



Teaching project management to primary school children: a scoping review

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Received: 9 May 2022 / Accepted: 17 March 2023 / Published online: 18 April 2023
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Abstract

Teachers have used projects in children’s education for over a century. More recently, project management knowledge and skills have become essential when students manage technological solutions from inception to presentation. This paper presents the first scoping literature review on teaching project management to primary school students. A total of 33 publications between 2000 and 2022 were analysed and presented both descriptively and thematically. While the review did not identify any empirical studies of teaching project management to primary school students, it did reveal several examples of suggested teaching approaches, project management activity, and common elements associated with project management. The review concludes with a recommendation for researchers, educators, and project management practitioners to build upon this research by exploring the effectiveness of comprehensive approaches to teaching project management to primary school students. This paper represents a significant area of research as project management is one of the most critical skills for students to achieve success in the twenty-first century.

Keywords Project management · Teaching · Children · Primary school · Scoping review

Introduction

Using projects in children’s education dates back to the early twentieth century (Knoll, 2012; Pomelov, 2021) and was popularised by William Kilpatrick (Clark, 2006), one of the most influential figures in pedagogical progressivism (Mintz, 2016). Since then, teachers have increasingly used real-world projects to provide authentic learning experiences for their students (Pecore, 2015). More recently, teachers and researchers have begun to examine the pedagogies that surround

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projects that help teachers deliver multiple curriculum outcomes in a single learning activity. Given the prevalence of projects and the emphasis on curriculum outcomes, it is understandable that teachers may have less focus on the processes and skills involved in managing these projects. At the same time, as students take on more responsibility for their own projects, there will be a growing need to develop project management skills.

Project management can be defined as ‘the knowledge, skills, tools, and techniques to project activities to meet the project requirements’ (Project Management Institute [PMI], 2021, p. 245). It is a complex discipline that has evolved over several decades through leading institutions such as the Project Management Institute, the Association for Project Management, and the International Project Management Association. Like other disciplines, the field of project management has created a body of knowledge that is transferable to practice (Lalonde et al., 2010). Furthermore, as organisations continue to use projects as the primary form of structuring work, most employees will be involved in project-related activities of some kind in the workplace (Konstantinou, 2015). Of these, approximately 90 million individuals will be performing project management activities by 2027 (PMI, 2017c). As a result, many of these individuals will require education and training in project management.

Institutions such as PMI have developed methodologies, practices and standards that underpin many of the project management education and training programs available today (Cicmil & Gaggiotti, 2018). Some programs include short courses, degree programs, industry training, professional development, and the ‘global standard’ in project management certifications: the *Project Management Professional* (PMP) accreditation from PMI (Richardson & Jackson, 2019, p. 26). While the complexity of these programs varies greatly, the concepts and terminologies are generally targeted at the adult population, not children. Nevertheless, there is some evidence of project management teaching in secondary schools and youth non-profit organisations. In 2018, the Student Research Foundation (SRF) surveyed over 35,000 secondary school students across the United States and found that 25% of students reported that they had been taught project management skills (SRF, 2019). In the United States, two examples of initiatives to teach project management skills in secondary school include a pilot in a Washington State high school where students in Grades 9 to 12 were taught project management over one semester (Garfein & Noeldner, 2011), and the National Aeronautics and Space Administration (NASA) commissioning Texas A&M University to design and implement a project management course to assist students in six high schools to better manage their Science, Technology, Engineering and Math (STEM) projects (Morgan et al., 2013). In Hampshire, England, a secondary school became the first in the United Kingdom to implement a pilot program by the Project Management Institute Educational Foundation (PMIEF) to introduce project management principles to students (Robertson, 2012). Finally, JA (Junior Achievement) Europe, a large youth-serving non-profit organisation that prepares students for the workforce, received a grant totalling USD \$977 K from PMIEF to integrate project management learning into their youth programs (PMIEF, 2021). Although these examples of project management learning in secondary schools

are encouraging, primary school children should also learn how to manage projects as a life and career skill (Partnership for 21st Century Learning [P21], 2019, p. 7).

