to understand the target word "hyperactive" would lead to an inability to answer the correction appropriately. However, in the case of the ICDS, the animated item would provide enough context for the child to recognize the intended construct (even if they couldn't label it), and therefore elicit an appropriate response.

Thus, the results of this study show the potential of animated scenarios demonstrating dynamic facial expressions and behaviours to overcome barriers typical to question and answer instruments that require the child to read, understand and respond to sophisticated statements about their wellbeing (Widen, 2016; Widen & Russell, 2010, 2015). Such findings provide further evidence against the notion that younger children are unable to reliably self-report on their own mental health and support a growing body of evidence which shows children's capacity to provide accurate subjective reflections on their emotions and behaviours (Cree et al., 2002; Hudziak et al., 2007; Kirk, 2007; Riley, 2004).

7.10.2 Strengths and Limitations

The primary strength of this study is its use of generative participatory design methodology with children (< 11 years) to improve the accuracy and acceptability of each animation. Specifically, a co-design approach was utilised across all stages of item and animation development and refinement in this study, using a sample of children who were at the target age for the ICDS instrument. To accommodate for the methodological challenges of conducting participatory design research with young children, the study implemented measures and rating systems in ways that were familiar to children and easy to understand. For example, we utilised star ratings and image-based questions to obtain data on acceptability and content validity. Importantly, the study contextualised the research aims to the needs and ability of the target group and utilised multiple measures of accuracy and outcome (e.g., internal representation, lexical labelling), to tap into children's ability to understand the intended constructs.

Notwithstanding these strengths, there were also some limitations. Given the aim of this study was to examine acceptability of the item format and content validity of the animations prior to selection for the ICDS instrument, we prioritized data collection via in-depth interviews, which allowed child participants to engage with the animations comprehensively and provide lengthy answers to questions. A consequence of this was that the sample size (N = 62 children) precluded in-depth comparisons of responses between ages and genders. For this study, which focused on early item development and establishing item accuracy and acceptability, this sample size was sufficient. However, full psychometric validation of the prospective measure is still required with much larger samples. An additional limitation is that our sample was relatively homogenous in that participants were predominantly white Australians of middle to high socio-economic status. It would be beneficial to recruit a more diverse sample in future research to identify whether certain cultural or sociodemographic factors influence item understanding and acceptability. Further, although neurodiversity and clinical status was not formally assessed, it is likely that this sample was not comprised of children with clinical level difficulties or developmental delays given the community sample recruitment strategy. These groups will require targeted recruitment in future research to determine applicability of the animated item content.

7.10.3 Implications

The findings of this research highlight that children as young as five have the ability to understand animated depictions of emotions and behaviours that serve as exemplars of emotional and behavioural distress and can apply them to themselves (internal representation). This has potential implications for the way such constructs are assessed (e.g., screening instruments) and clinical practice. As demonstrated here, animations potentially provide a novel and useful mechanism for obtaining accurate self-report data from young children. If the ICDS can be validated psychometrically, it will provide new opportunities for self-report assessment of children under 11 years of age that can inform our understanding of distress and wellbeing, from the perspective of the child as an adjunct to proxy report. Given the well-documented discrepancies between parent-child agreement on paper and pencil type measures, the findings of this study support a promising new approach to obtaining multi-informant, multi-method data on children's wellbeing.

7.10.4 Conclusion

The perspectives of children under the age of 11 have typically been neglected in assessments designed to provide self-report of child emotions, behaviours, or general wellbeing. The results of this study provide support for the notion that new digital technologies such as dynamic animations may be able to overcome some of the potential barriers to conducting self-rated assessment with younger children. In this study, children aged 5 to 11 years were able to accurately identify and understand complex emotions and behaviours via engaging digital animated items. Overall, this study highlights the general willingness of children to engage with (and the appeal of) digital animations designed to assess distress or mental health. The study also shows the potential of animated items to accurately convey depictions of emotional and behavioural constructs key to childhood disorders, especially when co-designed and refined through an iterative process.

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Declaration of competing interest

The authors have no conflicts of interest to declare.

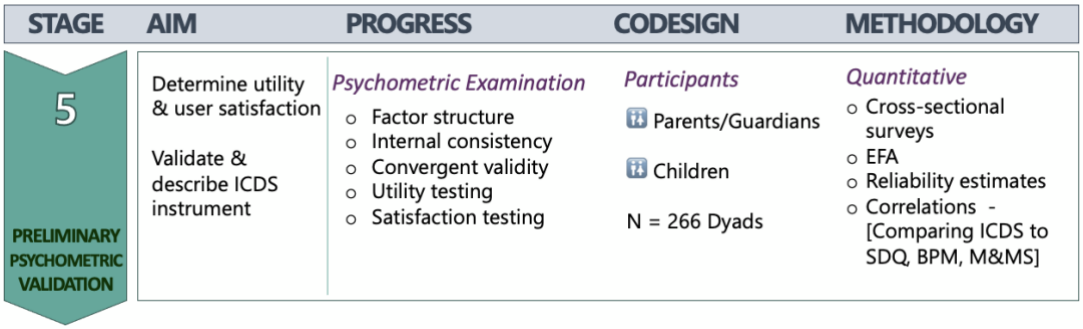
CHAPTER 8: STAGE FIVE STUDY 4 PSYCHOMETRIC EVALUATION

8.1 Overview of the chapter

This chapter describes Stage 5, Study 4 of this research program. The purpose of this study was to conduct preliminary psychometric evaluation on the complete ICDS instrument in a community sample. User reported satisfaction and utility of the digital format was also examined. Figure 8.1 provides a brief overview of the study.

Figure 8.1

Study 4 Outline in Brief



The manuscript describing this study was submitted to Assessment Journal and is currently under second round of review. The full manuscript is inserted as submitted to the journal.

Zieschank, K., Day, J., Ireland, M. J., & March, S. (2021). Description and preliminary psychometric evaluation of a new digitally animated self-reported assessment instrument for children: The Interactive Child Distress Screener (ICDS).

8.2 Description and preliminary psychometric evaluation of a new digitally animated self-reported assessment instrument for children: The Interactive Child Distress Screener (ICDS)

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8.3 Abstract

The present study aimed to provide the first psychometric evaluation of the newly developed, digitally animated, child-informed assessment instrument: The *Interactive Child Distress Screener* (*ICDS*). The latent factor structure of the novel ICDS was first established using exploratory factor analysis (EFA) on 15 pairs of animated items using a community sample (N = 266) of child-parent dyads. EFA results support a two-factor structure representing two broad domains of internalising and externalising difficulties (r = .52) and comprised of 12 items. The reliability of the factors was strong with ordinal alpha and omega coefficients above .84 and .87 respectively for each of the sub-scales. The convergent validity was supported with established measures and the ICDS factors demonstrated stronger convergence with other child-reported measures. User reported satisfaction and utility ratings of the digital format was highly acceptable.

Keywords: ICDS, digital screening, exploratory factor analysis, child self-report, scale evaluation, psychometrics

8.4.1 Background

Mental health problems throughout childhood can have detrimental effects on psychosocial wellbeing, academic development, and future achievement (Guzman et al., 2011; Merikangas et al., 2010; Ogundele, 2018). Prevalence rates are high with one in six American children, one in seven Australian children, and two in five British children meeting criteria for a clinical mental health diagnosis (Deighton et al., 2019; Lawrence et al., 2016; Whitney & Peterson, 2019). The most commonly diagnosed mental health problems in school-aged children (5-11 years) are disruptive behavioural problems (conduct disorders and attention deficit hyperactivity disorder), anxiety, and mood disorders (i.e., depression) (Centers for Disease Control and Prevention, 2020; Lawrence et al., 2016). Evidence suggests that the symptoms of such problems can occur for two to four years without detection, and almost half of children suffering will never receive treatment (National Research Council and Institute of Medicine., 2009). With such delayed recognition, valuable opportunities to intervene are missed before problems advance to a clinical level. Accordingly, universal mental health screening (hereafter referred to as screening) for emotional and behavioural difficulties in accessible locations such as primary health care settings and schools has long been promoted to aid detection and prevention (Carter et al., 2004; Dowdy et al., 2010; Humphrey & Wigelsworth, 2016; Mihalopoulos et al., 2012; Royal Australian and New Zealand College of Psychiatrists, 2010a).

Ideally, a screening instrument should be brief to administer and score, cost-effective, psychometrically sound, and successfully discriminate between children who require further evaluation and those who do not (Goodman-Scott et al., 2019; Ivey, 2020; Newlove-Delgado & Ford, 2020). A recent review by McCrae and Brown, (2018) describes three suitably broad screening instruments for use with school-aged children: the Behaviour Assessment System for Children, Second Edition Behavioral and Emotional Screening System (BESS; Kamphaus & Reynolds, 2007), Paediatric Symptom Checklist (PSC-17; Gardner et al., 1999), and the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997). The Brief Problem Monitor (BPM; Achenbach et al., 2011) and the Me and My School Questionnaire (M&MS; Deighton et. al., 2013) are other common instruments. Unfortunately, there are many barriers to implementing universal screening that include awareness of and access to such instruments, the intensive parent and professional involvement necessary to conduct most assessments, and the financial costs (Ivey, 2020; Wood &

McDaniel, 2020). For example, the BPM and BESS are expensive ($250AUD for 50 administrations and $450AUD for 25 administrations respectively) and like the SDQ they require professional access, administration, scoring, or interpretation. Such factors ultimately limit the potential of such instruments for universal application.

Deighton et al., (2014) suggest that child-reported measures may be less burdensome to administer. Yet, instruments assessing mental health in school-aged children (i.e., <11 years old) almost exclusively use adult caregivers (e.g., parents and teachers) as proxy informants. Out of the five measures previously listed, only the BESS and M&MS collect self-reported information from children under 11 years of age. Evidence shows that both parent and child perspectives are important and that with suitable measures, young children can not only provide unique and clinically useful information, but more accurate accounts of their internalising symptoms than adult informants (Arseneault et al., 2005; Dowdy et al., 2010; Jeffrey et al., 2020; Moffa et al., 2019). There is also growing impetus to foster client-centred practices and a shift toward patient-reported outcomes that encourage children to have a greater voice in their own health choices and care.

A common feature of the existing measures and standard psychological screening measures generally, is their presentation and response method. That is, they comprise of written statements or questions and utilise Likert-style response scales with temporal sequencing (e.g., ...*over the past 5 days: over the last six months*). With young children's limited capacity for reading comprehension and appraisal, we propose that this presentation style potentially challenges the reliability and accuracy of their answers. In a recent systematic literature review investigating children's ability to self-report, the authors concluded that measures for children should accommodate developmental variations by minimising assessment demands through refined wording or including auditory and pictographic response items (Bevans et al., 2020).

There have been some attempts to develop such instruments including a computer-administered version of the SDQ with added static colour graphics that was pilot-tested with children as early as 2001. It showed clinical sensitivity (in children 11 years and older), higher user satisfaction ratings, and improved engagement compared to the standard pencil-and-paper version (Truman et al., 2003). Another example is The Mood Assessment via Animated Characters (MAAC) instrument for assessing anxiety. Measuring 16 emotions, the MAAC was able to

discriminate between anxious and non-anxious children utilising static and animated images (Manassis et al., 2009). Though it is not designed as a screening instrument, the Berkeley Puppet Interview (BPI) represents another child-focused method for engaging children in a structured discussion about their emotions and behaviours via hand puppets. Ringoot et al., (2017) demonstrated that child reports collected via the BPI predicted treatment referral up to two years later and consistently correlated with parent ratings on the Child Behaviour Checklist. Though none of the aforementioned instruments are easily accessible, scalable, or intended directly for the purpose of broadly screening for emotional and behavioural difficulties, such efforts demonstrate that integrating visual components can improve assessments with young children. With the proliferation of the internet and the ease at which information can now be accessed on digital devices (e.g., smartphones, tablets) we are provided with the method and opportunity to increase access to universal screening in school environments, open-access, and primary health-care settings.

In order to advance self-reported screening for young children by overcoming the accessibility and age-based limitations of current methods, this research sought to psychometrically evaluate a recently developed digitally animated assessment tool: The Interactive Child Distress Screener (ICDS). Given the pervasive reach of the internet, digital assessments are more easily accessible and less resource-intensive than paper-based instruments and also allow for automatic scoring and reporting of results which in turn will facilitate administration in routine care settings and greater scalability. This study aimed to psychometrically evaluate the ICDS which was co-developed with over 100 children (aged four to 12 years) and has been described in previous feasibility and development studies (March, Day et al., 2018; Zieschank, Machin et al., 2021; Zieschank, Day et al., 2021). In the first of these development studies, child participants discussed, defined, and modelled audio-visual and behavioural exemplars for each of the contrasting emotional and behavioural construct-pairs as the first step of the item content co-design process. The resulting shared interpretations formed the narrative framework for, and subsequent creation of 30 prototype animated ICDS assessment items (Zieschank, Machin et al., 2021). In the second of these studies, child participants' understanding of the prototypes was evaluated throughout iterative co-design cycles of animation testing, analysis, and refinement (Zieschank, Day et al., 2021). The content validity of the animated items was supported when participants as young as five years could accurately

identify the intended emotional and behavioural constructs depicted in each animation. The current study aims to conduct a broader psychometric examination of the resulting ICDS instrument. If psychometric evaluation of the ICDS is adequate, it will confirm that the instrument has potential as a self-reported screening tool and scope within health care and educational settings to facilitate early intervention.

8.4.2 Aims

The aim of this study was to psychometrically evaluate the novel ICDS in a community sample of primary school-aged children (5–11 years). The ICDS assessment items were broadly developed under the domains of behavioural and emotional difficulties (March, Day et al., 2018). The ICDS is a brief, digitally animated, child self-report assessment instrument accessible on all web-enabled, digital devices. We sought to evaluate its structural validity, internal consistency, and convergent validity. A further aim was to examine whether the ICDS was acceptable to users and functional as a brief assessment instrument as demonstrated through high satisfaction and utility ratings. We had no a priori hypotheses regarding the factor structure of the items and adopted an exploratory approach to determining this. On the basis of overlapping theoretical constructs, we hypothesised moderate to strong positive correlations between the ICDS and other child-reported measures of behavioural and emotional difficulties (i.e., Me & My School Questionnaire and the Brief Problem Monitor-Youth Form). Due to the expectation that parent, and child reports of the same construct would share less variance than converging child reports, we hypothesised small to moderate positive correlations between the ICDS and parent-reported measures of behavioural and emotional difficulties (i.e., the Strengths and Difficulties Questionnaire-Parent Form and the Brief Problem Monitor-Parent Form).

8.5 Methods

8.5.1 Participants

Two hundred and sixty-six parents with children aged five through 11 years (51% male, M_{age} = 7.81 years, SD = 1.91) were recruited in dyads for this study from two community sources: a local state primary [elementary] school in Brisbane, Australia and via national social media advertising. Inclusion criteria for each dyad required the child participant to complete the ICDS and the parent participant to complete at least one parent-rated convergent validity measure (BPM-P or SDQ-P). The proportion of child participants across ages and gender is presented in Table 8.1.

For brevity, the term ‘parents’ is used throughout this paper and includes mothers, fathers, stepparents, or legal guardians of a child participant.

Table 8.1

Included Child Participants as a Function of Age and Gender (N = 266)

	Age in years n (%)							
	5	6	7	8	9	10	11	(*N*)
Gender								
Male	18 (13.24)	24 (17.65)	27 (19.85)	24 (17.65)	13 (9.56)	12 (8.82)	18 (13.24)	136
Female	15 (11.54)	22 (16.92)	21 (16.15)	21 (16.15)	23 (17.69)	10 (7.69)	18 (13.85)	130
Total	33 (12.41)	46 (17.29)	48 (18.05)	45 (16.92)	36 (13.53)	22 (8.27)	36 (13.53)	266

Note. One parent participated with each child. Parent participants *N* = 266

8.5.2 Measures

Interactive Child Distress Screener (ICDS)

The ICDS is a 15-item, animated, digital assessment instrument that was designed to detect self-reported emotional and behavioural difficulties among 5–11-year-old children. The item constructs were generated in a prior feasibility study by an expert panel of child psychologists and psychometricians (March, Day et al., 2018). Each of the 15 assessment items is comprised of two animations that depict children experiencing contrasting emotional or behavioural states. Negatively valenced states (e.g., sadness) are categorised as Target items and are scored with a “1”. Contrasting animations are positively valenced (e.g., happiness) and are scored as “0”.

The ICDS is delivered via a web-based application (app) and is optimised for use on computers, mobile devices (smartphones), and tablets (iOS and Android). The app opens with an administration page where the test administrator and parent details (email address) are captured, and an anonymous participant code is automatically generated. A *Welcome* page follows for children to independently complete the rest of the measure by clicking or tapping on images, accompanied by a voiceover. Children initially choose a colourful ‘*Buddy’* that is situated at the bottom of the screen throughout the measure. *Buddy* is a spoken voiceover assistant that is

activated by the user via a tap or click that provides instructions automatically and on-demand throughout the measure. Requested demographic information includes age (shown as numerals from four to 13), and gender (shown as girl and boy images and written words). An '*other'* choice is provided for those who prefer not to identify as one of these two genders. After submitting these responses, each pair of animated items is then presented sequentially. As each animation appears on screen the user is initially directed verbally to tap or click a '*play'* button (represented by a stereotypical triangle) centred on the animation. Though the sequence of 15 items remains the same for each user, the first animation seen by individual users in each item (i.e., target or contrasting animation) is randomised each time they complete the measure to remove the potential of an order effect. Tapping on the triangle activates the video which enlarges to fill the screen. After participants have viewed both animations in a pair, they are asked to respond to the audible and written question "*Which one is most like you?*" by clicking or tapping on their chosen animation. This sequence continues until all 15 pairs of animations have been viewed and responses recorded. The sequence of screens, as seen by the user, is depicted in Figure 8.2.

ICDS Utility Measure

To determine how functional the delivery format of the ICDS application was for child users, the number of instances that each child requested assistance in completing the ICDS was tallied. Utility observations were made regarding children's capacity to use the ICDS and successfully complete the demographic collection page, navigate through the application by following audible and written directions, appropriately use the '*play*' buttons and '*next*' arrows, select responses for each item, and submit their data. In addition, any verbal requests for assistance and use of the in-app helper assistant 'Buddy' were recorded. The utility assessment was omitted for the online sample of participants.

Me & My School Questionnaire

The M&MS is a brief, 16-item self-reported mental health measure for children as young as eight years old (Deighton et al., 2013). It yields composite scores for emotional difficulties (10 items) and behavioural difficulties (6 items), as well as a total score (range 0–32). Higher scores reflect greater difficulties. The items consist of short written statements such as, "Nobody likes me" and "I lose my temper" and utilises three response options (0: *never*; 1: *sometimes*; 2: *always*) regarding how the participant feels at the time of assessment. The M&MS is reported

to demonstrate good internal consistency across ages 8–11 years (behavioural difficulties: α = .68 - .80; emotional difficulties: α = .72 - .77). Construct validity has been examined with 11-year-old children demonstrating moderate to strong correlations between the M&MS subscales and corresponding child-reported SDQ behavioural (r = .56 - .67, $p < .001$) and emotional subscales (r = .70 - .85, $p < .001$) (Deighton et al., 2013; Patalay et al., 2014).

ICDS Satisfaction Survey

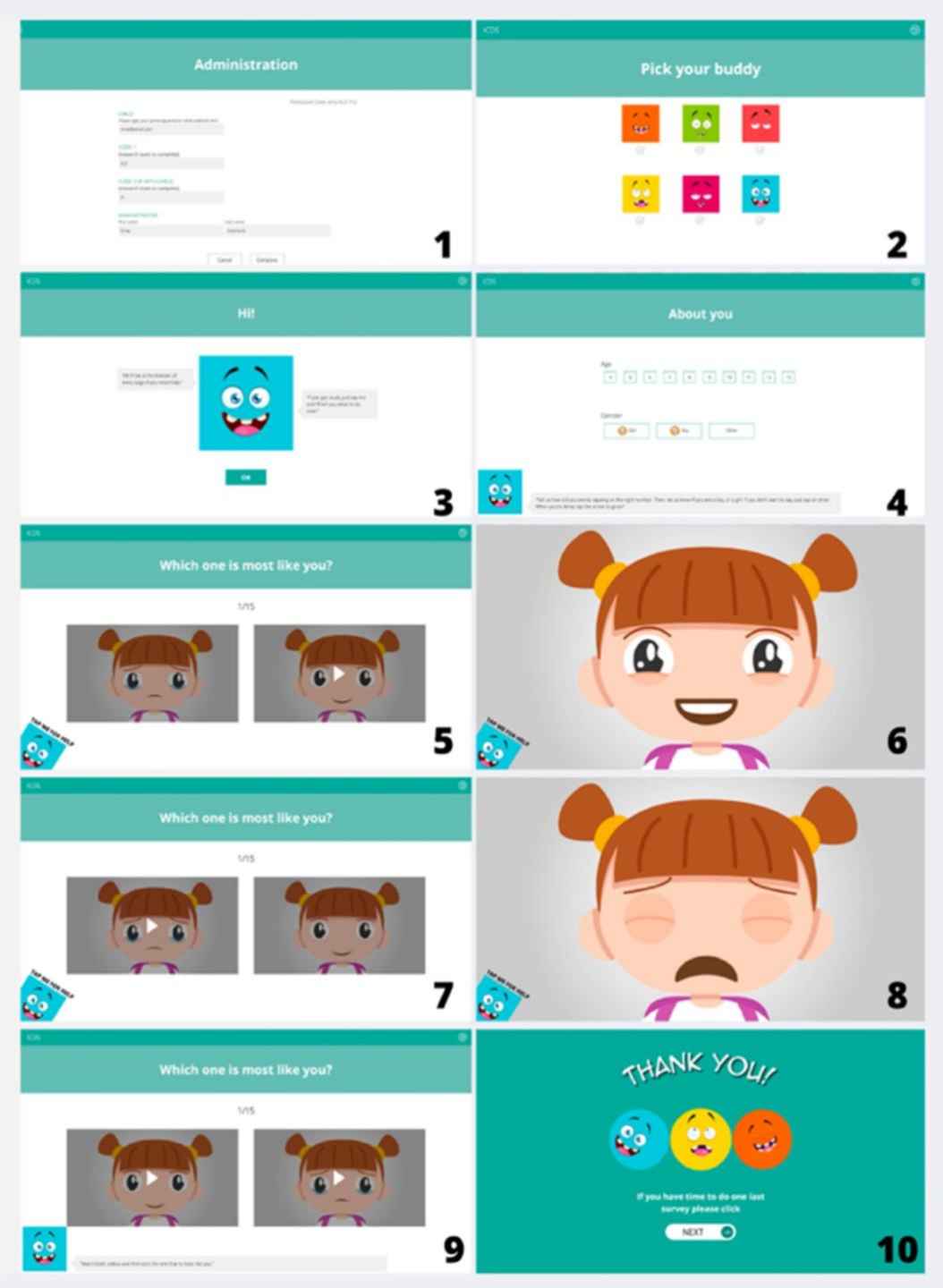
The final ICDS screen invites both child and parent participants to leave written feedback about the ICDS and provides an option for children to complete a nine-item author-developed measure of user satisfaction. The first four questions of the survey asked child participants to compare the digital format of the ICDS to the written format of the M&MS (i.e., as an example of a pen and paper style survey) across several factors and choose which they preferred. Questions asked which format they: (1) liked more, (2) thought was easier to understand, (3) would want to do again, and (4) would recommend to other children. The survey was presented as a simple 9-point Likert-scale represented as a line, which had a picture of the M&MS scale placed at the far-left of the line (coded as a score of '1'), a zero placed at the mid-point (coded as a score of '5') and a picture of the ICDS logo placed at the far-right (coded as a score of '9'). For each question, the participants were asked to indicate their response by making a mark on the line closest to their preferred measure. If they had no preference, they were advised to make a mark towards the middle of the line. Marks reflecting scores between 1–3 were coded as a distinct preference for the M&MS (i.e., a paper-based survey), scores between 4–6 were deemed reflective of a participant having no preference and scores of 7–9 were rated as an explicit preference for the ICDS. This was calculated for each of the first four questions.

The final five questions rated participant satisfaction with the ICDS specifically, utilising a yes/no scale represented by sad and happy face emoticons placed at the extreme ends of the line. Participants were asked to rate whether they thought the ICDS (1) was fun to do, (2) had easy instructions, (3) had a response option that was easy to understand, (4) took too long to complete, and (5) had likable characters. Participants responded by choosing either a sad or happy emoticon image or placing a mark anywhere between the two if they could not make a clear choice. A sad-face response was scored as '0' and indicated dissatisfaction, and a smiley-face

was scored as ‘1’ and indicated satisfaction with the ICDS. Any response between the two emoticons was rated as undecided.

Figure 8.2

ICDS Web Application Screenshots



Note. 1 = Administration page; 2 = Buddy helper assistant selection; 3 = Buddy assistant instructions; 4 = Demographic collection; 5–9 = Animated item, play, view, and response selection pages (repeats for each item); 10 = End and submission page.

Strengths and Difficulties Questionnaire - Parent Form

The SDQ-P by Goodman (1997) is a 25-item parent-reported measure for children aged 4–17 years. It is comprised of five, 5-item subscales: emotional symptoms, peer problems, conduct problems, hyperactivity inattention, and prosocial behaviour. A total difficulties score (range 0–40) excludes the prosocial scale. Broader dimensions may be examined by calculating externalising (sum of conduct and hyperactivity items) and internalising (sum of emotional and peer problem items) subscale scores. Higher scores reflect greater difficulties on each subscale and total score. The SDQ-P utilises three response options (0: *not true*; 1: *somewhat true*; 2: *certainly true*) regarding the young person's behaviour over the last six months or school year. Written statements include "Nervous in new situations, easily loses confidence" and "Often unhappy, depressed or tearful". Equivalent statements are used in the SDQ-Youth form (i.e., "I am nervous in new situations, I easily lose confidence").

The SDQ has been evaluated in multiple countries with some variability in reporting and results. An Australian study with a large community sample of young children (N = 1359) aged 4–9 years reported moderate to strong internal reliability (α = .59 - .80) across all five subscales (Hawes & Dadds, 2004) and stability at 12-months (α = .61 - .77) when compared to diagnostic interviews. This is consistent with the original findings by Goodman, (2001), which demonstrated similar coefficients for each subscale (α = .57 - .82) and stability at six months (α = .57 - .72).

Brief Problem Monitor

The BPM by Achenbach and colleagues (2011) is a 19-item measure with separate parent-report (BPM-P) and self-report options for youth 11-18 years (BPM-Y). Both result in internalising, externalising, and attention subscale scores and a total score (range 0 – 38). The BPM-P and BPM-Y consist of similarly written statements with slight changes for each informant. For example: "Feels worthless or inferior" and "Disobedient at home" for parents become "I feel worthless or inferior" and "I disobey my parents" for youth informants. Both versions utilise three response options (0: *not true*; 1: *somewhat true*; 2: *certainly true*). The BPM is an abbreviated version of the well-validated and widely utilised 113-item Child Behaviour Checklist (Piper et al., 2014). Prior studies have reported test-retest reliability correlations and

internal consistencies for the BPM-P total score as $r = .85$, $p < .001$, $\alpha = .92$ and BPM-Y total score as $r = .89$, $p < .001$, $\alpha = .86$ and mean Cronbach's α coefficients across the subscales as 0.84 (BPM-P) and 0.76 (BPM-Y) (Achenbach et al., 2011; Piper et al., 2014).

8.6 Procedure

A cross-sectional design was utilised with parent-child dyads recruited from both school and online community sources. Ethical approval was obtained from the University of Southern Queensland and the Queensland Government Department of Education.

8.6.1 Recruitment

School-based Recruitment and Procedure.

School children from a Brisbane school were provided with research study invitation packs containing individual parent and child information and consent forms, one copy each of the BPM-P and SDQ-P, and an envelope to return them. Seventy-four parents (10.6% response rate) consented to their child's involvement and returned completed parent-rated measures. A research team member met with child participants ($N = 74$, 54% male, $M_{age} = 7.43$ years, $SD = 1.90$) individually during their school day to complete child-report measures in person. Children were asked to write their name under their parents on the consent form if they agreed to participate and advised that even if their parent had consented, they could withdraw at any time. Child participants completed the ICDS on a touchscreen tablet, and all other measures were completed with pen and paper. Demographic data (age and gender) were provided by each child within the ICDS application. All children were observed by the first author (KZ) whilst they completed the ICDS to conduct the utility assessment. Incentives were not offered to participants sourced from the school.

Online Recruitment and Procedure.

Advertisements on social networks (i.e., Facebook and Instagram) were also utilised to recruit 192 parent-child dyads. Identical information and consent materials that were provided to school participants were also presented online at the survey website. Parents provided online consent and completed a brief demographic questionnaire about their child (child age, gender, school year level, and parent email address) followed by parent-report measures and then child measures for child participants ($N = 192$, 50% male, $M_{age} = 7.95$ years, $SD = 1.89$). A $15AUD gift card

was offered to compensate participating families for their time, with 64 (33%) providing contact details to receive this.

8.6.2 General Procedure Details

All data collected in this study were scored and evaluated, irrespective of participants meeting inclusion criteria. Parents were informed if any of their child's scores indicated an elevated level of distress according to the norms of the completed measures. Along with the notification, participants were provided with recommendations for further assessment and referral information. Regardless of recruitment source, each member of the dyad was asked to complete the same measures in the same sequence. For parents, this included the BPM-P and the SDQ-P, and for children, this included the ICDS, M&MS, BPM-Y, and ICDS satisfaction scale. The self-reported M&MS and BPM-Y were not developed for completion by children younger than eight and 11 years respectively; however, the M&MS was co-developed with children and the BPM Manual states that younger children (< 11 years) can act as an informant "if they are able" (Achenbach et al., 2011). Therefore, we included children outside the intended age range for these measures to provide comparative child-reported data for the purpose of validating the self-reported ICDS. For the school-based sample, the measures were read to the younger participants (or as required) by the researcher, and for the online sample, parents were asked to assist their children as needed. The M&MS was used with permission from the author and the BPM-P, BPM-Y, and SDQ measures were used under license.

8.7 Psychometric Analyses and Results

8.7.1 Factor Structure

Exploratory factor analysis (EFA) was conducted on the 15 items of the ICDS. With a sample size of 266 participants, our item to participant ratio was 1:17. This indicates the sample was sufficient for EFA (Comrey, 1988; Hoe, 2008). Violations of univariate and multivariate normality were apparent. Skew and kurtosis exceeded conventional cut-offs (> $\pm$ 1.5) on six items (1, 5, 8, 9, 10, and 14) indicating violations to univariate normality (Field et al., 2012). Multivariate tests for skewness and kurtosis proposed by Mardia (1970) revealed that while skew was non-significant ($m_{skewness}$ 109.46, $p > .999$), there was evidence of excessive multivariate kurtosis ($m_{kurtosis}$ 407.56, $p < .001$). Given the high multivariate kurtosis and the dichotomous response scale, we ran factor analyses using a tetrachoric correlation matrix in Mplus. Further, an MLR estimator in Mplus was employed as it provides

robust standard errors and overcomes such distribution asymmetries. Regarding the factorability of the correlation matrix, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was high (.81), and Bartlett's Test of Sphericity was significant 702.3 (df = 105; p < .001), indicating that the data were suitable for factor analyses and for yielding distinct and reliable factors (Field et al., 2012).

Kaiser's criterion suggested up to four factors to extract (eigenvalues > 1.00); however, it is notably lenient (Floyd & Widaman, 1995), therefore, model fit indices for 1- to 4-factor-solutions were appraised. These indices are reported in Table 8.2 and as indicated by the results; the three-factor solution yields the best model fit. A rotation approach was selected on both theoretical and empirical grounds.

Theoretically, any underlying factors are expected to overlap consistent with established accounts of mental distress factors. Empirically, an inspection of the correlation between factors revealed they were moderately correlated (r > .30). Both of these considerations led to the decision to use an oblique rotation and a 3-factor solution was estimated. An inspection of the loading matrix showed a clear structure with a couple of exceptions. Item 14 exhibited weak cross-loadings across the three factors (.16, .11, and .21), and factor 3 was comprised of only two items (8 and 13). Therefore, the decision was made to remove all three items and reserve them for further item development in the future.

Table 8.2

Model fit for 1 to 4-factor solutions

Solution	χ^2	$\Delta\chi^2$	RMSEA	CFI	SRMR
1-factor	165.65*	–	.06	0.80	.07
2-factor	98.53	57.72*	.03	0.94	.05
3-factor	66.90	27.67*	.02	0.99	.04
4-factor	63.52	9.33	.03	0.97	.03

Note. * p < .001.

Following the removal of items 14 (physically aggressive), 8 (hyperactive behaviour), and 13 (distracted - inattentive), a final 2-factor model was extracted using the remaining 12 items. The final solution exhibited excellent model fit, χ^2 (df = 43), 37.68, p = .701); RMSEA < .01, p = .998; 90% CI [<0.00, 0.03]; CFI = 1.00; TLI = 1.02 and SRMR = .03. Geomin rotated loadings for the final 12-items are reported in Table 8.3. The two remaining factors were strongly correlated r = .52.

The final interpretation of the factors is consistent with conventional facets of internalising and externalising difficulties with factor 1 exhibiting high loadings for items representing emotional distress and items on factor 2 demonstrating high loadings for items representing behavioural concerns. The implied measurement model is depicted in Figure 8.3.

Figure 8.3

Correlated Two-Factor Model with Items 8 'Hyperactive', 13 'Distracted', and 14 'Physical Aggression' Deleted.

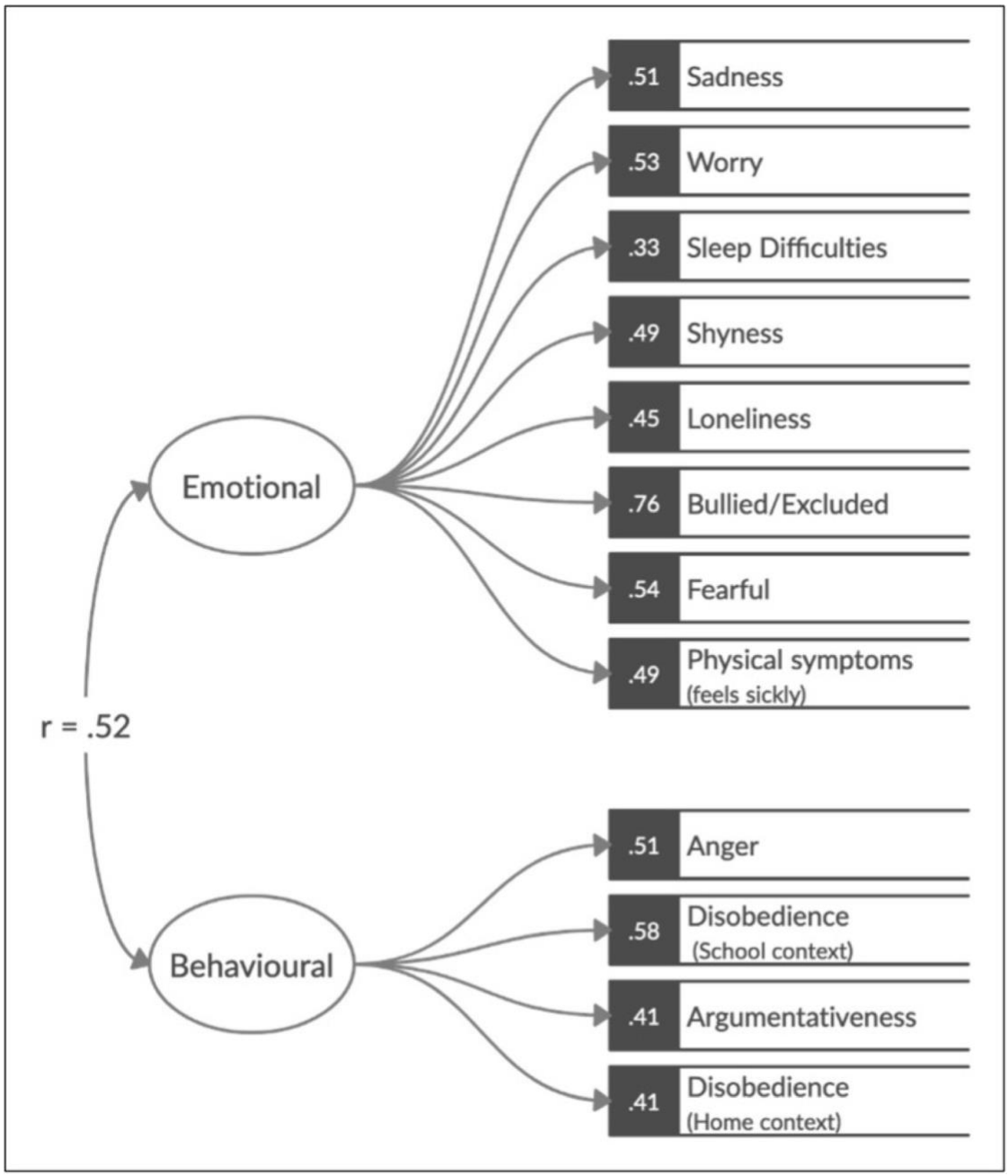


Table 8.3

Geomin Rotated Factor Loadings on Final 12-item EFA

Items	Factor		Dimensions
	1	2	
ICDS_1	.512*	.122	Emotional
ICDS_2	.534*	.017	
ICDS_3	.329*	.119	
ICDS_6	.491*	.016	
ICDS_9	.451*	.006	
ICDS_10	.775*	-.266	
ICDS_11	.539*	-.166	
ICDS_15	.492*	.101	
ICDS_4	.072	.510*	Behavioural
ICDS_5	-.008	.575*	
ICDS_7	.238	.407*	
ICDS_12	.079	.428*	

Note. * = significant at 5% level; Matrix: Tetrachoric correlations, Extraction: MLR, Rotation: Geomin. Loadings larger than .30 are in bold.

8.7.2 Internal Consistency

To estimate the internal consistency of the factors, we calculated Cronbach's alpha as well as ordinal omega coefficients using the tetrachoric correlation matrix. This method provides a more accurate estimate of reliability for dichotomous variables (Gadermann et al., 2012). Reliability estimates demonstrated excellent internal consistency for factor 1 (emotional distress items; $\alpha = .88$ and $\omega = .91$), and factor 2 (behavioural distress items; $\alpha = .84$ and $\omega = .87$). The reliability estimates for each measure used in the study are shown in Table 8.4.

Table 8.4

Reliability Statistics for Comparative Subscales on all Measures (Cronbach's α) (N = 266)

Scale	ICDS		M&MS	BPM-Y	BPM-P	SDQ-P
Behavioural	.84[a]	.87[b]	.79	.73	.85	.86
Emotional	.88[a]	.91[b]	.85	.74	.85	.80
Total Score	.90[a]	.93[b]	.89	.84	.90	.88

Note. [a] indicates Cronbach's alpha statistic, [b] indicates ordinal omega statistic

8.7.3 Construct-Related Validity

To assess the convergent validity of the ICDS, we compared the ICDS subscale scores against the corresponding scales of the child-reported M&MS and BPM-Y, and parent-reported BPM-P and SDQ-P. These results are presented in Table 8.5. For the whole sample, positive correlations were found at the .001 level for the behavioural subscale (r = .36 to .50) and emotional subscale scores (r = .31 to .58). Associations were larger in magnitude between the ICDS scores and youth-reported measures than between the ICDS scores and parent-reported measures across all subscales and age-group levels with one exception (BPM-Y < BMP-P behavioural subscale in the youngest age group).

For the 5-7-year-old sub-sample of children, moderately strong, positive correlations were found across all youth completed subscales. Correlations with the ICDS were weaker for parent completed subscales in this age-group, particularly for the emotion-focused subscales. Correlations with the M&MS were significant at the .001 level for both ICDS subscales, while the emotion-focused subscale was not significantly correlated with the SDQ-P for this group. Moderately strong to strong significant, positive correlations were found for the 8-10-year-old subsample on all measures. For the 11-year-old subsample of children, strong correlations were found for both subscales on youth completed measures, while emotion-focused subscales showed moderately strong correlations with parent completed measures. Correlations between the behavioural subscale and the parent reported measures were weaker, and not significant for the BPM-P measure. The complete correlation table for the whole sample is produced in Table 8.6.

Table 8.5

Correlations Between the ICDS Factors and Equivalent Subscales on M&MS, BPM-Y, BPM-P and SDQ-P as a Function of Age-Group Levels

ICDS Factors (*N*)	Youth Completed		Parent Completed	
	M&MS	BPM-Y	BPM-P	SDQ-P
Full sample (*N* = 266)	*n* = 266	*n* = 103	*n* = 265	*n* = 258
Behavioural	.498***	.484***	.362***	.401***
Emotional	.470***	.575***	.348***	.305***
Total score	.494***	.587***	.372***	.393***
5 – 7 years (*N* = 127)	*n* = 127	*n* = 43	*n* = 126	*n* = 125
Behavioural	.415***	.317*	.320***	.407***
Emotional	.370***	.463**	.223*	.138
Total score	.394***	.503***	.227*	.276***
8 – 10 years (*N* = 103)	*n* = 103	*n* = 25	*n* = 103	*n* = 99
Behavioural	.562***	.549**	.424***	.441***
Emotional	.562***	.729***	.471***	.446***
Total score	.582***	.736***	.501***	.508***
11 years (*N* = 36)	*n* = 36	*n* = 35	*n* = 36	*n* = 35
Behavioural	.672***	.704***	.333*	.281
Emotional	.608***	.625***	.463**	.498**
Total score	.678***	.632***	.532***	.526**

Note. *$p < .05$, **$p < .01$, and ***$p < .001$. Equivalent M&MS subscales = behavioural and emotional; BPM subscales = externalising and internalising; SDQ subscales = conduct and emotional

Table 8.6

Correlations Between ICDS, and M&MS, BPM-Y, BPM-P and SDQ-P Subscales and Total Scores Across the Whole Sample (N = 266)

Scale	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. ICDS Beh	—															
2. ICDS Emo	.422***	—														
3. ICDS Tot	.719***	.934***	—													
4. MMS Beh	.498***	.279***	.411***	—												
5. MMS Emo	.284***	.470***	.473***	.631***	—											
6. MMS Tot	.402***	.437***	.494***	.849***	.946***	—										
7. BPMY Ext	.484***	.416***	.499***	.648***	.455***	.590***	—									
8. BPMY Int	.189	.575***	.528***	.410***	.797***	.754***	.520***	—								
9. BPMY Att	.264**	.401***	.361***	.423***	.494***	.532***	.488***	.514***	—							
10. BPMY Tot	.378***	.570***	.587***	.600***	.716***	.767***	.814***	.837***	.808***	—						
11. BPMP Ext	.362***	.177**	.279***	.512***	.218***	.363***	.277**	.173	.210*	.267**	—					
12. BPMP Int	.173**	.348***	.335***	.332***	.459***	.452***	.214*	.332***	.171	.294**	.404***	—				
13. BPMP Att	.343***	.202***	.291***	.400***	.283***	.360***	.184	.210*	.373***	.309**	.624***	.374***	—			
14. BPMP Tot	.369***	.295***	.372***	.518***	.390***	.482***	.283**	.298**	.326***	.368***	.851***	.713***	.844***	—		
15. SDQP Ext	.409***	.233***	.341***	.510***	.353***	.454***	.265**	.205*	.434***	.366***	.732***	.358***	.859***	.823***	—	
16. SDQP Int	.251***	.319***	.344***	.404***	.519***	.522***	.184	.290**	.168	.264**	.428***	.760***	.470***	.675***	.519***	—
17. SDQP Tot	.385***	.313***	.393***	.529***	.494***	.558***	.263**	.287**	.357***	.370***	.678***	.623***	.779***	.865***	.891***	.850***

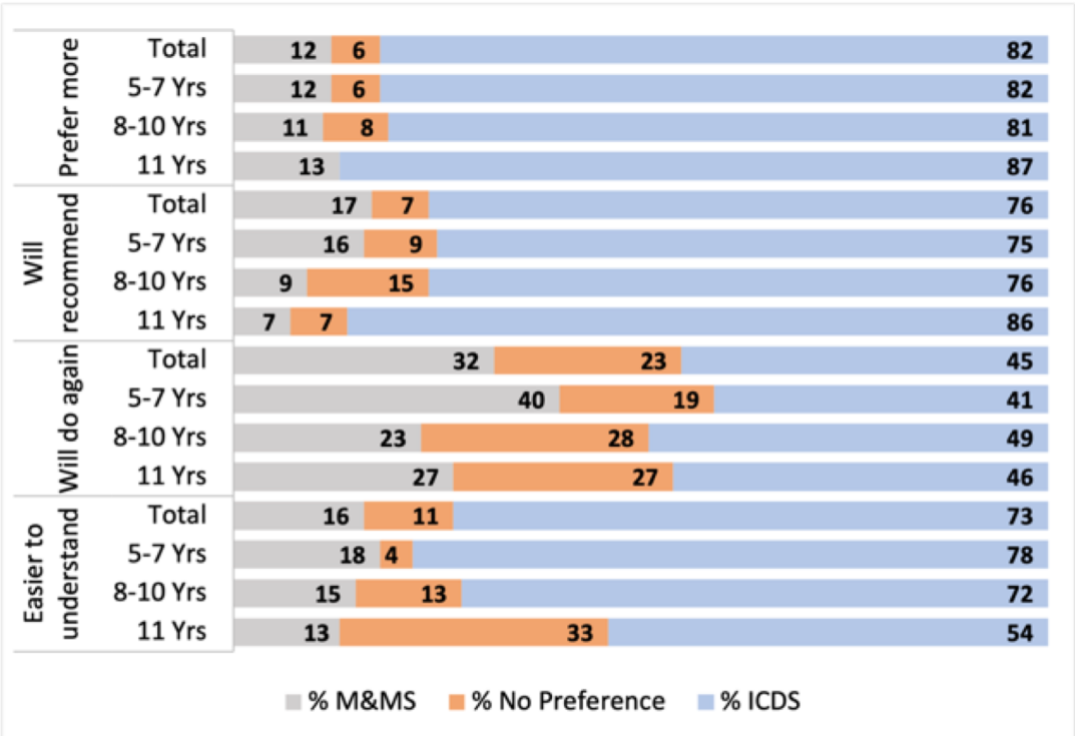
Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Beh = behavioural subscale, Emo = emotional subscale, Tot = Total scale score, Ext = externalising subscale, Int = internalising subscale, Att = Attention subscale. Sample size for ICDS and M&MS $N = 266$, BPM-Y $N = 100$, BPM-P $N = 265$, and SDQ-P $N = 258$.