In Australia, young children are already exposed to projects and project management. In 2012, the Australian Curriculum, Assessment and Reporting Authority (ACARA) produced *The Shape of the Australian Curriculum: Technologies* (ACARA, 2012). The Technologies curriculum was designed to ensure that students capitalise on the learning and application of emerging technologies critical to twenty-first century living. An overarching theme within the curriculum is the potential students have to influence their future through developing technological solutions (ACARA, 2012). Project management learning in primary school classrooms is a key concept within the Australian Technologies curriculum, made evident by the title of ACARA's Digital Technologies in Focus (DTiF) publication: *Teaching and supporting project management in the classroom F-6* (DTiF, 2020). The curriculum claims that students will produce technological solutions by managing projects from inception to realisation and can be measured by comparing how successfully a project met original expectations (ACARA, 2012). ACARA believes that project management is 'an essential element in building students' capacity to more successfully innovate' and will be included in every year of schooling (ACARA, 2012, p. 10). This implies that teachers will develop opportunities for students to understand how to manage a project.

Despite ACARA's recommendation that project management should be explicitly taught within the Technologies curriculum (DTiF, 2020), a preliminary search of the literature, both nationally and internationally, found no comprehensive research studies on teaching project management in a primary school context. There was some evidence of project management activity identified through various pedagogical practices such as inquiry-based learning, problem-based learning, differentiated instruction, and particularly project-based learning. These included common project management activities such as planning, group work, producing a product, and presenting to an audience. However, these activities alone do not constitute a holistic view of the knowledge and skills required for a child to successfully manage a project from beginning to end. Project management integrates numerous elements that must be managed effectively (PMI, 2017a) by an individual with a set of core competencies (PMI, 2017b). This is made more complex by the various ages of children in primary school.

This raises some significant questions. If project management is such a complex discipline, how is it being taught to primary school children? What research has been conducted investigating comprehensive approaches to the teaching of project management to children in primary school? To explore these questions further, and to inform the Australian situation, an international scoping review was undertaken to: (i) investigate the body of literature regarding teaching project management in primary schools; (ii) identify approaches to the teaching of project management and related skills in the classroom; and, (iii) build a foundation of evidence to inform future research. This paper is the first scoping literature review investigating the teaching of project management to primary school children.

Methods

A scoping review methodology was selected to explore the literature as this type of review aims to examine the extent, range and nature of research on a particular topic, summarise and disseminate the findings, and identify any research gaps in the literature (Arksey & O'Malley, 2005). Due to the sparseness of literature on the topic, the research was driven by a broad research inquiry resulting in the following research question: What does the body of evidence reveal about teaching project management to children in primary school? The use of a scoping review provides more flexibility than a systematic review (Peterson et al., 2017) because it is more concerned with the characteristics and concepts within a study than a specific question that informs policy or practice (Munn et al., 2018). Further, the results should only focus on a descriptive account of available literature (Arksey & O'Malley, 2005).

Scoping reviews often present information in broad themes (Arksey & O'Malley, 2005; Rumrill et al., 2010). Two themes emerged from the initial search of the literature: project management elements, and teaching project management to primary school children. *Project management elements* describe the project management activities, processes, and artefacts typical of many projects. This was the predominant theme due to the sheer volume of project management elements identified in the initial search. *Teaching project management to primary school children* is the central topic of this research. This theme concerns specific claims that project management is or should be taught in primary schools.

This scoping review adheres to the Joanna Briggs Institute (JBI) methodology for scoping reviews (Peters et al., 2020) and is guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Extension for Scoping Reviews (PRISMA-ScR) checklist (Tricco et al., 2018a). Lockwood et al. (2019) recommend the use of both resources when developing a scoping review. Further, a scoping review protocol was previously published by the authors of this paper (Delle-Vergini et al., 2023) to promote transparency and detail the objectives and methods of this review (Peters et al., 2020).

Inclusion criteria

The inclusion criteria were based on the PCC (population, concept, context) mnemonic, using the following phrases: children (population), teaching project management (concept), and primary school (context), which were also used to develop the scoping review article title and research question (Peters et al., 2020). Using the PCC mnemonic ensures a broader range of sources are considered compared to the population, intervention, comparator, outcome (PICO) mnemonic commonly used in systematic reviews (Lockwood et al., 2019). The *population* included studies that involved primary school students, regardless of gender or socio-economic status. The *concept* of this scoping review is teaching project management, while the *context* includes any public or private primary school that teaches or claims to teach project management to children or where children are engaged in project-related

activities that produce products and project management artefacts. As the age of primary school students can vary across countries and even between states, a range of 5–11 years of age was used during the screening process as this range is almost exclusively situated in a primary school setting. Information sources considered include qualitative, quantitative, and mixed-methods studies and reports. Journal articles, conference proceedings, dissertations, published books and grey literature from the years 2000 to 2022 were included to ensure the literature was relevant in twenty-first century classrooms. The validity of sources was achieved through the credibility of the institutions they were sourced from (i.e., Project Management Institute) and the academic databases mentioned in the next section.