8.7.4 User Acceptability and Satisfaction

The acceptability of the ICDS was determined by examining preference survey responses and written feedback from 136 children (53.7% male, M_{age} = 7.65 years, *SD* = 1.93). Data presented in Figure 8.4 indicates that the digital presentation mode of the ICDS is highly acceptable when compared to the written format of the M&MS. Across the whole sample and within age group levels (5-7, 8-10, and 11 years) at least 75% of children in each age group stated they would recommend the ICDS to other children. When asked which measure they would do again, results across the whole sample were mixed with 44.9% preferring to complete the ICDS, 33.4% preferring the M&MS, and 22.8% stating they had no preference. Comprehension was high with 72.8% of all participants reporting that the ICDS was easier to understand than the M&MS. Those who had no preference stated it was because they thought both measures were easy to understand. Overall, at least 80% of children in each age group stated they preferred the ICDS over the M&MS.

Figure 8.4

Participant Preference Rating for ICDS and M&MS Measures

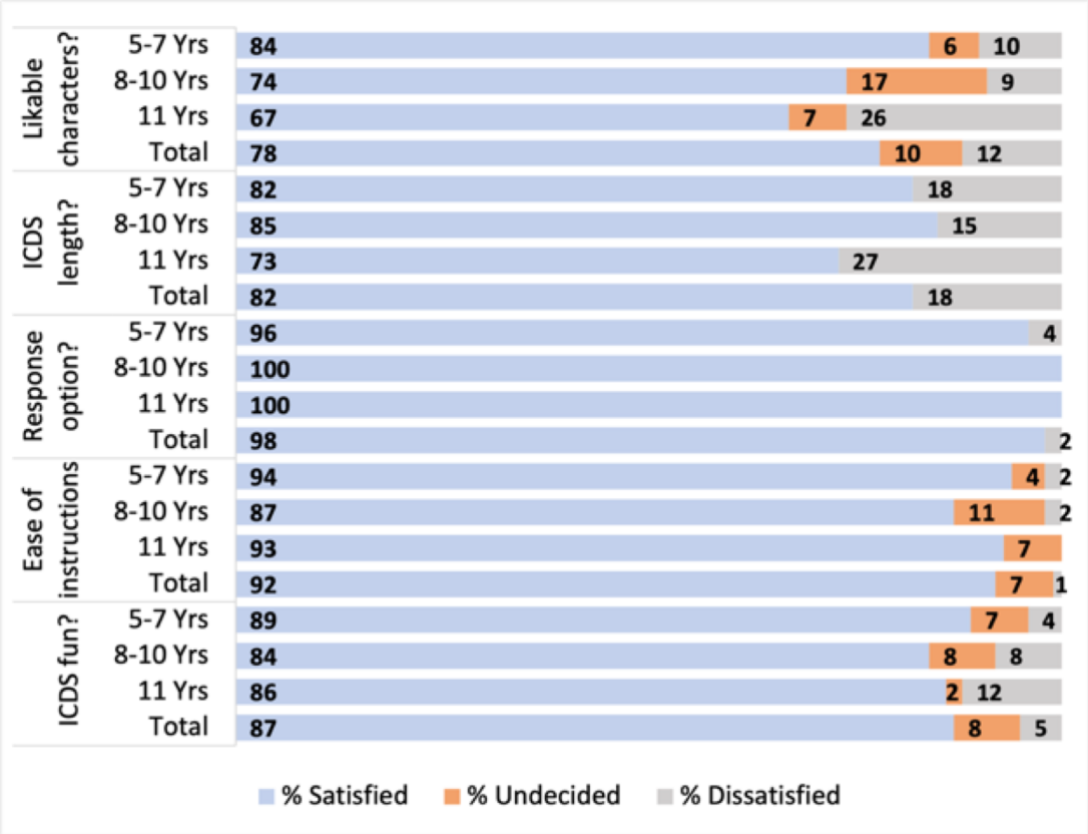


The satisfaction ratings of the ICDS were high across the whole sample with respect to the instructions and response options. Younger children <8 years (*n* = 68) reported the highest satisfaction with the characters (83.8%) and with how fun the ICDS was (88.2%). Whilst the majority of 11-year-old children (86.7%) were

satisfied with how fun the ICDS was, less were satisfied with its length (73.3%) and only two thirds were satisfied with the cartoon characters (66.7%). Satisfaction ratings for the whole sample and per age group level are presented in Figure 8.5. Nine parents and 73 child participants provided predominantly positive qualitative feedback on the ICDS. Individual written responses are stratified by age in Appendix E.

Figure 8.5

Participant Satisfaction with ICDS



8.7.5 ICDS Utility

All participants (N = 74, 54% male, M_{age} = 7.43 years, SD = 1.90) seemed accustomed with using an iPad as none of the participants required help to use it. Zero children who were above 7 years (62.2%) required any assistance to complete any section of the ICDS. Out of 79 five and six-year-old children, only nine (11.4%) required some form of help at least one time. Specifically, six of these children (50% male) asked for help to complete the demographic portion of the ICDS application (i.e., required direction to click on the correct numeral and to click on a cartoon image of a boy or girl to choose their gender) and two boys clicked on the in-app 'Buddy' helper assistant at least once. Following this, the same boys verbally asked,

"What do I do now?" and required prompting to click the 'next' arrow and 'play' button to begin the next cartoon animation. One boy (aged 5-years) clicked the 'Buddy' helper for assistance when completing the response portion of the questionnaire to respond to the question "Which one is like you?" and one 6-year-old boy asked how to re-watch a video. Overall, the ICDS application was highly functional with 88.6% of participants able to use the ICDS accurately and without any assistance.

8.8 Discussion

In contrast to standard written measures, the ICDS is presented digitally via web-application on internet-enabled devices and is optimised for smartphones and handheld tablets. The ICDS utilises contrasting pairs of audio-visual animations as response items and is intended for children as young as five years of age to complete. The current analysis first scrutinised the factor structure of 15 items via iterative EFA which yielded three initial factors. However, item 14 (physical aggression) performed poorly due to cross-loadings and factor three contained only two items. Item 14 is likely to have performed poorly due to content issues. This animation depicted one child being physically aggressive to another child and it may have been confusing for children as to which actor they were meant to identify with (i.e., aggressor or victim). The two-item third factor depicted attention-related problems that might be relevant for children with a diagnosis of attention-deficit disorder. That the EFA modelled these items as a distinct factor suggests that these types of difficulties are distinct though overlapping with emotional and behavioural issues. The lack of a robust third factor with at least three items highlights the need for additional item development to properly capture attention/hyperactivity problems in a full subscale. After removal of these three items 14 (physically aggressive), 8 (hyperactive behaviour), and 13 (distracted - inattentive), a clean two-factor solution was supported. The final factor solution fit the data well and produced two interpretable, internally consistent, and correlated factors representing emotional and behavioural difficulties. These results are promising given this is the first attempt to examine child self-reported responses to animated video items via factor analyses.

The converging construct validity of the two ICDS factors was also supported by the pattern of correlations with validated measures. Overall, correlations examining the construct validity of the ICDS revealed a pattern that showed the strength of association increased as participant age increased for all measures and

was consistently of a greater magnitude for youth report measures at each age-group level. This pattern is not unique to the ICDS and likely due to well-known difficulties in capturing variation via psychological constructs with younger children. While self-reported information is known to be more challenging to collect from younger children (< 11 years), proxy reports from parents and teachers may also be unreliable and inconsistent with child reports, especially for internalising information (Jardine et al., 2014). In light of such cross-informant variance, child reported data clearly needs to be given due consideration when making diagnostic or treatment decisions, and to do so, valid and reliable child-report instruments are needed.

The results of this study established that the digitally animated format of the ICDS instrument had high acceptability to school-aged children. That is, they liked it, understood it, mostly preferred it to pen-and-paper measures, and indicated they would recommend it to others. Satisfaction ratings were exceptional with the majority of children within each age group level rating the ICDS favourably on both satisfaction and preference questions. Utility results further demonstrated that the design of the ICDS was highly functional and that the digital format was straightforward for children to complete on their own. Given the growing digital literacy skills of today's children and their widespread use of such devices, open access to an engaging and innovative digital screening instrument such as the ICDS is a viable option for universal application.

The present study utilised a convenience sample of parents from one school in the Brisbane region along with an online sample. Though online recruitment did increase the geographical variation in our participant pool, this group was also self-selecting, which may introduce some sampling bias regarding the acceptability or utility data. Further, some respondents were asked to provide self-reported data for measures who were outside of the intended age-range for those instruments. While this may have increased measurement error and possibly attenuated the observed correlations for the younger age groups, this approach was necessary as there were no validated self-report measures available for corroborating child-report scores across the entire sample age range Nonetheless, the test battery was varied, incorporated both parent and child informants, and utilised well-established self-report scales for determining convergent validity.

Future research will focus on the development of additional items to examine the potential for a third factor focused on attention and hyperactivity as well as

confirming the factor structure of the emotional and behavioural factors established here. The capacity of the ICDS to differentiate between clinical and non-clinical children should also be examined to establish clinical norms and cut-off scores to assist with prevention, intervention, and treatment planning. Pre-post reliability and sensitivity of the ICDS to change following intervention is another area of examination required. With respect to the ICDS design and feedback from the older children who were less favourable about the look of the animated characters, the research team has commenced modification of the visual style of the animations to produce a more suitable version for older age groups.

In conclusion, this study aimed to examine the psychometric properties of the ICDS, a digital, animation-based instrument for detecting emotional and behavioural difficulties in children. The ICDS revealed good overall psychometric properties, with a clear two factor structure, excellent internal consistency and good construct validity. Furthermore, the digital instrument demonstrated high utility and satisfaction ratings, meaning children understood and enjoyed using it. Given that the ICDS was developed through a series of participatory co-design studies with young people, the instrument is likely to be more effectively implemented and accepted by this population. The ICDS instrument appears to present a promising opportunity for obtaining reliable information from young children under the age of 11 themselves regarding emotional and behavioural difficulties. The prevalence of mental health needs for children worryingly outpaces access to care so it is important to prevent delays to treatment. Universal screening can achieve early identification of problems, alter the trajectory of disorder development and minimise social, emotional, and economic burden.

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Declaration of competing interest

The authors have no conflicts of interest to declare.

CHAPTER 9: DISCUSSION AND CONCLUSION

9.1 Overview of the Chapter

Mental health difficulties in childhood are common, and it is clear that we need to detect problems early to intervene and disrupt deleterious trajectories into adulthood. However, there are a lack of instruments that can accurately obtain reports of emotional and behavioural distress from the perspective of young children under the age of 11. This research program involved young children in the co-design of a novel instrument containing animated cartoon items to assess common emotional and behavioural difficulties: the Interactive Child Distress Screener (ICDS). This research aimed to iteratively co-design, validate, refine, and evaluate the animated items and the animation-based instrument for measuring emotional and behavioural difficulties in children aged 5-11 years. This chapter will first present a summary of the main findings of each of the studies included in this research program, followed by a discussion of the overall interpretation of these findings. The clinical and scientific implications, along with the strengths and limitations of this research program, will be discussed next. Finally, this chapter will conclude with a discussion of the future directions for research.

9.2 Summary of Main Findings

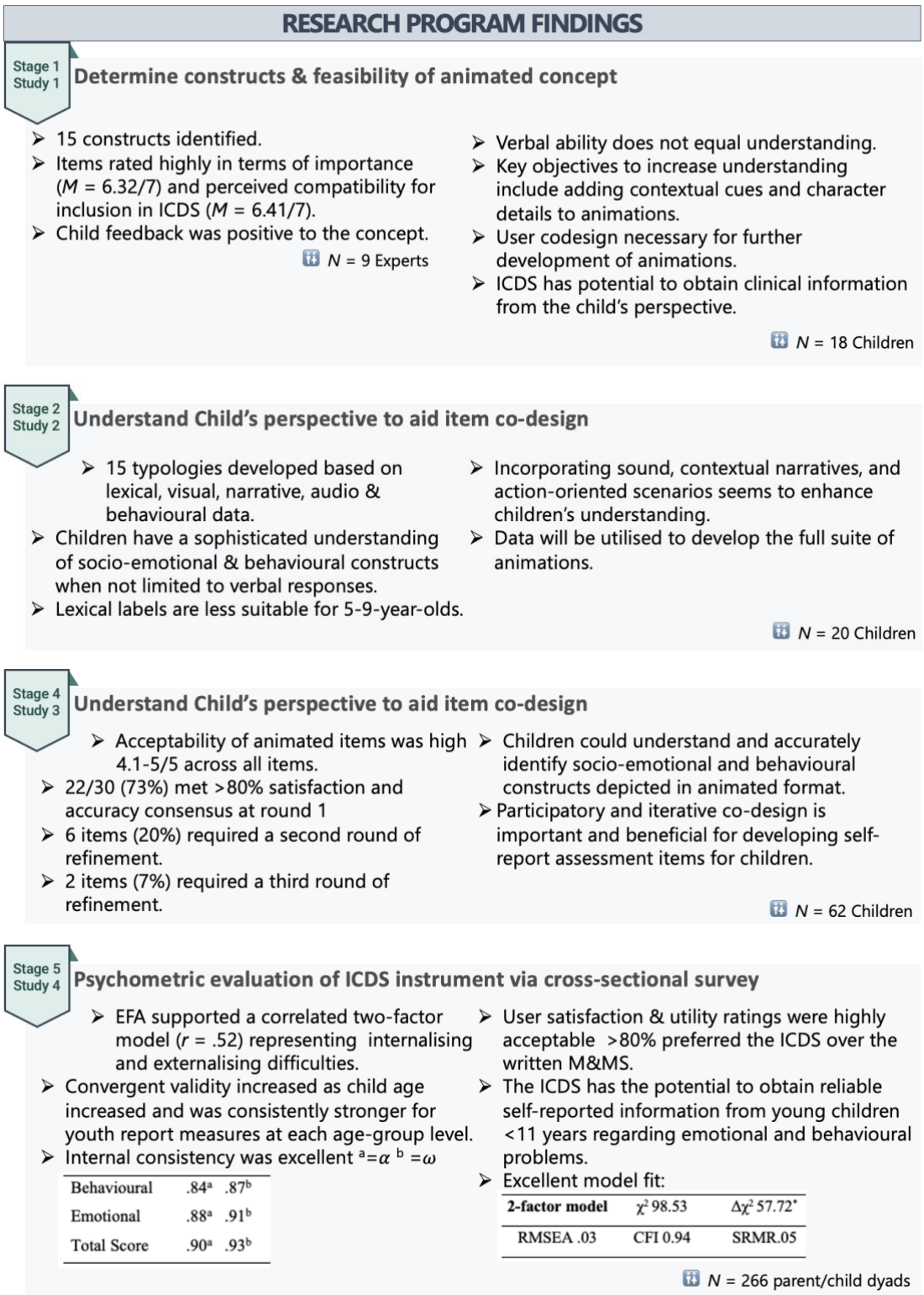
As described in Chapter 1, this thesis comprises four studies: determining the feasibility of the concept, co-designing item content, qualitative validation and iterative refinement of animated item content, and psychometric evaluation and utility testing. The key findings for each of these studies are summarised in Figure 9.1. At the completion of the four studies, the results revealed that the ICDS showed qualitative item validity, a stable two-factor structure representing two broad domains (internalising and externalising difficulties) and excellent internal consistency. Convergent validity was supported with other established measures.

9.3 Overall Interpretation of the Findings

There were three main messages to be drawn from this program of research. These include the finding that young children can accurately report on their own internalising and externalising states, the suitability of the digital and animated modality for delivering assessment instruments, and the importance of integrating children's perspectives via participatory co-design throughout the entire instrument development process.

Figure 9.1

Summary Results of Studies One Through Four in This Research Program



9.3.1 Children's Ability to Self-Report on their Own Internalising and Externalising States

This program of research provided unique insight into young children's ability to accurately report on their emotional and behavioural states when provided with appropriate tools to do so. Throughout the studies, participants as young as five years of age were able to recognise emotions and behaviours depicted via animations and accurately report on their mental health via this method. This mode provides a unique opportunity to obtain self-report from younger children that has not historically been possible. Typically, young children's mental health information is obtained via proxy informants such as parents/caregivers and teachers (Vaz et al., 2016). Yet, inconsistencies between parent and child reports and between parent and teacher reports are not uncommon, especially regarding internalising difficulties or when parents themselves are experiencing mental health problems (Kashani et al., 1985). Such inconsistency in reporting may also be exacerbated when proxy informants see the child in only one context (e.g., school or home) because children act differently in different settings (Vaz et al., 2016). Inconsistencies in proxy reporting highlight the need for accurate methods to obtain child self-reported information to ensure that the child's subjective experience is also considered. However, as indicated in Chapter 1, apart from the M&MS, child self-report screening measures exist only for young people aged 11 years and older. The findings of this research highlight the possibilities for children as young as five to accurately self-report on the presence of emotional and behavioural distress.

It is important to note that the purpose of this research program was to specifically examine ways of accurately obtaining self-reported information from children as young as five years and up to 11 years. One of the major benefits of the Interactive Child Distress Screener (ICDS) was that it did not require an understanding of verbal or lexical labels of emotions or behaviours for the child to complete the instrument. Each of the emotional or behavioural constructs were displayed via audio-visual scenarios rather than written statements, as is the case with most self-report instruments (e.g., SDQ, BPM, M&MS). Therefore, children simply needed to recognise which animation in an item pair acted most like them. Results showed that all children aged between five and 11 could accurately identify the constructs portrayed in the ICDS. Importantly, the results demonstrated that children's verbal or lexical labelling ability did not equate to their cognitive

understanding of emotions or behaviours. That is, even when some children could not name the construct depicted, they were all able to describe an equivalent scenario in which they had experienced or witnessed the same emotion or behaviour. Such understanding of the constructs indicated that recognition of emotions and behaviours via animations and audio-visual cues are an appropriate tool to facilitate self-report in this age group.

These findings support previous research that has demonstrated that younger children can provide accurate self-report when measures are developmentally appropriate, such as via Clinician-led interview (e.g., Barry et al., 2008; Stiffler & Dever, 2015). However, gathering child reports via interview is resource-intensive, costly, formal, and does not align with screening objectives. In contrast, the ICDS provides a format that does not require a clinician, can be completed by the child on their own, and delivered at scale for screening purposes. Because the ICDS is completed independently and removes the need for an adult overseer or interviewer, it circumvents the problem of children providing socially desirable responses (Bradford & Rickwood, 2012; Deighton et al., 2014; Grills & Ollendick, 2003; Mash & Hunsley, 2005), which may have contributed to historical perceptions that child self-report was unreliable. Overall, this research program highlighted that young children can provide accurate information on their mental health when obtained via developmentally appropriate methods. Such tools can facilitate the inclusion of the child's perspective and ultimately provide a more comprehensive overview of the child's difficulties.

9.3.2 Suitability of Digital and Animated Modality for Delivering Assessment Instruments

This program of research demonstrated that digital tools can be used successfully to assess childhood emotional and behavioural distress. The modality of the ICDS was received favourably by young children across all studies. High satisfaction ratings were evident concerning its ease of use, the response format, visual aspects, and overall likability. When compared with pen and paper measure, the digital ICDS was preferred by participants, and in terms of utility, there were no difficulties experienced by children in using the App or completing the instrument. The acceptability of this digital instrument by children was not surprising and consistent with previous research, which has shown enhanced satisfaction with digital instruments (Truman et al., 2003) and digital interventions more broadly (Hill

et al., 2018; March, Spence, et al., 2018; Vigerland et al., 2016). Given the ubiquitous nature of apps and digital technology in children's lives, instruments delivered via digital means are likely to be well accepted across the general population.

High qualitative content validity was demonstrated when considering the animated digital assessment items individually (Study 3). The results showed that children could comprehend each item's emotional and behavioural construct when delivered in an animated format. Further, children agreed items were accurate, or items were refined until this was achieved. The ICDS instrument showed excellent psychometric properties (see Chapter 8, Study 4), which further supported the suitability of the digital format for delivering such instruments. Compared to previous literature, these findings highlight the feasibility of the digital format when using animated items specifically. It is important to note that previous attempts to digitise screening or other self-report instruments have utilised very different designs to the ICDS. For example, the Dominic Interactive and SDQ included computerised adaptations of their paper questionnaires by presenting the written items onscreen and supplemented with static illustrations (Kuijpers et al., 2014; Truman et al., 2003). Minimal psychometric data were reported for both (e.g., no factor structure was reported) though preliminary results indicated that digital formats might offer benefits compared to the pen and paper versions (Kuijpers et al., 2014; Truman et al., 2003). The digital format utilised in this research program appears to be a feasible modality for delivering assessment instruments for children.

One reason why the digital modality utilised by the ICDS may be superior to that of previous attempts could relate to the specific format used to display items, namely, the dynamic, audio-visual, and scenario-based nature of the animations. Previous attempts have focused on using static images to illustrate a written statement. In contrast, the ICDS utilised cartoon animations that include meaningful, narrative storylines, dynamic movement, audio, context, and visual cues to depict different emotions and behaviours. Such methods are supported by the 'emotion scripts' view posited by Widen and colleagues (Widen, 2018; Widen et al., 2015), who argue that young children learn about emotions by watching people (live) and linking components of emotions (e.g., causes, consequences, behaviours, and vocalisations) and through facial expressions within particular contexts. This might be why children have some difficulty recognising emotions through static images

alone. Thus, when developing digital instruments for younger children, it is essential to build items using technologies that can show dynamic movement and provide contextual audio-visual cues. Overall, the results of this research highlight the utility of digital technologies, particularly animations, in delivering assessment items for young children.

9.3.3 Integrating Children's Perspectives Via Participatory Codesign

A clear outcome of this research was the necessity to involve children and gather children's perspectives at all stages of instrument design and development. By engaging children as co-designers and utilising participatory methodologies at all stages of ICDS development (e.g., item content generation, prototype design and development, integrating recommendations, user testing), meaningful and valid items were developed that were well accepted by children.

When developing instruments for young children, the results of this research program highlighted that significant attention needs first to be focussed on developing item content with the target group to ensure that they are relevant and understandable by children. This was particularly important given that there is a general lack of instruments for children under the age of 11, and thus very little knowledge about how to develop self-report measures for young children effectively. Further, very little literature examines young children's perceptions and comprehension of such a broad range of socio-emotional and behavioural constructs as required for the ICDS instrument. That which does exist focuses on basic emotions of happiness, fear, sadness, anger, surprise, and disgust.

There is only one other self-report broad emotional and behavioural screening instrument for children under the age of 11, the Me and My School (M&MS) Questionnaire (Patalay et al., 2014). Though participatory design was not a core feature of the development of this instrument, the developers did consult with children via focus groups and pilot tested words and concepts to determine if younger children used those words and understood them (Deighton et al., 2013). Whilst items are still presented via traditional pen and paper style; the M&MS demonstrates good psychometrics for children aged eight years and over. Thus, the consultation with children in its development likely assisted in the selection of meaningful items. In the current program of research, it was found that considerable time needed to be spent exploring how children conceptualised and recognised emotions and behaviours (see Chapter 5, Study 2) to inform the development of the

animated item content. Additional time was then required to ensure the constructed animations were meaningful across age groups by working with children via qualitative content validation methodologies and refining them based on their feedback (see Chapter 7, Study 3). In the current research, this led to a set of animated items that were valid and acceptable across the target age range.

This research program also highlighted the important contributions that can be made through true participatory co-design methodologies when developing digital instruments for children, particularly in comparison to more commonly utilised consultation, outcome feedback, or user testing approaches. Whilst participatory co-design approaches have been used in digital intervention development (Bevan Jones et al., 2020; Thabrew, Stasiak, et al., 2017), they have not commonly been integrated into scale development. In this research, the information provided by children at each stage was necessary for the next stage to progress. The children's decisions directed what was included and excluded from the ICDS item content and were integrated to inform and improve item design and development. This is a vastly different approach to simply consulting with users after an instrument or tool has already been developed and allows for an iterative process of refinement that ensures the final product is more meaningful to the user. As proposed by Stålberg et al. (2016), participatory designs must allow children (the ultimate end-user) to be equal partners during the whole design, development, and evaluation process, and not just as testers of an end product. By involving end-users in this way, the likelihood that the instrument will be generalisable to the intended population increases. The results of this research demonstrate the positive outcome of such a participatory co-design process with young children.

Overall, the results of this program of research show that the ICDS, which was co-designed with young children through an iterative process of staged scale development, is an acceptable and effective tool for assessing emotional and behavioural difficulties in children as young as five years of age. Notably, the development of this instrument was child-led, rather than adult-focused or adult-driven, and included the full involvement of children at all stages. Further, it integrated the theoretical steps of scale development with iterative development processes to ensure the instrument was valid and acceptable to the user. Ultimately this led to the successful development of items and an instrument that was

meaningful to children and effective at assessing the target domains through independent child self-report.

9.4 Strengths and Limitations

There were several important strengths to note in the current research. First, the overarching research and ICDS development program was guided by psychometric theory and general models of test development. Further, an exploratory, sequential, mixed methods research design was utilised to address specific research questions in each study. This mixed-methods approach is recommended in assessment item and scale development (Creswell & Plano Clark, 2011). The development of the instrument also utilised iterative and participatory co-design methods to ensure the item content was meaningful and acceptable to the intended user. Thus, the procedures undertaken in this research were systematic, involved children at every stage and utilised a combination of quantitative and qualitative approaches, which led to an effective outcome. The variety of qualitative methods employed in each study allowed for the collection of rich and comprehensive data, specifically relating to the development of emotional and behavioural typologies, upon which the ICDS instrument is based.

Second, the approach to participatory research implemented in this program is an evident strength. It reflects Level 5 of the Pathways to Participation model (Shier, 2001), which emphasises an explicit commitment from the research team to provide opportunities and procedures that ensured the children could be critical decision-makers in guiding the development of the ICDS items. This is in stark contrast to other forms of co-design that stop at earlier levels of participation, such as information gathering or consultation, where children are asked for opinion but don't have an influence on outcomes. Third, co-design was implemented in a way that utilised flexible, child-driven participatory methods. That is, the research aims, and data collection methods were contextualised to the needs and ability of the target group to ensure that children of all ages could engage and provide input. This also confirmed that the children's right to express their opinions freely were upheld and integrated into the research. Fourth, there was a broad range of children included in each phase of the research regarding age and gender to ensure that the items would be meaningful to children of the target age group, which included children 5-11 years of age.

Fifth, multiple accuracy, acceptability, and outcome measures were utilised in this research, both within and across each study. This helped to ensure that item components were accurate and acceptable before they were included in the subsequent study (or final instrument) and allowed multiple opportunities for children's input before finalisation. Further, there were various ways that the accuracy and acceptability of item content were assessed to ensure there were several ways children could provide feedback and trigger refinement for comprehensive evaluation of each item. Finally, more than 366 children were recruited to be part of this research which is a substantial number of young people who provided input and feedback on the ICDS.

Notwithstanding these strengths, there were some limitations to this program of research. First, the samples across the studies were relatively homogenous concerning demographic characteristics. Children and parents were predominantly white Australian, with only some representation of participants from Indigenous backgrounds or other ethnicities. Thus, the ICDS may not apply cross-culturally, though this was not explicitly examined, and some characters within the instrument were developed to represent different ethnic backgrounds. The participants within this research were also predominantly from middle to high socio-economic class backgrounds in the first three studies. However, the school sample was recruited from a low to middle-class area in the final study. Thus, it is possible that the results of this research may not be generalisable to broader groups and should be validated in further population samples. It is also possible that the ICDS may not be suitable for neurodiverse children, though this has not been explicitly examined.

Second, the online recruitment method utilised in Study 4 to obtain the community sample for psychometric evaluation might have meant that this sample was biased and already held favourable views towards digital technology. However, it is important to note that most children have significant experience using technology and have favourable views of digital tools, so this is unlikely to be a significant problem. Further, part of the sample in Study 4 was recruited via school-based recruitment, which meant that we were able to obtain a proportion of the data via traditional pen-and-paper responses. Third, despite best efforts at contacting many schools and inviting their participation, only one school could be utilised for school-based recruitment. Seventy-four participants out of 266 (29%) in Study 4 were recruited via the school, and it is possible that the results may reflect a school

cohort effect. However, given the spread of participation from school-based participants across the ages and in combination with the data from participants recruited online, it is unlikely that this influenced the overall findings. It is also important to note that the school-based participants represented only a 10.6% response rate of invitations sent out to potential participants. Thus, there is also likely bias within the school-based sample in that participants may have been more likely to include those willing to discuss mental health difficulties or seek assistance. Therefore, it will be important to examine the utility of the ICDS in extended population and demographic groups.

Third, with only two items loading onto a third factor representing attention and hyperactivity, there were insufficient items to create a third subscale, as is commonly found in some other screening tools for children. It is likely that with further co-design and refinement, additional animated item content could be developed to complete a third subscale. However, this would require additional recruitment of child participants, co-design, creation of animations, further qualitative content validation, and content refinement and was not possible within this program of research.

Finally, whilst this program of research has taken the first important steps towards demonstrating the utility of the ICDS in accurately assessing emotional and behavioural difficulties through independent child self-report, it did not yet directly examine the capacity of this instrument to act as a screening tool. Although the findings did show that the ICDS demonstrated excellent psychometric properties with other established screening instruments, it did not test the sensitivity or specificity of the instrument. Thus, whilst this research cannot yet determine the status of the ICDS as a screening tool, it has reported on the comprehensive steps taken to co-design the items and establish psychometric properties of the instrument in assessing child emotional and behavioural difficulties. The development of valid items is an essential component in the construction of a successful broad screening instrument. Establishing sensitivity, specificity and clinical cut-offs are required next steps.

9.5 Implications

This program of research highlighted several opportunities for practice and research. The comprehensive and diverse data collected through the qualitative methods enabled the production of typologies for common emotional and

behavioural constructs. This qualitative data has been collated into shared response typology tables detailing the common participant conceptualisations across the ages for each of the 15 pairs of emotions and behaviours examined. The complete list of Typology Tables and Figures can be found in Appendix S1.1. The typology tables outline common participant perspectives for visual cues, narrative context, behavioural actions, and sound cues that the children associated with each target and contrasting emotion and behaviour (e.g., sad and happy). These also exist in an extended document whereby all perspectives are categorised according to age groups (5-6, 7-9 and 10-11-years), and therefore, item-level variations between ages can be explored. This extended version can be found in Appendix S1.2 Such resources will likely be useful in clinical, educational, and research settings for people working with young children and might assist in assessing or understanding how young children perceive, experience, and recognise emotions and behaviours. They may be particularly useful in the production of future tools or resources that relate to socio-emotional and behavioural concepts from the child's perspective.

This research suggests that any future measures assessing emotional and behavioural difficulties via self-report in young children should incorporate dynamic, audio-visual stimuli with contextual scenarios or narratives applied. In this research, findings demonstrated that younger children were less able to provide lexical labels for emotions and behaviours; however, by using audio-visual stimuli, their cognitive understanding of the constructs was not affected and nor was their ability to provide accurate responses. Thus, typical pen and paper style measures with written questions and Likert style response scales are unlikely to be effective in this age group, especially very young children.

The ICDS demonstrated efficacy in assessing emotional and behavioural difficulties independently self-reported by young children. Supposing sensitivity and specificity are confirmed, and the ICDS can differentiate between clinical and non-clinical populations (see below for future directions). In that case, it has the potential to act as a brief and broad screening instrument for emotional and behavioural distress. Given that current best practice relies on multi-informant reports from adult observers to identify young children experiencing distress, such an instrument would provide an alternative approach that could first detect risk independently via the child themselves. It would also have the potential to be delivered free via a web-based App in routine care and education settings or universal screening programs. Specifically,

the ICDS instrument could be completed by the child during GP clinic appointments to either inform the care received by the GP or to guide the GP regarding referral for further psychological assessment. The ICDS instrument could also be used in school settings within classrooms to identify children needing referral to school counsellors or guidance officers for further assessment or intervention. Unlike currently available tools, it could be scored automatically within the App and immediately connected to referrals, avoiding the requirement for scarce and costly clinician input. Thus, the ICDS has the potential to assist in detecting mental health problems early and facilitating referral into appropriate assessments and treatments via an easily accessible (internet-based), low cost (free to anyone with access to the internet), time-efficient modality that anyone could use.

9.6 Future Directions

Briefly outlined in Figure 9.2 are the future directions this line of research will take. The most important step will be to conduct further psychometric evaluation of the ICDS instrument in community and clinical samples to establish sensitivity and specificity of the instrument and determine its utility as a screening instrument. Further, it will be essential to verify its ability to differentiate between clinical and non-clinical samples and determine clinical cut-offs. Once psychometric evaluation is complete, it will be important to finalise the scale and implementation of the instrument. This will include establishing administration recommendations, norms across samples from relevant populations, evaluating psychometrics in other populations and preparing a test manual. It would also be useful to trial the ICDS, once established, in routine care settings or as an open-source online tool, to examine its acceptability and utility as a screening instrument in different settings. One possible avenue for future research and clinical delivery would be to create multiple versions of the characters within the app, whereby children can choose their character based on ethnicity or other culturally-relevant characteristics and then view animations of those characters throughout the ICDS instrument. This may increase identification with the characters and questions and enhance acceptability in diverse populations.

It would also be important to examine whether it is possible to create additional valid items related to the attention and hyperactivity constructs and whether a third factor is evident in this scale. These items were the most difficult to animate well and may simply not be amenable to the current style of animation used

in this version of the ICDS. New items would require the same refinement and evaluation process to ensure equivalent acceptability and validity. Therefore, the current attention and hyperactivity items will be removed from the ICDS scale until additional items can be developed and tested.

Finally, future research will examine whether such animated audio-visual approaches to assessment might benefit older age groups. The research team have subsequently developed an adolescent version of the ICDS. Drawing from the child animations an equivalent adolescent version of each animation has been developed (N = 30). However, significant changes were made to the style of animation, the look of the characters, and specific aspects of the scenarios. A simpler hand-drawn line-style of animation has been utilised to appeal to an older audience and a decision was made to replace the bright colours evident in the child focused animations with black and white imagery and simple pops of colour for effect. A screenshot taken from an adolescent animation is shown in Figure 9.2. In planning the adolescent version we hypothesise that older youth will not require the contrasting animations to choose between and will likely be able to determine how much a 'target/negative/deficit' animation is like them via a more sophisticated sliding scale response format. Therefore the first phase of testing will only utilise target animations. Ethical approval has been granted for a study to examine the acceptability and feasibility of these animations in young people aged 11-16-years.

Figure 9.2

Exemplar of Adolescent Animation

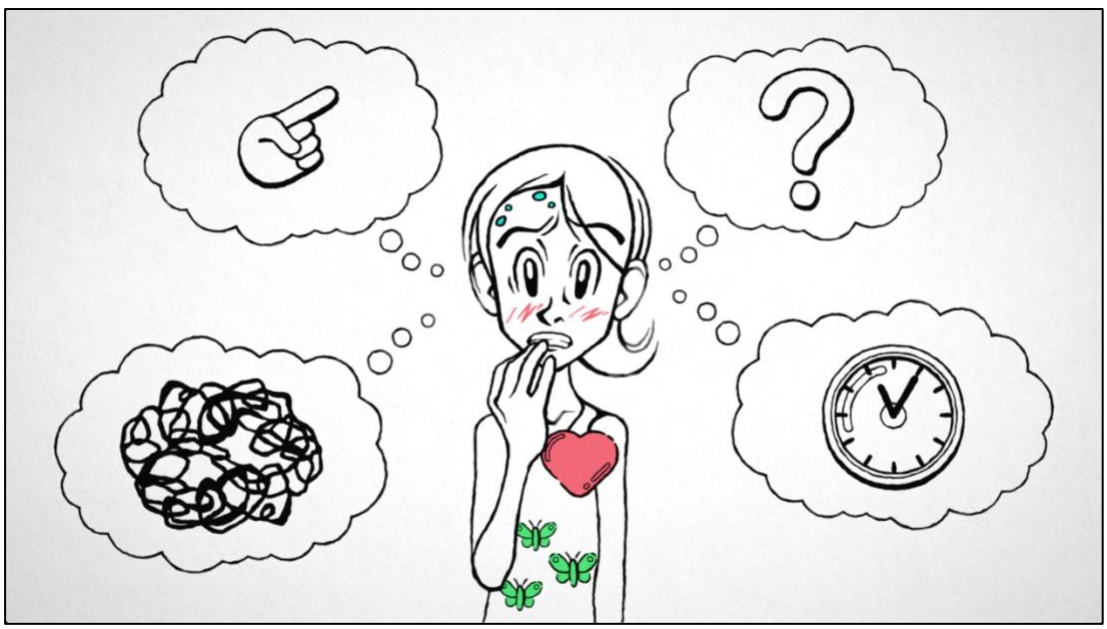
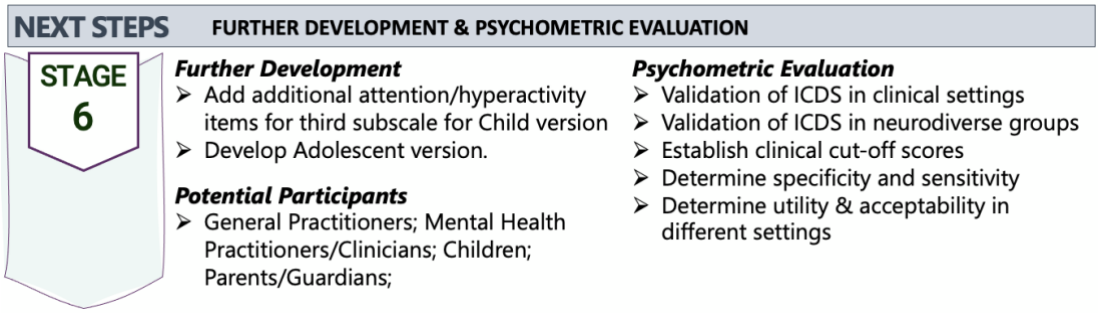


Figure 9.3

Future Directions of ICDS Instrument



9.7 Conclusion

Considering less than half of children who have mental health difficulties receive help, it is essential that opportunities for screening young people for emotional and behavioural distress are more accessible to enable earlier intervention. It is also imperative that assessment approaches allow children to provide independent self-reports instead of relying only on proxy informant reports. Findings from this research demonstrate that the use of developmentally appropriate tools that have been co-designed with children can elicit valid self-reports on emotional and behavioural states in children as young as five years of age. This research also highlights the suitability of digital and animated modalities for delivering such instruments and the importance of integrating children's perspectives throughout all stages of instrument development. These findings provide insight for future researchers and clinicians in developing psychosocial instruments and digital tools for young children.

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APPENDIX A1

Table A1

Preliminary and Revised Construct Groupings, Utilising Items From Three Brief Measures of Child Emotional and Behavioural Difficulties

Initial domain	Example items	Scale	Revised domain	Example items	Scale
1. Nervous/shy	I am shy	MMS	1. Shy	I am shy	MMS
	Nervous or clingy in new situations, easily loses confidence	SDQ		Self-conscious or easily embarrassed	BPM
	Self-conscious or easily embarrassed	BPM			
2. Sad/depressed	I am unhappy	MMS	2. Sad/depressed	I am unhappy	MMS
	Often unhappy, depressed or tearful	SDQ		Often unhappy, depressed or tearful	SDQ
	I cry a lot	MMS		I cry a lot	MMS
	Unhappy, sad, or depressed	BPM		Unhappy, sad, or depressed	BPM
	Feels worthless or inferior	BPM			
3. Worried/anxious	I worry when I am at school	MMS	3. Worried	I worry a lot	MMS
	I worry a lot	MMS		Many worries or often seems worried	SDQ
	Many worries or often seems worried	SDQ		Worries	BPM
	Worries	BPM	4. Physical symptoms	Often complains of headaches, stomach-aches, or sickness	SDQ
	Often complains of headaches, stomach-aches, or sickness	SDQ	5. Fearful	Too fearful or anxious	BPM
	Too fearful or anxious	BPM		Many fears, easily scared	SDQ
	Many fears, easily scared	SDQ		I feel scared	MMS
	I feel scared	MMS			
4. Sleep problems	I have problems sleeping	MMS	6. Sleep problems	I have problems sleeping	MMS
	I wake up in the night	MMS		I wake up in the night	MMS
5. Irritable, argumentative, easily loses temper	I get very angry	MMS	7. Angry	I get very angry	MMS
	I lose my temper	MMS		I lose my temper	MMS
	Temper tantrums or hot temper	BPM		Temper tantrums or hot temper	BPM
	Often loses temper	SDQ		Often loses temper	SDQ

Initial domain	Example items	Scale	Revised domain	Example items	Scale
	I am calm (+)	MMS	8. Argumentative	Argues a lot	BPM
	Stubborn, sullen, or irritable	BPM			
	Argues a lot	BPM			
6. Aggressive behaviour	Often fights with other children or bullies them	SDQ	9. Physically aggressive	Often fights with other children or Bullies them	SDQ
	I do things to hurt people	MMS		I do things to hurt people	MMS
	Threatens people	BPM		I hit out when I am angry	MMS
	I hit out when I am angry	MMS		I Break things on purpose	MMS
7. Destructive behaviour	I break things on purpose	MMS		Destroys things Belongs to his/her family or others	BPM
	Destroys things belonging to his/her family or others	BPM			
8. Social problems	I feel lonely	MMS	10. Difficulty making friends	I feel lonely	MMS
	Nobody likes me	MMS		Nobody likes me	MMS
	Has at least one good friend (+)	SDQ		Has at least one good friend (+)	SDQ
	Gets along Better with adults than with other children	SDQ	11. Bullied or teased By other children	Picked on or Bullied By other children	SDQ
	Picked on or bullied by other children	SDQ		Generally liked By other children	SDQ
	Generally liked by other children (+)	SDQ			
	Rather solitary, prefers to play alone	SDQ			
9. Noncompliant behaviour	Disobedient at school	BPM	12. General noncompliance (school context)	Disobedient at school	BPM
	Disobedient at home	BPM	13. General noncompliance (home context)	Disobedient at home	BPM
10. Illicit or covert Behaviour	Steals from home, school, or elsewhere	SDQ			
	Often lies or cheats	SDQ			
	Feels too guilty	BPM			
11. Impulsive behaviour	Impulsive or acts without thinking	BPM			
	Thinks things out before acting	SDQ			
	Acts too young for his/her age	BPM			

Initial domain	Example items	Scale	Revised domain	Example items	Scale
12. Inattentive behaviour	Inattentive or easily distracted	BPM	14. Inattentive Behaviour	Inattentive or easily distracted	BPM
	Easily distracted, concentration wanders	SDQ		Easily distracted, concentration wanders	SDQ
	Fails to finish things he/she started	BPM		Can't concentrate, can't pay attention for long	BPM
	Can't concentrate, can't pay attention for long	BPM		Good attention span, see chores or homework through to the end	SDQ
	Good attention span, see chores or homework through to the end	SDQ			
13. Hyperactive behaviour	Can't sit still, restless or hyperactive	BPM	15. Hyperactive Behaviour	Can't sit still, restless or hyperactive	BPM
	Constantly fidgeting or squirming	SDQ		Constantly fidgeting or squirming	SDQ
	Restless, overactive, cannot stay still for long	SDQ		Restless, overactive, cannot stay still for long	SDQ
14. Helpful and considerate of others (+)	Kind to younger children	SDQ			
	Shares readily with other children, for example toys, treats, pencils	SDQ			
	Considerate of other people's feelings	SDQ			
	Helpful if someone is hurt, upset or feeling ill	SDQ			
	Often volunteers to help others (parents, teachers, other children)	SDQ			

Note. (+) Item or domain is worded positively, reflecting an absence or lack of difficulty in that domain. SDQ = Strengths and Difficulties Questionnaire; BPM = brief Problem Monitor; MMS = Me and My School Questionnaire.