Search strategy and source selection

As recommended by Morris et al. (2016), the search design and strategy involved a research librarian. Consistent with the JBI methodology, it involved three stages (Peters et al., 2020). During the first stage, an initial search of the following databases: Academic Search Ultimate, Business Source Ultimate, eBook Collection, Education Research Complete, E-Journals, ERIC (all via EBSCOhost Megafile Ultimate), Proquest One Academic, Web of Science, Scopus, and Google Scholar was conducted independently by two of the authors (SD, DE). The use of at least two reviewers to meet, discuss and select relevant sources is recommended by Levac et al. (2010). The search utilised synonyms and like terms derived from phrases located in the title of this paper, as detailed in Fig. 1. This search yielded 799 results.

The sources were then loaded into EndNote, and duplicates removed, yielding a total of 619 sources. On several occasions, the same two authors (SD, DE) met to discuss and agree on the items for inclusion and exclusion. A title and abstract examination of the 619 sources resulted in 586 exclusions, leaving a total of 33 sources for consideration. A full-text examination of these 33 sources commenced, resulting in 22 excludes (full text not found: $n=5$, project management concept missing: $n=11$, a language other than English: $n=2$, no primary school context: $n=3$, only teacher managing project: $n=1$), leaving a total of 11 included sources.

In the second stage, a manual search for other sources (i.e., websites) was performed. This process was necessary as the search of databases only produced limited sources. A handful of websites (i.e., Project Management Institute Educational Foundation, Buck Institute for Education) produced content in the form of reports, videos, blogs, and recommendations for books that referenced project management teaching in primary schools. The process of searching these and other websites and

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(child* OR student*) AND (teach* OR instruct* OR train* OR educat* OR learn*) AND ('project management' OR 'manag* project*' OR 'plan* project*' OR 'project-based learning' OR 'project based learning') AND ('primary school*' OR 'elementary school*')
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Fig. 1 Search string

their content produced a further 20 sources, one of which was excluded after closer examination. The third and final stage examined the reference lists of the 11 database sources and 19 website sources which produced a further three sources.

This rigorous search strategy and source selection process produced a total of 33 sources that matched the inclusion criteria for this scoping review. The process is detailed in Fig. 2.

Data extraction and presentation

Despite the growing use of the JBI methodology and PRISMA-ScR checklist, a study by Khalil et al. (2020) discovered that of all the stages throughout the scoping review process, data extraction was the most inadequate. Data extraction was made difficult by the lack of explicit examples of approaches to teaching project management in primary schools. As such, it was necessary to identify and group project management elements to capture and understand the characteristics of the teaching of project management within the literature. The authors decided that the phases within a project life cycle were a logical choice to group the project management elements.

A project life cycle consists of phases of related project activity that a project passes through until it is completed (PMI, 2017a). While there is no universal agreement on project life cycle phases (Kerzner, 2022), the authors selected four project management process groups: *initiate*, *plan*, *execute*, and *close*, which reflect the four generic project life cycle phases: starting the project, organising and preparing, carrying out the work, and ending the project (PMI, 2017a). Each phase contains several project management elements that were used to map the results in tabular format (Thomas et al., 2017). The elements extracted were important in identifying the building blocks of project management and were largely derived from two key Project Management Institute publications: *A Guide to the Project Management Body of Knowledge: PMBOK® Guide* (PMI, 2017a), widely considered as ‘the gospel of project management’ (Kerzner, 2010, p. 169), and the *Project Manager Competency*