APPENDIX A2

Interview Protocol Study 1 (2nd Study)

Introduction

Hi thanks for coming in to help us with our research.

My name is ……
Would you please tell me your:

Whole name: _____ Age: _____

Gender: M___ F___ O___ School Year: _____

Because we need to say the same information to all the kids that we talk to, I'm going to read to you from my paper. As we go along, I'll check that you understand what we're talking about.

We're working on creating an App that children can use to tell us about feelings (or emotions), and we want it to Be fun. The app will show the different types of feelings in a Bunch of cartoon videos.

Today, we would like your help to see if the cartoons show the feelings the right way and are fun for kids to watch.

Are you okay with that so far? [If the child responds affirmatively, move on. If the child does not respond, or responds negatively, STOP and discuss any issues or questions]

It won't take very long but if you feel like you need a Break, just let me know and we'll have a little rest.

For some of the questions I'm going to show you this chart which will help you tell me how much you do or don't like something. For example, if I asked you how much you like pizza you might say "I love it" and give it a happy face or a 5/5. And if I asked you how much you like Brussel sprouts, you might say "no, I hate it" and give it a sad face or 1/5. Does that make sense? [If the child responds affirmatively, move on. If the child does not respond, or responds negatively, STOP and explain again until the child understands and is happy to continue]

So now I'd like to show you our cartoon videos. Is that ok?

I'm very interested in finding out what you think about them. If you don't know what to say or don't understand what one of the cartoons mean, that's okay and will Be very helpful to us. There are no wrong answers.

1. CONTENT VALIDITY

Show child a single video and ask questions **1 2 3 4** Then repeat with the next video.

Q1 *What do you think is happening for the Boy/girl in this video?*

CU	Video

	1Sad
	2Happy

*__CU__ Correctly understood - tick for yes, x for no.

Q2
If correct: *That's right – in this video we meant to show [emotion/Behaviour].*

If incorrect: *In this video we meant to show [emotion/Behaviour].*

If you were going to make a cartoon showing a 'sad' feeling how would it look? What would happen?

Child's 'Better' interpretation of each video

Q3 *What rating do you give this video for showing the 'x' (feeling/Behaviour)?*

CU	**Video (Construct)**	**Rating**

Q4 *Can you tell me a story about a time when you or someone you know felt the same as the cartoon Boy/girl?*

Notable Remarks

Understanding the instructions

Q5 *What do you think I mean if I ask you "Which video is most like you?*

Show the child each video pair (negative and then positive) and ask **Q6a** & **B** Before moving onto the next video pair.

Q6a. *Would you say you are MORE like one of the characters in these two videos?* ***B.*** *Why?*

a Circle Child's Video Choice and B Child's Response	
Pair	Target
	Contrast

Q7 *If I ask you tell me if you think the character "is a lot like you" or "a little Bit like you" - what you think we mean by that?*

2. ACCEPTABILITY

Characters

I'm going to show you two of the videos again. [Show VIDEO 1 'sad' and then VIDEO 5 'worried']

Q8 *I would like to know what you think about the characters in the videos. [Prompts]*

- *What did you like about them?*
- *What didn't you like about them?*
- *Can you show me on the chart how much you liked or didn't like the characters?*

Like	Dislike	Rating

Sounds

Can you remember the cartoons that showed Boys sleeping? [Show the videos 3 and 4 again if needed]

Q9

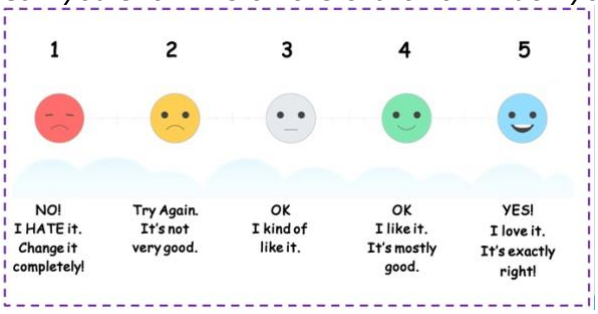
a. *What did you think of the sounds in the videos we just watched?*

B. *Do you think the sounds helped you to understand what was happening in the video?*

c. *Did the sounds make it easier to understand how the Boy/girl was feeling?*

d. *Would you like every video to have sounds?*

Can you show me on the chart how much you liked or didn't like the sounds?



Rating _____

3. OTHER

Do you have any other ideas that you think would make the cartoons easier to understand?

That's all the questions I have for you. Are there any questions you have about what we've done today? [If the child responds No, move on. If the child has questions or issues, address them to the child's satisfaction]

Thank you very much for helping us with our research

APPENDIX A3

Qualitative Responses From Child Interviews (Study 1: Phase 2)

Table A2

Verbatim Feedback From Children (By Age and Gender), Including Initial Interpretation of Items and Whether Considered Correct By the Interviewer; Suggestions From Child for Improving Animations to Better Convey Intended Meaning; and Child's Personal Story, Identifying a Time When They Have Felt Like the Character in the Animation

Construct	Age	Gender	Interpretation	Correct?	How improve?	Personal story
Sad	4	M	Sad	Y	Like that (points to target cartoon)	When no one wants to play with me, even my sister
	4	F	Sad	Y	-	When Mummy was dropping me off at kindy
	5	M	Sad	Y	-	When [Brother] tripped over and hurt his hand and foot and he was sad
	5	F	Sad	Y	Show a Bully	-
	6	M	Sad	Y	Show somebody crying	-
	6	F	Sad	Y	Show him crying more	When my friend didn't get to kick the Ball
	7	F	Sad	Y	-	When she got a red ant Bite
	8	M	Sad	Y	A Bit more actions	When no-one wants to play with me
	9	M	Sad	Y	-	When you're left out of games at school
	9	F	Sad	Y	-	She was getting Bullied
	9	F	Sad	Y	-	At home when my Brother was sad
	9	F	Sad	Y	-	When I had to move to a new school and leave my friends
	11	M	Sad and crying	Y	Show a kid dropping ice-cream on the floor and then crying	When our cat Chilli died
	11	M	Crying. Sad, worried, stressed	Y	Bit more action, show what she's sad about	-
	11	F	Sad	Y	-	When I was getting Bullied
	11	F	Sad	Y	-	-
	12	M	Upset	Y	Have friends running, show him more upset	-
	12	F	Sad	Y	Show someone getting upset	When a pet died
Happy	4	M	Happy	Y	Like that (points to target cartoon)	When Daddy was singing songs with me

Construct	Age	Gender	Interpretation	Correct?	How improve?	Personal story
	4	F	Happy	Y	-	When I was going to the Despicable 3 movie
	5	M	Happy	Y	-	When my friend was playing with me
	5	F	Happy	Y	I stand up to the Bullies, I stand up for myself	-
	6	M	Happy	Y	Show somebody shouting out 'Yay' and jumping	-
	6	F	Happy	Y	Show his Bottom teeth	When I get to play with my friend
	7	F	Happy	Y	-	When she didn't need to Be the Mum in the games all the time
	8	M	Really happy	Y	A little more actions too	When I've done something good and feel proud
	9	M	Happy	Y	-	When you feel not left out
	9	F	Happy	Y	-	She met new friends
	9	F	Happy	Y	-	When we got our cat
	9	F	Happy	Y	Jumping up and down and looking excited	When I got my NAPLAN results – I did well
	11	M	Happy	Y	-	When I got my BMX Bike
	11	M	Happy, did well	Y	Same But for happy	-
	11	F	Happy	Y	-	When I found out about a holiday
	11	F	Happy	Y	-	All the time
	12	M	Happy	Y	Having fun on a playground	-
	12	F	Happy	Y	Someone who won something, smiling joyfully	When I won a medal
Sleeping poorly	4	M	Having a Bad sleep	Y	Like that (points to target cartoon)	When I woke up at kindy I had a Bad dream of monsters and wolves eating me
	4	F	Sad in his Bed		-	Because I had a Bad dream
	5	M	Tired and sleepy		-	There was a scary noise and I couldn't sleep so I went to Mum's room
	5	F	Not happy, he didn't have a good sleep, not comfortable	Y	-	-
	6	M	Sleepy		-	-
	6	F	Sad and tired		Take the moon away	-
	7	F	Boy didn't get enough sleep	Y	-	When I stay up too late
	8	M	Couldn't sleep well, feels really tired	Y	Add a dream bubble	I have nightmares a lot about things eating my Brains

Construct	Age	Gender	Interpretation	Correct?	How improve?	Personal story
	9	M	Tired and sad		Show him get out of Bed and walk like a zombie	I fell out of Bed
	9	F	Uncomfortable		Nightmare dream bubble above his head	-
	9	F	Uncomfortable		Show him a bit crankier	Bad dreams make me sleep Bad
	9	F	Slept Badly	Y	-	At my friend's house sleepover, it was unfamiliar
	11	M	Moving in their sleep, seems angry		Show someone getting out of Bed in the morning, hunched over, really tired, dragging their feet, yawning	-
	11	M	Can't sleep, had nightmare, really tired	Y	-	-
	11	F	Uncomfortable		Add a nightmare dream bubble; get out of Bed looking sleepy and walking slowly	If I have a nightmare or I can't sleep
	11	F	Uncomfortable		-	Tired and grumpy
	12	M	Trouble sleeping	Y	-	-
	12	F	Can't get to sleep	Y	-	When you feel Bad for doing something good
Sleeping well	4	M	Having a good sleep	Y	Like that (points to target cartoon)	My happy dream was I went to a tea party
	4	F	Happy in his Bed		-	Because I had a good sleep
	5	M	Sleepy and wakey		-	-
	5	F	He had a good sleep	Y	-	-
	6	M	Sleepy		-	-
	6	F	Okay		Make the window somewhere else	-
	7	F	He got enough sleep	Y	-	When I go to Bed early
	8	M	He had a nice sleep	Y	Add a dream bubble	After a fun day and I have good dreams
	9	M	Happy		Show him jump out of Bed in the morning energetic	Wake up happy
	9	F	Tired		Happy dream bubble above his head	-
	9	F	He had a good night	Y	Show yawning and smiling	-
	9	F	Slept well	Y	-	When I have a late night the day Before
	11	M	He came Back from the dead, he did not move		Show someone jumping out of Bed with lots of energy and smiling	After a sleep-in, when you don't have to wake up early
	11	M	Didn't dream and had good dreams	Y	-	-
	11	F	Sleepy		Add a happy dream bubble	-

Construct	Age	Gender	Interpretation	Correct?	How improve?	Personal story
	11	F	Comfortable		-	When I feel rested and good
	12	M	Good night's sleep	Y	-	-
	12	F	Tired		-	When you've had a Busy day and are really tired
Worried	4	M	Angry – hurt her hand		Like that (points to target cartoon)	I was on the stage at kindy and I didn't know what we were doing
	4	F	Don't know – sad and lost		-	When I wanted my Mummy
	5	M	Angry and sad		-	Sometimes I worry Because my friend wasn't playing with me
	5	F	Hungry		-	-
	6	M	Sad		She can't find her Mum and Dad	-
	6	F	Just a Bit sad		Make her smile	-
	7	F	Bored		Doing a test in class and a very worried face	-
	8	M	Bit sad and lonely		A more scared face, more actions	When I think I've lost Mum and Dad in the shops
	9	M	Sad		-	When my friend got lost
	9	F	Confused		She could Be looking around more	-
	9	F	Nervous	Y	-	Feel a Bit sick like Butterflies in my tummy
	9	F	Nervous – same as worried	Y	--	Backstage Before my dance concert
	11	M	Alone and anxious waiting at a Bus stop	Y	A student receiving test results, waiting for test results	Doing NAPLAN
	11	M	Anxious, worried, waiting	Y	Show what she's worried about – add a Bus stop and a clock to show it's late	-
	11	F	Waiting and lonely		More thought bubbles of worrying things	When I couldn't find my mum
	11	F	Nervous	Y	-	Getting to school late
	12	M	Lonely		-	-
	12	F	Worried	Y	Someone taking a test	about exams
Confident	4	M	Happy		Like that (points to target cartoon)	When I was playing a superhero and I helped them pack up the mess
	4	F	Happy		-	-
	5	M	Happy		Talking to all the kids at kindy	When I was talking out at my kindy – when I was doing my show-and-tell of the Eiffel Tower when I saw it and took a picture of me in front of the Eiffel Tower

Construct	Age	Gender	Interpretation	Correct?	How improve?	Personal story
	5	F	Happy		-	-
	6	M	Happy		-	-
	6	F	Happy and okay		Show some friends around her sitting Beautifully listening to her talk	When I'm dancing in a concert
	7	F	Happy		Getting a high score in a maths test	My Brother is confident
	8	M	Confident and proud	Y	-	-
	9	M	Really happy		-	-
	9	F	Feels like a superhero; energetic		Throw the cape off	When my friend was doing show and tell and had memorised her speech
	9	F	Excited		-	-
	9	F	Confident	Y	-	I knew my part really well in speech and drama
	11	M	Confident	Y	Someone doing a presentation in class, with no palm cards and smiling, standing up straight	When I was doing a presentation and I knew everything I had to say
	11	M	Role playing, feels good about himself		-	-
	11	F	Special and proud		Have a medal pop up on her chest or trophy in her hand; or singing in front of friends	For my first singing and guitar gig
	11	F	Confident	Y	-	When I hand in assignments on time
	12	M	Brave	Y	-	-
	12	F	Happy		Someone doing a talk or presentation in front of the class with confidence	In front of the class

APPENDIX B

Common Response Typology Tables

Shared response typology tables detailing the common participant responses across ages (5–11 years) for each of the 15 pairs of emotional and Behavioural constructs are outlined Below for the following conceptual categories: (a) visual cues including specific information related to eyes, forehead, Brows, mouth, nose, face, and Body, (B) narrative Context (when or why), (c) Behavioural actions, and (d) sound cues. If the participant's face was at rest or lacking any obvious movement it was labelled as a neutral position. The lexical labelling category was excluded from these tables as verbal responses were not consistent across all age group levels. Images of children demonstrating the target item are included Below each table.

Table B1

Common Response Typology for Children Aged 5–11 Years Regarding Sad and Happy Items (N = 20)

Category	Target Item Sad	Contrasting Item Happy
Visual cues		
Eyes	Downcast, teary, avoid or no eye contact, Blinking, closed tight	Wide open, relaxed, direct gaze, crinkled
Forehead	Wrinkled, furrowed	Neutral, relaxed, raised
Brows	Drawn down and in	Natural position, raised
Mouth	Frowning, pouting, Bottom lip out/wobbling, Bite lip, tight line	Smiling, ("Big" smile) showing teeth, mouth open/closed/relaxed
Nose	Sniffling, runny nose	Neutral
Face	Scrunched up when crying	Neutral
Body	Head lowered, looking down, shoulders slump and shake when you cry, scrunched in a Ball, rocking, covering face with hands	Open relaxed posture
Narrative Context (when or why)	When someone is doing something to you that you don't want to happen, when you have to do something that you don't want to do, when you don't get something that you want, something is happening that you don't like (to person or property), lose something, a pet dies/hear Bad news	When things are good, when you're having fun, at a party, getting presents, when nothing is wrong
Behavioural Actions	Cry, go to Be alone or seek comfort from parent/family/friend, rub your eyes, hug yourself (arms around your own Body), curl up in a Ball, go to Bed	Playing, taking part in activities, relaxing, smiling, laughing
Sound cues	Audible Breathing, crying sounds – sobbing, sniffling	Laughing, chatting, giggling

Figure B1

Children Demonstrating Target Item 'Sad'

Table B2

Common Response Typology for Children Aged 5–11 Years Regarding 'Worried' and 'Not Worried' Items (N = 20)

Category	Target Item Worried	Contrasting Item Not Worried
Visual cues		
Eyes	Scanning, looking around quickly, wide open, hardly Blinking	Open and relaxed, full eye contact at times
Forehead	Wrinkled, furrowed	Neutral, relaxed
Brows	Drawn down and in	Natural position
Mouth	Pursed, tight line, frown, Biting lip	Smiling widely, relaxed, closed neutral smile
Nose	Neutral	Neutral position
Face	Pale or red, tense chin	Neutral or happy
Body	Fidgeting, Biting/picking at fingernails, shaking legs, Butterflies in the stomach, sweaty	Open relaxed, sitting in any comfortable position
Narrative Context (when or why)	When: someone is doing something to you that you don't want to happen, when you have to do something that you don't want to do Because it scares you, when you don't get something that you want/need, something is happening that you don't like (to person or property), lose something, a pet dies/hear Bad news	An absence of any worries or upsetting situations, when with friends and having fun/relaxing
Behavioural Actions	Cry, go to Be alone or seek comfort from parent/family/friend, rub your eyes, hug yourself (arms around your own Body), curl up in a Ball, go to Bed	Meditating, smiling and relaxing, playing
Sound cues	Audible Breathing, crying sounds – sobbing, sniffling	Laughing, singing, whistling/humming

Figure B2

Children Demonstrating Target Item 'Worried'

Table B3

Common Response Typology for Children Aged 5–11 Years Regarding 'Sleeps Poorly' and 'Sleeps Well' Items (N = 20)

Category	Target Item Sleeps Poorly	Contrasting Item Sleeps Well
Visual cues		
Eyes	Blinking, dark shadows underneath, drooping/half-closed	Closed But relaxed
Forehead	Wrinkled, furrowed	Neutral, relaxed
Brows	Drawn down and in	Natural position
Mouth	Open/drooping mouths, yawning	Neutral, relaxed, small smile
Nose	Scrunched up or neutral	Neutral
Face	Scrunched	Neutral, relaxed
Body	Can't get comfortable, keep changing position, arms stretched up	Any comfortable sleeping position
Narrative Context (when or why)	When you have nightmares, can't go to sleep, not tired - lay awake for ages, keep waking up, feel hot/cold/uncomfortable, feel stressed	You are comfortable, not hot, not cold, when you sleep in; wake up happy/rested
Behavioural Actions	Movement – kick out, tossing and turning in sleep, getting tangled in Blankets, wake up a lot, rub your eyes, dragging your feet in the morning, walking slowly	Not much movement at all, is quite still
Sound cues	Moaning/groaning, snoring	Inaudible Breathing; silence, snoring

Figure B3

Children Demonstrating Target Item 'Sleeps Poorly'

Table B4

Common Response Typology for Children Aged 5–11 Years Regarding 'Angry' and 'Not Angry' Items (N = 20)

Category	Target Item Angry	Contrasting Item Not Angry
Visual cues		
Eyes	Glare, squint, narrowed, direct gaze, scanning	Open and relaxed, gaze less direct
Forehead	Wrinkled, furrowed	Neutral, relaxed
Brows	Eyebrows go down, mad' v' shape, drawn down and in	Natural position
Mouth	Showing small amount of teeth with upper lip curled, tight line, sneer, wide open (if shouting), frown	Smiling, relaxed, closed smile, slightly open
Nose	Scrunched up (squeezed or Bent so no longer in natural shape)	Neutral
Face	Scrunched, red	Neutral
Body	Tense, crossed arms, hands on hips with elbows forward, head slightly lowered	Open relaxed, any comfortable position
Narrative Context (when or why)	Someone is doing something to you that you don't want to happen, when you have to do something that you don't want to do, when you don't get something that you want, something is happening that you don't like (to person or property)	When you don't mind/ care, you don't want to fight, feel chilled out, you're happy chilled out, think 'so what'
Behavioural Actions	Stamp feet, kick, lash out, stand over others, heaving chest, pointing finger at 'other', Break property, slam doors, clench hands in fists	Shrug shoulders, hands in pockets walk away from/ignore others, are politely Behaved
Sound cues	Audible/ heavy Breathing, shout/yell "grrr, growl, ughh, aargh", cry, swear	Inaudible Breathing; say words/phrases like "meh, oh well, whatever, pffft".

Figure B4

Children Demonstrating Target Item 'Angry'

Table B5

Common Response Typology for Children Aged 5–11 Years Regarding 'Disobedient' and 'Obedient' Items (N = 20)

Category	Target Item Disobedient	Contrasting Item Obedient
Visual cues		
Eyes	Avoidant or Brief eye contact, looking away and rolling eyes	Eye contact
Forehead	Raised	Natural position
Brows	One or eyebrows raised, arched	Neutral
Mouth	Poking tongue out, smirk, sneer	Smiling sweetly/nicely
Nose	Natural position or scrunched up	Natural position
Face	Pulling silly faces	Natural position (not silly), pleasant
Body	Slouched posture, crossed arms, Back turned/ facing away, relaxed posture	Head erect, straighter posture, facing towards adult, hands in lap
Narrative Context (when or why)	Don't want to do 'something' (such as follow an instruction or a rule), parents/teachers are annoying, don't care about consequences, frustration, impatience, Boredom, don't like schoolwork, indifference to expectations	To Be helpful, adult expectation, get rewards, to Be seen as good, care about consequences, to do - the right thing/as told/expected
Behavioural Actions	Ignore/talk Back to parent/teacher, act out physically – kick, hit, punch, throw/damage property, slam doors, ignore rules/ instructions, play on furniture (i.e., swing on chairs, jump on Bed, sit on Benches, put feet on tables), distract others with Behaviours	Tidy/clean up, pay attention, do as told, will apologise, nod, listen
Sound cues	Laughing rudely, grunting, huffing – "humph", "whatever", "nyah nyah", shout out/at parent or teacher, swear, won't say sorry	Word or sounds of agreement – "ok, uh huh, yep", remain quiet, use manners and will say "sorry", "thankyou", "please"

Figure B5

Children Demonstrating Target Item 'Disobedient'

Table B6

Common Response Typology for Children Aged 5–11 Years Regarding 'Shy' and 'Confident' Items (N = 20)

Category	Target Item Shy	Contrasting Item Confident
Visual cues		
Eyes	Avoid almost all eye contact	Full eye contact
Forehead	Slightly furrowed	Smooth
Brows	Natural position or furrowed	Neutral or raised
Mouth	Closed, unsmiling	Broad smiles with teeth
Nose	Natural position	Natural position
Face	Blushing, hidden	Happy, open, engaging
Body	Body angled away, head down and turned away, arms crossed/hugging self, shoulders rounded and pulled inwards, closed posture	Head erect or tilted Back, straight, open posture, facing forward, hands on hips – elbows Back, open chest – shoulders Back
Narrative Context (when or why)	Situational discomfort, new situations/people, lack confidence, to avoid meeting/talking to others, nervous	Situational comfort, confidence, familiarity – people/situations
Behavioural Actions	Don't look at others, hide Behind parent or Book or phone, unspeaking, remove self from situation, refuse to join situation	Engage with others - wave, smile, talk, nod, play, join in
Sound cues	Silence, mumbling	Laughter, chatty talking

Figure B6

Children Demonstrating Target Item 'Shy'

Table B7

Common Response Typology for Children Aged 5–11 Years Regarding 'Argumentative' and 'Not Argumentative' Items (N = 20)

Category	Target Item Argumentative	Contrasting Item Not Argumentative
Visual cues		
Eyes	Narrowed, rolling, eye contact, glaring	Eye contact
Forehead	Furrowed down or raised up	Natural position
Brows	Furrowed, drawn together or raised high	Natural position
Mouth	Tense, lip curled, open wide (to shout), sneer	Smiling
Nose	Scrunched	Natural position
Face	Angry, mean	Neutral, friendly
Body	Arms crossed, facing off, hands on hips, leaning towards/standing over another, weight forward, chin forward, finger pointing	Relaxed open posture, respectful of others personal space, keep hands to self
Narrative Context (when or why)	Disagree with others' position, others are annoying, Belief in own position, want own way, want to Be seen as correct or in the right	Agree with others position, have manners, to Be seen as friendly/helpful
Behavioural Actions	Point finger at other, cross arms, shake fist, mirror other person's actions invading others space without physical contact	Nod head, shake hands, wave
Sound cues	Shout, firm/loud voice, talk over other	Turn taking when speaking

Figure B7

Children Demonstrating Target Item 'Argumentative'

Table B8

Common Response Typology for Children Aged 5–11 Years Regarding 'Hyperactive' and 'Calm' Items (N = 20)

Category	Target Item Hyperactive	Contrasting Item Calm
Visual cues		
Eyes	Wide open, minimal eye contact, unfocused – crossed eyes	Closed, naturally open, natural eye contact
Forehead	Raised	Natural position
Brows	Raised (wiggling)	Natural position
Mouth	Grinning, tongue poked out, exaggerated smiles, open	Smiling, neutral
Nose	Scrunched up, nostrils flaring	Natural position
Face	Changeable – 'pulling silly faces'	Neutral, 'sleepy', natural position
Body	Quick and erratic movements – arms up, out, grabbing self, stiff, loose, constant movement, can't sit still	Comfortable, free, open posture – leaning Back, resting forward, arms Behind head, meditation pose – sitting cross-legged
Narrative Context (when or why)	Excitement, Boredom, lack of control/awareness, excess energy, are too 'Busy', overwhelmed, overstimulated, want to annoy others, having fun, to get attention	In control, relaxed, to Be more reserved or sensible, avoid attention, expectation (parents or teachers)
Behavioural Actions	Random movement – jumping, waving arms, spinning, fidgeting, wiggling, swinging arms/legs, wiggling head side-to-side, bobbing head	Chest movement from deep Breathing, stillness, calm activity - read a Book, meditate, listen to music, drawing, seated
Sound cues	'Silly' noises – yayaya, woohoo, giggling/laughing, from tongue - pthtt	Yawn, slow, deep, soft Breath sounds, whistle a tune

Figure B8

Children Demonstrating Target Item 'Hyperactive'

Table B9

Common Response Typology for Children Aged 5–11 Years Regarding 'Lonely and Alone', and 'Sociable and Has Friends', and 'Alone by Choice' Items (N = 20)

Category	Target Item	Contrasting Items	
	Lonely and Alone	**Has friends/Sociable**	**Alone By Choice***
Visual cues			
Eyes	Downcast, teary, avoid/no eye contact	Full eye contact	Brief eye contact
Forehead	Neutral, natural position	Neutral, natural position	
Brows	Neutral, natural position	Neutral, natural position	
Mouth	Pouting, Bottom lip out, frowning, Bite lip, tight line	Smiling, neutral, natural position	
Nose	Neutral, natural position	Neutral, natural position	
Face	Covered – head in hands, sad	Pleasant, neutral, open	
Body	Drooping head/shoulders, slumping over, head tilted, hands held together, holding self, loose posture, legs drawn up with arms around them	Open posture, relaxed	Will nod/wave to others, wave others away (indicating desire to Be alone)
Narrative Context (when or why)	Don't have any friends, not liked By others, feel awkward, alone, insecure, emotional, sad, low self-esteem, Being excluded or feel excluded By others	Friendly, has friends, feels liked, feels included, feel happy	Happy to Be By self, want alone/quiet time, completing a solitary activity, feels good, has friends
Behavioural Actions	At school escape to the library, solitary activities – not By choice, eat/sit By self, look at other kids and wish you were with them, Bite fingernails	Interact with others By choice – chatting, playing sport, exercising, dancing, going to movies	Having fun By self. Solitary activities such as: listening to music, reading, playing on device
Sound cues	Crying, sniffling, quiet, silent	Will talk/chat with others By choice, laughing	Humming or singing to self

Note. *alone By choice was included as a supplementary item as a result of participant responses

Figure B9

Children Demonstrating Target Item 'Lonely and Alone'

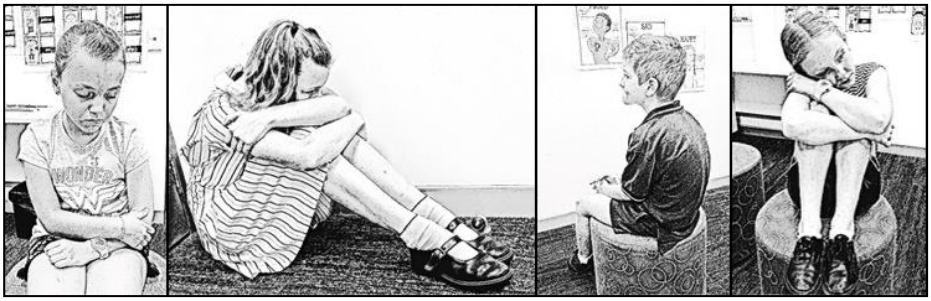


Table B10

Common Response Typology for Children Aged 5–11 Years Regarding 'Bullied or Excluded', 'Perpetrator', and 'Not Bullied and Included' Items (N = 20)

Category	Target Item	Contrasting Items	
	Bullied or excluded	**Perpetrator (a Bully)***	**Not Bullied and included**
Visual cues			
Eyes	Downcast, looking away, teary	Glaring, narrowed, direct gaze	Open eyes, eye contact
Forehead	Wrinkled/furrowed	Furrowed	Natural position
Brows	Drawn down and together	Drawn down and inwards	Natural position
Mouth	Frowning, tight line, pouting	Showing teeth, pursed, tight line, lip raised in a sneer	Smiling
Nose	Natural position or scrunched	Scrunched up nose	Natural position
Face	Red splotchy, chin dimpled, tears on face	Mean face, laughing face	Open, smiling, responsive to others
Body	Head Bent down, shoulders slumped or raised [per fearful item], loose, drooping posture, hands clasped together and hugging self	Leaning over others, head lowered, tight/stiff posture weight is forward, turn Back on others	Head up, chest puffed out, shoulders Back, open posture, hands on hips
Narrative Context (when or why)	Feel sad, mad, lonely, worried, miserable, embarrassed, upset; others are mean, rude, Bossy, hurt, threaten, lie. Being left out or excluded. Feel unwanted and don't have friends	Anger, amuse self, to dominate, retaliate, intimidate, scare others with words and actions, sense of entitlement, to get what they want	Feel wanted, proud, happy, cool, popular, included. Have friends. Others are 'nice' and friendly
Behavioural Actions	Get away - run/walk/turn away	Hurt others physically, exclude, threaten, spread lies	High-fives, play with others
Sound cues	Crying, sniffling, sighing	Shout at others, laugh meanly, tease/call others' names	Laughing, whistling, talking nicely

Note. *' Perpetrator (a Bully)' item was included as a supplementary item as a result of participant responses

Figure B10

Children Demonstrating Target Item 'Feels Bullied' at left and 'Being a Bully' at right

Table B11

Common Response Typology for Children Aged 5–11 Years Regarding 'Fearful' and 'Brave' items (N = 20)

Category	Target Item Fearful	Contrasting Item Brave
Visual cues		
Eyes	Wide open/closed tight, darting around	Looking up, full eye contact, determined gaze – slightly narrowed eyes
Forehead	Raised or drawn down	Neutral position
Brows	Raised or drawn down/together	Neutral position
Mouth	Wide open with jaw lowered in 'O' shape, stretched wide with clenched teeth showing	Closed, small smile
Nose	Scrunched up if eyes are closed	Neutral position
Face	Lengthened, open and extended followed By scrunched up tight	Chin up
Body	Hands to cheeks/covering mouth, thrown up in front, Body hunched over, looking over shoulder, goosebumps, Both shoulders drawn up to ears and head/chin pulled down into neck	Puff chest out, standing straight and tall, hands on hips, superhero stance, strong open posture, head raised, crossed arms
Narrative Context (when or why)	Fearful 'things': monsters, the dark, dogs, spiders, rats, heights, storms, Blood etc. Fearful situations: doing exams, Being alone, meeting new people, giving a speech, going to the dentist etc.	Protecting others, acts of confidence/Bravery
Behavioural Actions	Hide/cover face, keep lights on, shake/shiver, Bite fingernails, jump/startle in fright, cuddle teddy/Blanket for comfort, run away, looking around quickly, shaking, trembling, suck your thumb, knees wobbling, go stiff/you freeze	Turn off the light (in the dark), show your strength, act fierce, stand up to others, shoo away e.g., spiders
Sound cues	Audible fast/heavy/deep Breathing, teeth chattering, gasp, scream, cry, shout, moan	Whistling, yawning, slow Breathing

Figure B11

Children Demonstrating Target Item 'Fearful'

Table B12

Common Response Typology for Children Aged 5–11 Years Regarding 'Inattentive' and 'Focused' Items (N = 20)

Category	Target Item Inattentive	Contrasting Item Focused
Visual cues		
Eyes	Looking off into distance/up and around, dreamy, half-asleep, staring into space	Wide open, looking forward, following (point of focus)
Forehead	Natural position	Natural position
Brows	Natural position	Natural position
Mouth	Open or closed	No smile, neutral/natural position
Nose	Natural position	Natural position
Face	Bored, sleepy	Neutral/serious face
Body	Head Back, relaxed: leaning Back/forward, arms in relaxed postures: loose in lap, head resting on one or Both hands	Sitting up straight, Back/head straight, folded arms, hands in lap, stiff posture
Narrative Context (when or why)	Boredom, others are distracting, something else is more interesting, want to Be doing something else	Showing interest, responsibility,
Behavioural Actions	Looking around, facing away from others, wiggling/fidgeting, daydreaming, twiddling thumbs, yawning	Facing forward, looking, and listening, paying attention
Sound cues	Talking to others, whistling/ humming to self	Silence

Figure B12

Children Demonstrating Target Item 'Inattentive'

Table B13

Common Response Typology for Children Aged 5–11 Years Regarding 'Physically Aggressive' and 'Kind or Peaceful' Items (N = 20)

Category	Target Item Physically Aggressive	Contrasting Item Kind or Peaceful
Visual cues		
Eyes	Glaring, wild, narrowed, direct gaze	Eye contact
Forehead	Furrowed	Neutral
Brows	Drawn down and inwards,	Neutral
Mouth	Showing teeth, pursed, tight line, sneer	Smiling
Nose	Scrunched up nose	Neutral or scrunched up
Face	Scrunched,	Look concerned
Body	Arms stiff or raised up with hands raised in fists/clenched, leaning over others, head lowered, tight/stiff posture, weight is forward	Keeping hands to self: in lap, Behind Back, resting By side, open posture
Narrative Context (when or why)	When others are mean/aggressive, when angry, to dominate others, to retaliate ('get someone Back')	Friendly situations, to Be agreeable, to avoid aggression, to Be kind/helpful/nice to others
Behavioural Actions	Being rough/hurting others: punching, pushing, poking, kicking, smacking, tripping, Breaking 'things'	Assisting them, taking turns, sharing, waiting your turn
Sound cues	Shouting, rude words, growl/grrr, laugh meanly	Talking nicely

Figure B13

Children Demonstrating Target Item 'Physically Aggressive'

Table B14

Common Response Typology for Children Aged 5–11 Years Regarding 'Physical Symptoms – Feel Sickly Item (N = 20)

Category	Target Item Physical Symptoms – feel sickly
Visual cues	
Eyes	Wrinkled up, tightly closed, tired, red, droopy
Forehead	Furrowed
Brows	Drawn down
Mouth	Frowning, grimace
Nose	Wrinkled/scrunched
Face	Green/pale/red, cheeks puffed out
Body	Hunched/Bending over, hanging head, hands on hurting part of Body
Narrative Context (when or why)	Illness/pain, nervous excitement, dizziness, don't want to do something/go somewhere
Behavioural Actions	Avoid school, holding stomach/head/face, rub/close eyes, rest – lay down, sleep, vomit, Biting lip, pick at fingernails
Sound cues	Groaning, sniffling, moaning, crying, vomiting sounds, whinging, audible Breathing

Note. *' No Physical Symptoms – feels well' item was not included as participant responses were very diverse

Figure B14

Children Demonstrating Target Item 'Physical Symptoms - Feel Sickly'

APPENDIX C

Focus group questions and resulting data stratified by age-group levels.

Q1. Lexical Labelling Interview Question: Provide a Definition or Equivalent Substitute Word for the Item Label

Table C1

Children's Responses to Lexical Labelling Question as a Function of Age-Group Level per Construct

Item Pair number	Target Construct / Contrasting Construct	5 - 6 years	7 - 9 years	10 - 11 years
1	Sad	not happy	not happy, unhappy, mopey, upset	depressed, miserable, unhappy, down, heartbroken, disappointed.
	Happy	not sad	not sad	joyful, overjoyed, glad, cheerful, thrilled
2	Worried - Anxious	unable to answer but could recognise physical demonstrations of 'worry' as worry	upset, got troubles, scared, stress, got Butterflies	stressed, concerned, upset, scared, Bothered, on edge, knots/ Butterflies in stomach
	Not worried	unable to answer	have no problem	chilled out, have no problems
3	Sleeps poorly	when you have a Bad dream, when you hear scary noises, when you're not tired	when you have a Bad sleep, have nightmares, when you stay up too late	when you don't sleep well, can't sleep, when you can't go to sleep or can't stay asleep
	Sleeps well	when you have good dreams when you're tired and sleepy	when you have a good sleep, no nightmares, have a comfy Bed, wake up happy, have happy/ good dreams	when you can sleep properly, no/ good dreams
4	Angry	mad, very cross	not pleased, not happy, mad, furious	annoyed, irritated, mad, furious
	Not angry	you 'go' it's okay, just not Being angry	don't mind, not mad, not Bothered by stuff, don't get angry, able to ignore 'it', like whatever, calm'	fine, don't care, ok, when you're "chill/chilled out", relaxed, not mad; calm

5	General noncompliance: Disobedient (School context)	unable to answer but could understand the word naughty => Bad	naughty, Bad, misbehaving, doing the wrong thing, not doing what you're told	misbehaving, mucking up/around, Being Bad, not doing the right thing
	Compliance: Obedient (School context)	when you are good (as opposed to 'Bad'); not naughty to the teacher; have "listening ears"	well Behaved, doing what you're told, doing the right things	well Behaved, doing what you're told, doing the right things, do what the teacher says, being a nerd, Being a goody goody
6	Shy	unable to answer but able to provide physical demonstration	not confident, quiet, embarrassed,	not confident, get embarrassed, insecure, nervous, 'got' shame
	Outgoing - Confident	chatty; standing up straight	really happy and you chat with everybody at play time; friendly; game to try new things	friendly, talkative, try/do anything, show-off, comfortable in who you are; popular; secure/self-assured
7	Argumentative	unable to answer (prompt - demonstrate an argument) --> fighting, being shouty, when you say "no, no, no!"	a fight with words, talk Back, don't agree, think you're right, don't listen to others, arguing	disagreeing, talk Back, arguing, fighting, debating
	Not Argumentative	unable to answer -> (prompt demonstrate people smiling, nodding, and talking nicely) Being nice, say please and thankyou	agree, don't argue, let others have their own opinion;	agree, don't talk Back, having a conversation without disagreeing; don't care enough to argue
8	Hyperactive Behaviour	silly, very Busy	over-excited, so excited you can't control yourself	over-excited, hyper, crazy, silly, wild, can't sit still
	Sensible - Calm	relaxed, peaceful	still, cool, not excited, acting mature, chilled out, sensible	normal, Being chill, relaxing, sensible
9	Lonely - Alone	have no friends, by yourself*, don't play with other people, sad	no-one talks to you, someone with no friends, all alone	loner, loser, have no friends, don't want to Be by yourself, alone
	Sociable - Alone by choice	friendly, chat with anyone, play with anyone, happy	friendly, chatty, happy by yourself and just not want to do anything sic with other people	easy-going, popular, chilling by yourself, want alone-time, sociable
10	Bullied - excluded by other Children	getting picked on, other kids are Being mean	teased, picked on, left out	teased, picked on, not included, left out, don't have friends

	Not Bullied - included by other children	have friends who are nice	not picked on, not teased, not left out	popular, part of the group, have friends, not excluded/included
11	Fearful - Scared	scary, afraid	afraid, you are scared of something	afraid, have fear
	Not Scared - Brave	superhero, not scared	not scared of anything, confident	not scared, confident, courageous
12	General noncompliance - Disobedient at home	don't know (prompt when you don't do what your mum or dad says) - then --> Being a naughty Boy/girl	naughty, Bad, misbehaving, doing the wrong thing	Bad, misbehaving, naughty, mucking up
	General compliance - Obedient at home	(once understood disobedient then understood the opposite) --> Being good, on Best Behaviour, not naughty	Being good, well Behaved, doing what you're told, doing the right things	doing what you're told/expected to do by your parents, Behaving
13	Distracted - Inattentive	don't know, (prompt not paying attention) - then -> not having listening ears	not concentrating, daydreaming	not paying attention, not concentrating
	Focused - Pays attention	don't know (prompt when you are paying attention) - then --> having listening ears, doing your work	concentrating	concentrating
14	Physically Aggressive	hit or kick or punch, fighter	punch, or kick or pushed, poking	rough, punch, kick, hit, mean, fighting physically
	Kind - Peaceful	not fighting, nice	Nice to others, gentle	nice, won't fight
15	Physical symptoms Feel sickly	headache, vomit, feel Bad, feel funny in your tummy	Bleurgh! (With associated demonstration of vomiting and dramatic fainting), not well, have a virus or cold	unhealthy, unwell, have an illness or disease
	No physical symptoms Feels Well	not sick, feel good	just feeling well, not sick, healthy	healthy, when you're not sick, not unwell

Note. Data code: An accurate synonym or verbal description for the item label. Data source: verbal transcripts, field notes.

Q2. Visual Cues Interview Question: Describe Verbally What Happens to Your Body When You Experience Each of the Target Emotions and Behaviours and/or Demonstrate Physically What These Emotions and Behaviours Look Like by Means of Facial Expressions, Body Postures and Movements

Table C2

Children's Responses to Visual Cues Question as a Function of Age-Group Level per Construct

Item Pair number	Target Construct / Contrasting Construct	5 - 6 years	7 - 9 years	10 - 11 years
1	Sad	frown, see tears, downcast eyes, head lowered slightly or resting on chest, shoulders slumped, lower lip protruding	frown, pout, downcast eyes, head lowered/looking off to the side, crossed arms, slumped over, hugging knees	downcast teary eyes, avoid or no eye contact, Blinking, wrinkled, furrowed Brow, eyebrows drawn down and in, mouth - frowning, pouting, in a tight line, Bottom lip protruding, Biting lip, runny nose, head lowered slightly or resting on chest, shoulders rounded
	Happy	Broad smiles, open, relaxed postures, Bright, twinkly eyes and rosy cheeks	Big smiles, hands on hips, chest puffed out, looking up, shoulders Back	open relaxed postures, Broad smiles, head slightly raised
2	Worried - Anxious	Face gets red splotches, fold your arms and look down, Bend your head down, eyes downcast, Bullies turn their Back on you (exclusion)	Blinking, dark shadows underneath, drooping/half closed, scrunched up faces, hands to eyes/rubbing eyes, eyebrows drawn down and in	feel sick, frown,
	Not worried	smiling	Very relaxed posture, normal open eyes, relaxed mouth, smiling	Neutral face, smiling, open eyes

3	Sleeps poorly	Blinking, dark shadows underneath, drooping Body, half closed eyes, hanging head, rubbing eyes, eyebrows drawn down and in	Blinking, dark shadows underneath, drooping/half closed, scrunched up faces, hands to eyes/rubbing eyes, eyebrows drawn down and in	screwed up/ scrunched up face, dark shadows under eyes, red eyes, wrinkled forehead, furrowed forehead, twisted up in sheets/Blankets, half-closed or slow Blinking, eyebrows drawn down and in
	Sleeps well	smiling with eyes closed,, snuggled up in Bed, hands raised to chin, laying still, neutral expression	laying still, closed eyes, neutral expression	no expression, comfortably sleeping, laying still, neutral face, closed eyes
4	Angry	make fists, showing teeth, shout, point fingers, scrunched up nose, scrunch your nose up, glare your eyes, point finger at someone, lips curled up, fists at sides, leaning forward	Squinty eyes, glaring, clench your fists, tense muscles, face scrunches up, stiff with hands clutched By your side, standing straight, stamping your feet, Big strong stance, nose scrunched up, eyes a Bit closed like you're in Bright sun and glaring, hands on hips, angled forward	Red face***, make fists**, lash out, squint your eyes, frown, wrinkled forehead, arms crossed, eyebrows go down/mad V shape, arms crossed
	Not angry	smiling	Very relaxed, normal open eyes, relaxed mouth	Neutral face, shrug shoulders, hands in pockets, put your hands up in "I give up" pose
5	General noncompliance: Disobedient (School context)	poking tongue, roll eyes, scrunch up your nose, kicking, hitting, Biting	cheeky face (smirk, looking away, tongue out), swinging on your chair	one eyebrow raised and smirking, rolling eyes, looking away, Back turned
	Compliance: Obedient (School context)	Looking at teacher and smiling, sitting cross-legged with straight posture and hands in lap	Little smile, eyes looking at the teacher, not silly, sitting up straight in class,	Look like an angel, smile, sit up straight, facing forward
6	Shy	Look away, look down, hide, stare, hand/arm over face	Won't look people in the eye - no eye contact, you look down a lot, look away, protect yourself By making yourself smaller, look at the ground	Be silent, mumble and look away if someone talks to you, avoid eye contact, put your head down

	Outgoing - Confident	Standing confident, smiling* and happy*	Holding hands, chatty, happy and smiling	Very happy, smiling, talking to anyone
7	Argumentative	Angry faces, mean face, roll eyes	Arms crossed, straight eyes, firm mouth, shouting mouth, standing up facing the other person, leaning towards them, roll eyes	Hands on hips leaning towards the person you're arguing with, eyes glaring, hands on hips, leaning over someone, rolling their eyes at people to annoy them
	Not Argumentative	Smiling and nodding	Smiling, nodding your head	Take turns in a discussion, friendly smile, twinkly eyes, Big smile
8	Hyperactive Behaviour	Wiggling, fidgeting, crazy smile, laughing silly, sticking your tongue out silly, jumping up and down, spinning around, shaking hands and head	Turning in circles, show excitement, Be jiggly, run around, fidgeting, not concentrating, running in circles	Can't sit still, really fidgety, overexcited, wiggling, everything's moving - legs, arms, head
	Sensible - Calm	Leaning Back and sitting with legs crossed, arms wrapped around self, yawn	Relaxed Body, look a Bit sleepy, laying Back	Relaxed face, small smile or no smile, sit still, leaning Back, arms Behind hand
9	Lonely - Alone	Head tilted off to the side, eyes down, crossed arms, slump shoulders, pouting, Bottom lip out, Big frowns, drooping head, slumping over	Your head is down a lot, holding yourself with your arms crossed, look sad	Looking down, a teary eye, pout/frown, Bite your lip, looking around a Bit like you're looking for a friend, sitting in a corner, slumped shoulders, head down
	Sociable - Alone by choice	Smiling with your friends, have fun, play	Have a relaxed face, not super happy But not sad either, little smile, just chilling out	Just a happy face, smiling, relaxed face
10	Bullied - excluded by other Children	Face gets red splotches, fold your arms and look down, Bend your head down, eyes downcast, Bullies turn their Back on you (exclusion)	Look down, fold your arms, hunch your shoulders, teary eyes, eyebrows drawn together, shoulders hunched over, Bully has a mean face or laughing face, you might look scared and Be looking down, frowning, eyebrows go down, cross your arms and hug yourself	Frown, sad eyes, looking down, keeping to yourself, tears in your eyes/on face, eyebrows would go down, might look mad or sad

	Not Bullied - included by other children	smile, open eyes	Big smiles, hands on hips, chest puffed out, looking up, shoulders Back	Happy looking and surrounded By friends
11	Fearful - Scared	Shaking, eyes Big, teeth chatter, wide open eyes, looking around quickly, make yourself smaller - curl in a Ball, hide face, cover eyes with hands	Shoulders hunched up, scrunch up your face so you can't see the scary thing, suck your thumb, Big wide-open eyes -> can't stop looking or squinting eyes/eyes closed tightly trying not to look, shaking, cover eyes/whole face with hands, showing teeth - grimace, chin raised	Shaking, knees wobbling, looking around quickly, eyes darting around, hunched a Bit, looking over your shoulder, goosebumps, wide eyes or really scrunched eyes, shaking or trembling
	Not Scared - Brave	Glaring eyes, tight mouth, puff your chest out, look up Bravely, chin up, stand up straight and tall, hands on hips, stand like a superhero	Hands on hips, standing tall, looking up and facing the scary thing, stand up straight, you might look angry or calm or determined, straight posture, mouth in straight line - not smiling	Chest puffed out, smiling, chin up like a superhero
12	General noncompliance - Disobedient at home	poking tongue out at mum	Poke your tongue at mum	Roll eyes at parents, cross your arms, put your head down, look away
	General compliance - Obedient at home	look at mum and smile	Smile and nod at mum	look normal
13	Distracted - Inattentive	Looking off into the distance, eyes looking up	Head Back and looking at the sky, mouth open, falling asleep, Body relaxed, leaning Back, leaning on your hand with your chin, Bored face, twiddling thumbs	looking up and around instead of paying attention, dreamy half-asleep eyes, staring into space
	Focused - Pays attention	Sitting up straight, folded arms, looking straight ahead, serious face, hands in your lap	Eyes wide open, Sitting up straight, folded arms, looking straight ahead, Back straight	sitting up straight with a straight Back, looking straight ahead, eyes forward, no smile
14	Physically Aggressive	Show your teeth with a mad face, look angry and laugh like ha to be mean, screw up your nose	Look really angry, glare with your eyes, show your teeth, arms up like a Boxer	Punching, kicking, Breaking stuff, wild eyes, fists, leaning over people

	Kind - Peaceful	Smiling, keeping hands to self - in lap/Behind Back/resting By side	Hands out like they're saying calm down, little smile, look concerned	Not react angrily to anything, act calmly to aggressive Behaviour
15	Physical symptoms Feel sickly	hands on your tummy, green face**, hold your head when you're dizzy, touch your head, rub your face, frown, pale face	Screw up your eyes, wrinkle your nose, grab your head, hold your stomach Bending over, red eyes, tired eyes, frown mouth	Bite your lip, picking at your fingernails, sad face - frowning, wrinkling up the eyes and forehead, pale face, red face, green face
	No physical symptoms Feels Well	Rosy cheeks, smiling, tanned	Bright eyes, rosy cheeks, smiling	happy, twinkly eyes, look normal

Note. Data code: What can Be seen by an observer: something that can Be seen when a still photo is taken. Data source: verbal transcripts. *Item stated by every child in a group

Q3. Narrative Context Interview Question: Causation/Triggers. Describe Verbally Why and When Children Might Feel or Behave Like ' Item' to Explore Perceived Causes for the Target Emotions or Behaviours to Further Define the Constructs and Apply a Contextual Story

Table C3

Children's Responses to Narrative Context Question as a Function of Age-Group Level per Construct

Item Pair number	Target Construct / Contrasting Construct	5 - 6 years	7 - 9 years	10 - 11 years
1	Sad	When no one wants to play with me, even my sister, When Mummy was dropping me off at kindy, When you hurt yourself (my Brother tripped over and hurt his hand and foot and he was sad), When my friend didn't get to kick the Ball	When no-one wants to play with me, When you're left out of games at school, When you get Bullied, when you lose a game, When I had to move to a new school and leave my friends	When I was getting Bullied, When your pet dies, When you're not allowed to do what you want, When you can't have a sleepover, when you Break/lose something, when you get your phone confiscated, getting an A on a test
	Happy	when you get presents/lollies, having fun with friends, playing	At Birthday parties, when you're playing, when you get presents, having fun	when things are good, when you're having fun, at a party, getting presents, when nothing is wrong
2	Worried - Anxious	mum is late (to collect child), when you have to do something that you don't want to do, something scary - spiders /dogs /dark /storms /Blood	someone is doing something to you that you don't want to happen, when you have to do, something that you don't want to do: meeting new people, giving a talk at school, doing a test, scared of spider/dogs/dark/storms/Blood	someone is doing something to you that you don't want to happen, when you have to do, something that you don't want to do: meeting new people, giving a speech, doing a test, anything you're scared of - flying, heights, giving speeches, exams
	Not worried	when you feel good, when you are dancing, playing /doing fun activities, when you don't have any worries	when you've got no problems, when you're just at home relaxing and chilling out with friends, reading	when you don't have any worries, at home relaxing/chilling, hanging with friends, chatting to friends

3	Sleeps poorly	When you wake up from a Bad dream of monsters and wolves, when there a scary noises, when you want your mum, when you can't sleep, you have a Bad sleep when it's really hot	When you have Bad dreams/nightmares, if you fall out of Bed, if you're at a sleepover and the place is unfamiliar, can't sleep or wake up a lot, if it's a hot night and you're sweaty or you're cold and can't find your Blanket	if you have a nightmare, when you can't sleep and you're really overtired and grumpy, when you just can't get comfortable or can't get to sleep, might Be hot or cold, if you're too stressed to sleep
	Sleeps well	when you have happy dreams of tea parties, after a fun day, have good dreams, when you get lots of sleep and don't wake up in the morning (sleep in), when you're happy in the morning	if you have a late night the day Before then you'll sleep well, after a sleep-in, when you wake up happy, when you go to Bed early,	after a sleep in and you don't have to wake up early, when you feel rested when you wake up, when you've had a Busy day and are really tired,
4	Angry	when someone's doing something you don't want them to do, feel really cross, when someone hurts you or is Bossy, when someone takes your stuff, when someone makes fun of you, when you're not allowed to do stuff you want to, Because you've got too much emotions	When people are mean to you, if someone gets physical with you, if you don't get what you want, if you have to do something you don't want to do, when someone makes fun of you	You're annoyed at something happening, Broke/lost something
	Not angry	When you don't mind, nah I don't care	You don't want to fight, you don't care about some stuff, doesn't get upset	Don't care, you're so chilled out, if you get called names - so what, when 'stuff' doesn't Bother you

5	General noncompliance: Disobedient (School context)	Be naughty, Kicking, punching, throwing 'things' Because you are angry, getting/Being messy	You don't care about getting in trouble	Feel frustrated and impatient so you call out in class, Boredom, don't like the work
	Compliance: Obedient (School context)	Get a Big star on your work, you want to Be good	You care about getting in trouble, you want to Be good, you do what you're told	You want to do the right thing
6	Shy	You don't like 'it' [i.e., situation], you don't want to talk, not confident, you don't know people, scared to Be with other people, you're not confident	When you don't know someone or are meeting new people, every time you talk to someone new, nervous, not confident, scared of others	You want to avoid people, you feel uncomfortable, feel nervous, lack confidence
	Outgoing - Confident	You like doing stuff, you're really happy and chatty* with everyone, do stuff with people all the time	Hanging out with friends and people you know already, means you're comfortable where you are, chat with everyone at playtime	You have confidence, hey how ya doin?, fine with everything, good mood
7	Argumentative	Say no, you don't like what the other person says, fighting with my sister/Brother Because they are annoying	You disagree with the other person, you stick to your own point, you want your own way	You don't want to agree with the other person, you think your position is right, having the last word
	Not Argumentative	You're happy, have manners**, say please and thank you	you agree with the other person	like using knives and forks at the dinner table Because you have to show manners, Being friendly, Being helpful
8	Hyperactive Behaviour	Can't sit still, when it's very exciting, have too much energy, when you're feeling very Busy	Being silly and have too much energy, can't contain yourself	too much energy, feel like Being silly, feel like annoying (someone), Boredom, something exciting is happening, you get a Big surprise, get overwhelmed By something good or Bad

	Sensible - Calm	you relax, are quiet, Big deep slow Breaths	When you meditate, just chilling out, sit cross legged and going ommmm, When you're doing what you want, like something relaxing like drawing, just sitting down in front of the TV, playing with your iPad	meditating, when you do whatever you're meant to do
9	Lonely - Alone	You don't have any friends, no one like you, feel sad, can Be scary	No-one plays with you, you're By yourself, no friends, feel sad, no friends, Because you're excluded, feel emotional, low self-esteem, feel emotional	Feel sad, feel awkward and insecure, when I'm left out By my friends and I'm By myself at lunch, it makes me feel upset and I want to cry
	Sociable - Alone by choice	When alone By choice: Feel good, having fun By yourself	When alone By choice: You want to Be By yourself so it's fine, you just want some alone time	When alone By choice: you're happy to chill out By yourself, doing stuff on your own - reading a Book
10	Bullied - excluded by other Children	Feel sad**, When you ask kids to play in the playground, a Bully says no, Bullies say rude things to you, you feel picked on, when people are Bossy to you, get left out, when people won't play with you**, when other kids turn their Back on you (exclude)	Bullies gang up on you, might feel angry at yourself, feel really sad that people are mean to you, feel angry at the Bully, Bullies scare people and tell lies about them, feel threatened, Bullies might make threats (I'll Beat you up), Bullies exclude you, Bullies are in gangs and they try to hurt us, feel sad, angry, and upset	when you're sad, lonely, worried, miserable, embarrassed, upset, no-one talks to you, no friends, Bullies pull your hair, push you, make fun of your glasses, clothes, weight, are excluded By others
	Not Bullied - included by other children	Feel really happy when other kids want to play with you, you have lots of friends, you're popular	Have lots of friends, feel proud and happy, you'd feel cool Because you've got lots of friends	You're not alone, when you've got lots of friends to hang out with
11	Fearful - Scared	Because you're scared**, monsters, Being in the dark, Big dogs, doing homework	Scared of things like spiders, the dark, dogs, nightmares, seeing something 'scary'	Scared of something - like the dark, dogs, spiders, rats

	Not Scared - Brave	Because you're Brave, you'll go up to anyone, feeling confident, you can turn off the light at night-time, you can fight off the Bad guys	to protect someone else, when you're not scared of something, feeling in control, someone walking around in the dark and they're just fine	when you're confident about yourself, when you're not worried about stuff, when you're not scared anymore/ have overcome a fear
12	General noncompliance - Disobedient at home	You're naughty, when you're mum gets angry with you, Being rude to mum and dad, jumping on the good couches: jumping on the Bed, jumping off the table, slamming the door, hitting my sister	Disobeying your parents, not doing what you're told to do, Brothers wrestling you	your parents annoy you, you don't want to do stuff, so you don't, you don't do what is expected of you
	General compliance - Obedient at home	when you're on your Best Behaviour, when you do what you're told	Eating your veggies, going to Bed when you're told, agreeing with your mum and dad, Being helpful	when you do what your parents ask you to do
13	Distracted - Inattentive	When you're talking to your friends instead of listening to the teacher, not listening	Feel Bored Because something else is more interesting, want something else/Better to do, listening to speeches on assembly	when your mind wanders, when others are distracting you, you're really Bored, you prefer to Be somewhere else
	Focused - Pays attention	You like what you're doing, you want to see, you want to listen	You're listening carefully, you're interested,	when you're interested in what you're doing, when you have work to do
14	Physically Aggressive	They want their toy Back and take it rough, they (kids) are mean, when (kids) punches you or kicks you or pushes you	You're angry, someone's made you mad and you get physical instead of telling an adult	You think you can do what you want, to get your own way, Because you're Bigger than another kid, feel really angry, don't care about others or rules
	Kind - Peaceful	Sharing their toys	You don't fight back, you wait your turn	when you're nice to people, take turns, are kind to other kids
15	Physical symptoms Feel sickly	Have a sore tummy**, when your head is hurting, get dizzy, headaches, if you don't want to go somewhere, if you've got to do homework and you don't want to do it, sore head, feel yucky, dizzy	Have a headache, have a stomach-ache, might Be from nerves, nervous excitement - when you feel sick Before a race when you doubt yourself	you're sick: have an illness, virus, headaches, stomach-aches, vomiting, diarrhoea, giving speeches

No physical symptoms Feels Well	Feel happy, Not sick	when you're not sick, don't have any problems	feel well, feel normal, having a good day

Note. Data code: Causation and triggers: a verbal rationalisation for a feeling or behaviour. Data source: audio transcripts

Q4. Predicted Behaviours Interview Question: Predictable actions – Display physically and/or describe verbally the expected/typical active Behaviours that children display when they feel a particular way to understand predicted action outcomes (e.g., when they feel sad, they might cry and turn away to cover their face).

Table C4

Children's Responses to Predicted Behaviours Question as a Function of Age-Group Level per Construct

Item Pair number	Target Construct / Contrasting Construct	5 - 6 years	7 - 9 years	10 - 11 years
1	Sad	cry, rub your eyes, cover your face (head down on arms)	cry, rub eyes, cover face, curl up in a Ball, go to your mum or dad, go to your Bedroom	cry, want to Be alone or to Be with friends, rub your eyes, hug yourself (arms around own Body), curl up in a Ball, go to Bed
	Happy	playing, smiling, laughing	playing, smiling, laughing, doing fun stuff	playing, listening to music, doing activities, relaxing, smiling, laughing
2	Worried - Anxious	fidgeting, Biting/picking at fingernails, shaking legs, run away, go completely stiff, look around	fidgeting, Biting/picking at fingernails, shaking legs, Butterflies in stomach, sweaty, run away or freeze, look around	fidgeting, Biting/picking at fingernails, shaking legs, Butterflies in stomach, sweaty, look around
	Not worried	neutral or smiling relaxed faces and Body postures, sat cross legged with eyes closed as if meditating	neutral or smiling relaxed faces and Body postures, lay Back with arms resting Behind head, leaning comfortably Back in a chair	neutral or smiling relaxed faces and body postures, sat cross legged with eyes closed as if meditating, leaning comfortably back in a chair or resting chin on one hand

3	Sleeps poorly	"wiggling" around (moving a lot), tossing and turning, kick legs around, rub your eyes, yawning, stretching	lots of movement - tossing and turning, get tangled up in sheets, scrunching up face, half-closed eyes Blinking, stretching with yawning	movement - get all twisted in sheets/Blankets, tossing and turning, pulling faces with closed eyes, rubbing eyes, yawning, open mouth - exaggerated smacking of lips, full Body stretching
	Sleeps well	sleep on your tummy, curled up (comfortable sleeping position), stay still/no moving	sleep in a comfortable sleeping position, stay still/ no moving	asleep in a comfortable sleeping position, no moving around/ no movement
4	Angry	Shout and kick, stamp your feet, cross your arms very hard, throw stuff, cry on your Bed	Cross your arms, stamp your feet, you might yell	Stamping feet, you might Break something, slam doors, stand over people
	Not angry	Shrug your shoulders, ignore people who make you mad, say whatever	Shrug your shoulders like you don't mind, walk away, put your hands up (show you won't fight), you would say please stop, you're polite	Shrugging shoulders
5	General noncompliance: Disobedient (School context)	Hitting someone sitting next to you, go to the naughty corner, kick sand on people in the sandpit, shout out in class	Shouting out at school, swearing, saying the F word, call out in class, distract others, pushing and shoving in line-ups, throw your food wrappers on the ground	Call out in class, throwing rubbish on the ground and not cleaning up, not obeying rules, not caring about rules, not doing what you're told, shaking head in annoyance
	Compliance: Obedient (School context)	You shake hands with the principal when you get an award, don't speak when the teachers speaking, listen and pay attention, Be quiet	Put your hand up in class, listen to the teacher, quietly doing work	Line up in a straight line quietly, put your hand up in class, don't talk when the teachers talking
6	Shy	Don't look at people or talk to people, hide away from people, don't talk to people, hide Behind your mum, stare at others But don't talk, duck head, put arms over face, not join in	wouldn't talk very much, hide Behind someone, might hide Behind a Book, hide Behind your mum, curl up in a Ball, don't play, look down, no eye contact	Look at your phone, hands Behind Back, feet turned in, Blushing, hide Behind parent, turn away or cover my face to hide and avoid eye contact

	Outgoing - Confident	Stand up for themselves, go and join in, play with anyone at playtime	Waves and smiles, talks to any people, make eye contact, Be friendly to other people - talk, smile, wave	High five people, friendly to people, engage with other people, nod to people
7	Argumentative	you shout at people, go to the naughty step, go to your Bedroom for time out, shake your fist at someone	Shaking or pointing your finger at someone, you shout and use a firm voice	Both talk at the same time and talk over each other, point in people's faces
	Not Argumentative	Shake people's hands, nod your head to say yes	shaking hands, nodding your head at someone, use manners, no shouting, don't ignore people	Shake hands with people, nod your head to say hello, waving
8	Hyperactive Behaviour	Jump up and down, run in circles, wave your arms around, Be very Busy, wiggle, spinning around, shaking your hands	Swing on your chair and fidgeting, you're not careful when you're hyperactive, might knock things down Because you're not aware of your surroundings	Running circles, spinning on a chair really fast, might Be a little Bit jittery, can't think. When I have too much energy I run around, or maybe Bored and I just want to do something else
	Sensible - Calm	Sit Back and close your eyes, take some Big deep Breaths - chest moving in and out, Blowing Breath out	Listen to music, Be still, you are in control when you're calm and can contain yourself	Read a Book, meditate
9	Lonely - Alone	Sit By yourself, eating lunch By yourself	Look at other kids cause you'd rather Be with them	play on your phone, read a Book, go to the library at school, want to cry
	Sociable - Alone by choice	When alone By choice: Eating lunch without your friends, But its ok, play By yourself on your iPad, doing colouring in	When alone By choice: Wave kids off when they call you over, playing video games	When alone By choice: Doing whatever you want, want to relax, having alone-time/ quiet time, listening to music, playing on your phone
10	Bullied - excluded by other Children	I would say stop it, I would tell a teacher, you go away and find someone else to play with, walk away from the Bully	You try and protect yourself, turn away from the Bully, make yourself smaller, cry, get pushed, I'd maybe want to fight Back, Be in tears, Be trying not to cry	Run away, fight Back, get away from them, ignore them
	Not Bullied - included by other children	Skipping with your friends, eat lunch with friends, play	You get included, people play with you, people are nice to you and friendly	Laugh, hang out with your friends

11	Fearful - Scared	Hide your face, turn the lights on, shake a Bit, curl up on the floor, cover your face, Bite your fingernails	You startle when you get scared, you jump in fright, you might cuddle a teddy or Blankie, run away, hide your face, looking around quickly	Shivering, run away and make tracks
	Not Scared - Brave	Turn off the light even when its dark	act fierce - strong stance and glaring at someone	Show some muscles, stand up to anything or anyone
12	General noncompliance - Disobedient at home	Kick stuff, when your mum gets angry at you, punching, hitting or kicking	Throwing stuff around your room, messing up stuff, ignore your mum, sitting on the table	Talking Back to your parents, kick a hole in the wall, jumping on the couch, ignore your parents, slam your Bedroom door
	General compliance - Obedient at home	Sitting down reading a Book and your mum smiles at you, say sorry, listen and pay attention	Tidying up stuff, cleaning up your room	Do what you're told, don't muck up
13	Distracted - Inattentive	Face the wrong way in class, kicking your legs when you're Bored, move about a lot, wiggling, looking around the room, looking out the window, talk to other kids	Daydreaming, looking around instead of listening to someone who's talking to you	muck up in class, don't pay attention and look around or at your phone
	Focused - Pays attention	Look and listen, have your listening ears turned on	Behave, do your work	face forward, pay attention
14	Physically Aggressive	Punching*, pushing*, smack your sister*, poking, kick, poke someone, hit or punch	Push people over, trip people, punch someone, Be rough, you hurt people	Strangle someone, have a punch up, fight with someone
	Kind - Peaceful	Be kind to people and helpful, Be nice to people	Back away from a fight, let people do what they want	Try and stop someone Being aggressive, Be kind, take turns
15	Physical symptoms Feel sickly	Don't want to go to school, throw up**, lay down and rest, rub your face, close your eyes, fainting (dramatically), wobbly head, sleeping	Be whingeing, you might throw up	Holding their stomach, rubbing your eyes, hold your stomach or head, throw up

No physical symptoms Feels Well	go to school (normal routine), Be skipping, playing, having fun doing fun things - playground/sport at lunchtime	Act normal, give two thumbs up, giving a high five, play sport and do activities	giving a thumbs up, exercising, running, normal Behaviour

Note. Data code: Predictable actions: any moving action able to Be seen in a video that could Be ambiguous via a still photograph and emphasise intention. Data source: video data/audio transcripts

Q5. Sound and Audio Interview Question: What might Be heard in each situation. Describe verbally and/or demonstrate audibly the sounds that are typically affiliated with certain emotions and Behaviours that will promote recognition according to social contextual cues (e.g., such as crying and sniffling with sadness.

Table C5

Children's Responses to Sound and Audio Question as a Function of Age-Group Level per Construct

Item Pair number	Target Construct / Contrasting Construct	5 - 6 years	7 - 9 years	10 - 11 years
1	Sad	crying sounds	crying; sniffing	crying; sobbing; sniffling; no sound
	Happy	laughing	laughing; giggling; chatting	laughing; saying woohoo; saying oh yeah; talking excitedly; giggling'
2	Worried - Anxious	fast/heavy Breathing; whimpering; crying; sniffling	fast/heavy Breathing; moaning; whimpering; crying; sniffling	fast/heavy Breathing; crying; sniffling; moaning
	Not worried	no sound; music	singing; humming; talking; quiet	talk nicely to people; quiet and making no sounds; singing/humming; whistling
3	Sleeps poorly	audible fast Breathing (having nightmare); moaning/groaning, snoring	heavy sigh; moaning/groaning, snoring	snoring; sighing (in frustration); moaning/groaning; yawn sound; snoring
	Sleeps well	snoring; nothing (no sounds)	snoring; quiet Breathing, no sound	snoring, no sounds, Breathing
4	Angry	crying sounds; aaah - angry yell	Grrr; growl	ughh!!; swear; aargh
	Not angry	say 'oh well''	talk normally	meh

5	General noncompliance: Disobedient (School context)	fart noises; noise when you poke your tongue	say 'ugh, whatever', Being loud - general talking when you shouldn't Be	make silly noises with your mouth; saying rude words; make noise By tapping your hands/fingers on your desk
	Compliance: Obedient (School context)	Being shhh (quiet)	answering questions properly	saying 'ok', 'uh huh', 'yep'
6	Shy	No response	Be very quiet, not talking	(wouldn't say anything)
	Outgoing - Confident	laughing	Be loud and laughing, talking to other people	say "Hi" to people; chatty; talk with anyone; laughing
7	Argumentative	rar rar rar	loud talking	shouting; talking over each other
	Not Argumentative	talk nicely	talk normal	talk nicely to people; use manners
8	Hyperactive Behaviour	Say yayayayaya	Giggling; make silly noises	laughing; saying woohoo; saying oh yeah
	Sensible - Calm	Whistling a happy tune; yawn; slow deep Breathing	Happy sigh, deep slow Breaths	gentle, soft Breathing
9	Lonely - Alone	No response	No response	crying; sniffling
	Sociable - Alone by choice	talking to other kids; say 'la la la la la la'	Be loud and laughing	say "Hi" to people; chatty; talk with anyone; laughing
10	Bullied - excluded by other Children	cry; mean words	Bullies will Be louder than the kid Being Bullied; sniffling	mean kids say haha - like Nelson on the Simpsons
	Not Bullied - included by other children	laughing	whistling;	talk nicely to people; use manners;
11	Fearful - Scared	go 'aaaahhhh'; teeth chattering	Gasp; scream; quick Breathing	crying; screaming; shout; gasping; moaning
	Not Scared - Brave	whistling a happy tune; yawn; slow deep Breathing	No response	No response
12	General noncompliance - Disobedient at home	ptth (sound when you poke your tongue out noisily)	Laughing; saying "nyah nyah"	grunting; huffing; saying "whatever"

	General compliance - Obedient at home	No response	No response	saying 'ok', 'uh huh', 'yep'
13	Distracted - Inattentive	talking to other kids; say 'la la la la la la'	whistling;	humming
	Focused - Pays attention	no sound	no sound	no sound
14	Physically Aggressive	rar rar rar	Grrr; growl	shouting at someone - rude words
	Kind - Peaceful	talk nicely	No response	No response
15	Physical symptoms Feel sickly	Throwing up sounds, groaning; sniffing; 'funny' Breathing; Blehh; aargh; ewww	Urrrgh; puking sounds - Bleurgh	Vomit sound; groaning; moaning; crying
	No physical symptoms Feels Well	laughing	singing	laughing; saying woohoo; saying oh yeah

Note. Data code: Audible noise heard by an observer; expressed audibly by an individual; to emphasise an emotion or behaviour. Data source: video and audio transcripts

General Audio-Visual Field Notes

Table C6

Researcher Focus Group Observations per Item

Item Pair number	Target Construct / Contrasting Construct	General Observations
1	Sad	downcast teary eyes, avoid or no eye contact, looking down or away, Blinking, closed tight, wrinkled, furrowed Brow, eyebrows drawn down and in, mouth - frowning, pouting, in a tight line, Bottom lip protruding/wobbling, Biting lip, sniffling, runny nose, head lowered slightly or resting on chest, shoulders slumped, shoulders shake when you cry, fold Body into a Ball, rocking, covering face with hands
	Happy	eyes wide open and relaxed with a direct gaze, neutral, relaxed or raised forehead, Brows raised with smile or in neutral position, smiling, (‘Big’ smile) showing teeth, mouth open when laughing, open relaxed posture
2	Worried - Anxious	eyes scanning or darting around/looking around quickly, eyes wide open, hardly Blinking, Brow wrinkled, furrowed, eyebrows drawn down and inwards, mouth in a pursed, tight line or frowning, Biting lip Between teeth, sucking thumb, Biting fingernails, fidgeting, shaking legs
	Not worried	open posture, full eye contact at times, smiling, hands on hips, laying Back with hands Behind head, neutral facial expression
3	Sleeps poorly	children lay down But then changed position continually then sat up and rubbed their eyes/faces, yawning and stretching, showed drooping postures and faces with half-closed eyes, moaning sounds as they 'tossed and turned', snoring and yawning sounds, imitations of nightmares expressed By moaning with pulling faces - grimaces, turned down mouth, scrunching up nose
	Sleeps well	Children lay still in a position they normally sleep in (on stomachs/Backs/on side), either silent or exaggerated snoring/whistling sounds

4	Angry	Head generally lowered with eyes narrowed and looking up with a direct gaze or scanning, Brow furrowed, eyebrows drawn down and in, Mouth may Be pursed, in a tight line, or sneer. Nose is scrunched. Posture is tight and stiff, as if ready for movement, leaning forward and slightly closed, arms are folded or in fists raised or at sides. Weight is forward. Breathing is heavier and audible. When shouting mouth is wide open, teeth are visible. Movements tend to be either extreme stillness to sharp and quick - stamping feet, one finger pointing aggressively
	Not angry	Head is upright or tilted Back slightly. Eyes are open and gaze is less direct. Forehead neutral and relaxed and Brows in natural position, Mouth may Be closed in a neutral smile, or resting slightly open. Posture is quite open and loose, leaning/reclining slightly Back. Weight is positioned to the Back, Arms are resting comfortably - on hips, Behind head, at sides. Breathing is inaudible
5	General noncompliance: Disobedient (School context)	sticking tongue out, laughing, smirking, rolling eyes, relaxed postures, showing lots of attitude, sneer - lip raised, pulling face
	Compliance: Obedient (School context)	sitting up straight, hands to self, arms relaxed, hands in lap or By side, head erect, eye contact, neutral face, relaxed Brows
6	Shy	closed in posture, head down, eyes downcast, looking off to the side, arms protective - hugging self/crossed, shoulders hunched over, Biting fingernails, finger in mouth, thumb in mouth, hiding Behind a parent, avoiding eye contact
	Outgoing - Confident	open posture, full eye contact, smiling, hands on hips
7	Argumentative	two people facing each other, leaning towards each other, chins jutting out, eye contact, hands on hips, weight forward, fingers pointed in each other's faces, lips curled, arms crossed, mouth tense, eyes narrowed
	Not Argumentative	smiling, neutral face, shrugging, relaxed posture, shaking another hand
8	Hyperactive Behaviour	wide eyes, minimal eye contact, arms up or out, Big smiles, tongues hanging out, grinning
	Sensible - Calm	smiling, neutral face, relaxed posture, leaning Back, arms Behind head, leaning comfortably forward, 'mediation pose'
9	Lonely - Alone	looking down, eyes downcast, resting head in hands, mouth in frown, lip pouting, face covered, arms resting in lap, shoulders slumped, posture loose
	Sociable - Alone by choice	smiling, pleasant neutral face, open posture, relaxed
10	Bullied - excluded by other Children	downturned mouth, looking down, head down, forehead wrinkled up, eyebrows drawn in, chin dimpled, lip pouting, shoulders slumped, soft posture, mouth in a tight line

	Not Bullied - included by other children	smiling, eye contact, open posture, hands Behind Back, in lap, By sides, hands on hips, head up
11	Fearful - Scared	eyes wide, mouth open, hands to cheeks {fingers spread}, looking around quickly, shoulders pulled up, eyes darting, teeth showing/Bared, arms stretched and tense, mouth open, eyebrows raised, startle reflex, jumping Back, eyes closed tight, hands over face
	Not Scared - Brave	strong, open posture, head up, eye contact, strong poses, crossed arms, chin up
12	General noncompliance - Disobedient at home	rolling eyes, crossed arms, avoiding eye contact, looking off to the side, slouched posture, head Back
	General compliance - Obedient at home	smiling, pleasant neutral face
13	Distracted - Inattentive	no eye contact, head Back, arms in relaxed postures - in lap, leaning Back, resting on hands, mouth closed, neutral face, looking off into the distance, mouth open in a yawn
	Focused - Pays attention	stiff Body posture, sitting up straight, neutral face, sitting cross-legged, serious face, not looking around, fixed gaze
14	Physically Aggressive	Head generally lowered with eyes narrowed and looking up with a direct gaze , Brow furrowed, eyebrows drawn down and in, Mouth may Be pursed, in a tight line, or sneer. Nose is scrunched. Posture is tight and stiff, as if ready for movement, leaning forward and slightly closed, arms are folded or in fists raised Weight is forward.
	Kind - Peaceful	smiling, eye contact, open posture, hands Behind Back, in lap, By sides
15	Physical symptoms Feel sickly	hold onto wherever it hurts - head, stomach, face, frown, grimace, droopy eyes, puffing out cheeks, hunched over, hanging head down, chin to chest
	No physical symptoms Feels Well	smiling, energetic, giving a thumbs up/ two thumbs up

APPENDIX D

Interview Protocol Study 3

(First 4 animations example)

Introduction

Hi thanks for coming in to help us with our research.
Name: _____ Age: _____

Gender: M___ F___ O___ School Year: _____

Because we need to say the same information to all the kids that we talk to, I'm going to read to you from my paper. As we go along, I'll check that you understand what we're talking about.

We're working on creating an App that children can use to tell us about feelings (or emotions), and we want it to be fun. The app will show the different types of feelings in a bunch of cartoon videos.

Today, we would like your help to see if the cartoons show the feelings the right way and are fun for kids to watch.

Are you okay with that so far? [If the child responds affirmatively, move on. If the child does not respond, or responds negatively, STOP and discuss any issues or questions]

It won't take very long but if you feel like you need a break, just let me know and we'll have a little rest.

So now I'd like to show you our cartoon videos. Is that ok?

I'm very interested in finding out what you think about them. If you don't know what to say or don't understand what one of the cartoons mean, that's okay and will be very helpful to us. There are no wrong answers.

Researcher Instructions: *Do not explicitly state the emotion or behaviour depicted in the cartoon until Q2b. **Can repeat cartoon as often as child likes.

1. Show the child the first cartoon and then ask SATISFACTION RATING questions. Then continue on with CONTENT VALIDATION questions **1 2 3 4** for the same cartoon.
2. Repeat question process with 2nd cartoon, then 3rd and so on.

SATISFACTION RATING

Q1. ***After watching the video can you rate how much you like...?***

	SOUNDS	CHARACTERS	DRAWINGS MOVEMENT	OVERALL RATING	TOTAL
1a Happy	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	
1b Sad	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	
2a Anxious/Worried/ Nervous	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	
2b Confident	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	
3a Sleeps well	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	
3b Sleeps badly	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	
4a Angry	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	
4b Not angry	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	

CONTENT VALIDITY - ACCURACY

Q1. *After watching video* ***Can you tell me a story about a time when you or someone you know felt the same as the boy/girl in the cartoon?***
[this is to determine if the child's internalisation of the construct can corroborate the animation – i.e. may not be able to label the current animation but are able to explain it or provide a comparable example]. Show one cartoon and then ask the question Q1-4.

Researcher rating: Is child's interpretation equivalent?	
1a Happy----------	
1b Sad----------	
2a Worried/Anxious/Nervous----------	
2b Confident----------	
3a Sleeps well----------	
3b Sleeps badly----------	
4a Angry----------	
4b Not Angry----------	

Q2a. ***Can you tell me how the boy/girl in feeling/behaving in this video?*** [Can the child verbally label the intended emotion or behaviour?]
Q2b. Correct each misunderstood interpretation by saying "**In this video we meant to show** [**emotion/behaviour**]" **Would you give this cartoon a tick or a cross for showing** [**emotion/behaviour**]? Tick = * good, correct, right, accurate or Cross = **bad, incorrect, wrong, inaccurate

2a.	**U**	**Write the child's interpretation of the animation only if they misunderstood it**	**2b. Child's Rating of Accuracy of Cartoon**
1a Happy		----------	
1b Sad		----------	
2a Anxious Worried		----------	
2b Confident		----------	
3a Sleeps well		----------	
3b Sleeps badly		----------	
4a Angry		----------	
4b Not angry		----------	

Q2c. ***What could we change or do in this cartoon so that it does show 'x' feeling/behaviour?***

	Write child's 'better' idea or story to interpret the intended 'Emotion or Behaviour' of cartoons they thought were inaccurate.
1a Happy	----------
1b Sad	----------
2a Anxious Worried	----------
2b Confident	----------
3a Sleeps well	----------
3b Sleeps badly	----------
4a Angry	----------
4b Not angry	----------

	Q3. SOUND **a.** ***Do you think the sounds helped you to understand what was happening or how the boy/girl was feeling in the cartoon?*** *Y or N* **b.** ***Are there any changes you think we should make to the sounds?*** (note these under add or remove)			**Q4. ANIMATION** ***Are there any animated parts of the cartoon that you think we need to add or remove or change in some way?*** (such as tears, sweat, colours, facial expression/body movements, colour on faces to look like they're blushing/very angry; or added shapes like on the high-five/steam out of the ears etc. Should we make them bigger/smaller, add more/less of; remove completely, is too much/exaggerated, or change the colour?	
	Y or N	**add?**	**remove?**	**Add Enhance More Bigger Colour**	**Remove Reduce Less Smaller**
1a Happy		---------- ----------	---------- ----------	---------- ----------	---------- ----------
1b Sad		---------- ----------	---------- ----------	---------- ----------	---------- ----------
2a Anxious Worried		---------- ----------	---------- ----------	---------- ----------	---------- ----------
2b Confident		---------- ----------	---------- ----------	---------- ----------	---------- ----------
3a Sleeps well		---------- ----------	---------- ----------	---------- ----------	---------- ----------

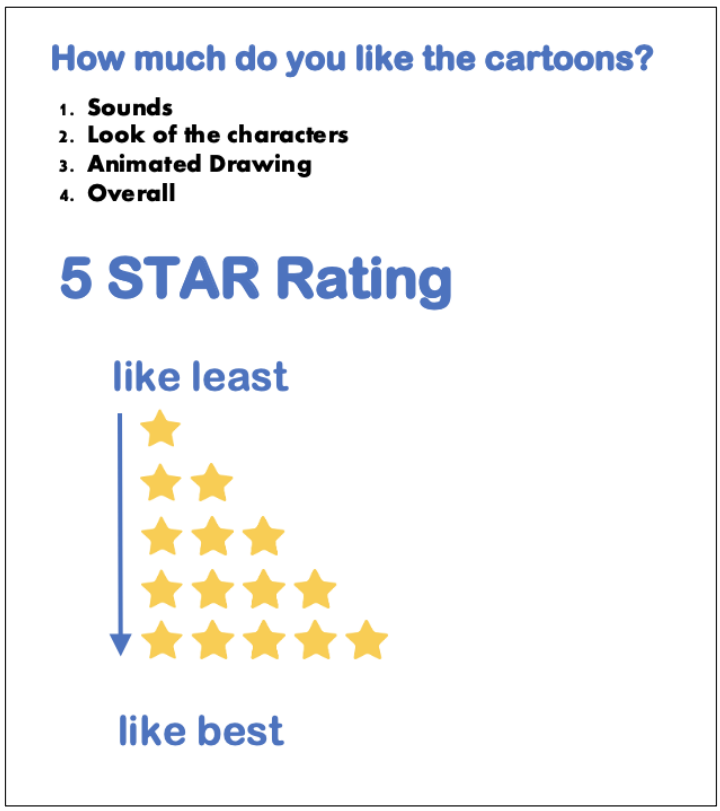
OTHER

Do you have anything else you'd like to say about the cartoons?

That's all the questions I have for you. Are there any questions you have about what we've done today?

[If the child has questions or issues, address them to the child's satisfaction

Satisfaction Rating Chart



Accuracy Rating Chart

APPENDIX E

Table 1

Satisfaction Comments Stratified by Child Participant Age

5 Years

*Miss 5 said as soon as she finished "I want to do it again". Really professionally put together.
*My daughter understood what to do easily and enjoyed the process. Well done on a fantastic app!!
It was fun.
It was helpful and easy to understand.
*My son really enjoyed the videos as it was interactive
*Great animations, my son really enjoyed answering them!
The app was pretty good, some questions were hard to find an answer, so I picked the closest one

6 Years

*My child has ASD level 2 – it was great :)
It was fun.
*I felt that sometimes he chose the picture or scenario he'd like to Be in rather than the one which truly reflected his Behaviour, especially with the ones where he knows we are trying to improve his Behaviour.
*He was very engaged in the animations and needed no assistance; with the written questions he needed some clarification Because he didn't really understand the questions.
It was really fun.
*Very child friendly and easy to do. It lets children Be independent.
This was really cool - thanks :)
I really enjoyed it.

7 Years

I enjoyed answering the questionnaire... the cartoon app was awesome, and I ♥ the funny cartoon videos.
I like this a lot!
It was good But I don't like doing these much.
It was really good I could understand what the films meant. It was a lot easier than going to a psychologist.
It would help if there more words for people like my Brother Because he has problems with understanding emotions. Overall, it was amazing!
*My daughter really enjoyed the movie part - she asked if she was going to level 2 thinking it was a game.
I like this a lot!

8 Years

Cartoons are funny.
I liked it
I love this survey!!!!!!!!!!
I liked it But thought it was a Bit hard trying to choose the right answers.
It was good
I hope I can do it 1 million more times
Thank you it was easy and interactive.

9 Years

I think it's very good.
It was really cute.
Thanks.
The laugh at the end was very creepy; But otherwise, it was really good!
It was a Bit hard to scroll down to see the answers on my screen (mobile phone).

10 Years

I like the animations!
It was fine. They were Both easy.
The laughing girl at the end is lame.
It was helpful and easy to understand.
I liked it.
I really liked it and thought it was good for me. Some of the videos I had to re-watch But other than that everything was great.

11 Years

It's a very good way to find out how people feel.
Good. I have done questions at the Drs, and this was way Better.
I liked it and it was more fun than the writing one, But I think it's probably Better for younger kids.
I thought it was really fun.
It was pretty easy, and I enjoyed it. Thank you.
Good needs more describing for some.
I liked all of the videos.
This was really cool - thanks :)