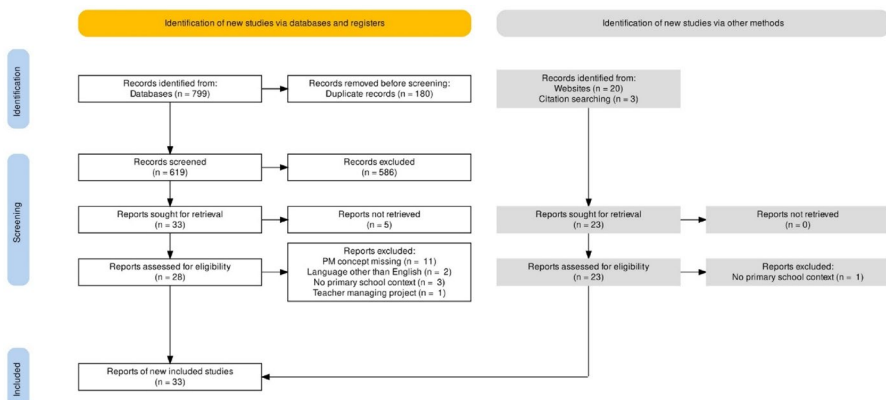


Fig. 2 Scoping review search and selection process

Development Framework (PMI, 2017b). Seventeen project management elements across four project lifecycle phases were used to capture evidence of project management activity.

Results

A comprehensive mapping of the 33 sources included in this scoping review and the project management elements identified in each source are provided in Table 1 of the Appendix and should be referred to throughout this paper. This section includes a descriptive overview of the results, followed by a thematic overview, as recommended by Levac et al. (2010). To supplement the numerical analysis in this paper, such as number counts and percentages, the authors used the following classification schemes: $\leq 33\%$ was interpreted as a low level of representation; 34–66% as a moderate level; and $\geq 67\%$ as a high level.

Descriptive overview

Due to the limited number of research articles discovered, the data extraction elements typical of a scoping review, such as study aims, population sample, methodology and key findings (Peters et al., 2020), were not available for most sources and thus were excluded from this scoping review.

- *Publication source* The scoping review sources consisted of a thesis ($n=1$), published books ($n=6$), journal articles ($n=7$), web documents ($n=7$), government documents ($n=2$), conference proceedings ($n=1$), videos ($n=3$), and blogs ($n=6$). Of the seven journal articles, one could not be confirmed as peer-reviewed (D’Orio, 2009).
- *Year of publication* The inclusion criteria prohibited sources published earlier than the year 2000. In chronological order, sources were published in the year 2000 ($n=2$), 2002 ($n=1$), 2005 ($n=1$), 2008 ($n=1$), 2009 ($n=2$), 2010 ($n=1$), 2012 ($n=1$), 2013 ($n=1$), 2014 ($n=4$), 2015 ($n=3$), 2016 ($n=3$), 2017 ($n=3$), 2018 ($n=6$), 2019 ($n=1$), 2020 ($n=2$), and 2022 ($n=1$). It is uncertain exactly when ACARA (2022) was published, as there are multiple versions, but version 8.4 of the Australian Technologies curriculum (Foundation to Year 6) is the latest version as of writing this article.
- *Project management elements by phase* Only 19 (57.6%) sources contained at least one element in each of the four phases (initiate, plan, execute, close). The initiation phase contained 103 of 231 (44.6%) possible elements identified across 33 sources. The planning phase contained 80 of 132 (60.6%) possible elements. The execution phase contained 62 of 132 (47.0%) possible elements. Finally, the closing phase contained 26 of 66 (39.4%) possible elements. Of the 561 project management elements possible across all sources and phases, only 271 (48.3%) were present.

- *Project management elements by publication type and source* Of the 17 project management elements available, government documents (30 of 34; 88.2%), web documents (107 of 153; 69.9%) and books (71 of 102; 69.6%) contained a high level, followed by a moderate level for theses (10 of 17; 58.8%), and journal articles (54 of 119; 45.4%), and a low level for videos (12 of 51; 23.5%), conference proceedings (4 of 17; 23.5%) and blogs (13 of 102; 12.7%). Nine sources (27.3%) contained a high level of elements (12 elements and above), 13 sources (39.4%) contained a moderate level (6–11 elements), and 11 sources (33.3%) contained a low level (5 elements and below). Only three elements were identified in a high number of sources: constraints ($n=26$; 78.8%), and both project management tools/artefacts ($n=23$; 69.7%) and activities/tasks ($n=23$; 69.7%).
- *Thematic alignment* The two themes presented in this paper were identified in a number of sources. Project management elements ($n=30$; 90.9%), and teaching project management to primary school children ($n=14$; 42.4%).

Thematic overview

Two themes emerged from the review of the literature: project management elements, and teaching project management to primary school children. Each theme is briefly described in the *Methods* section.

Project management elements

Seventeen elements provided evidence of project management activity within the literature, the people and processes involved, the artefacts used in managing projects, and the products produced during those projects. These elements were categorised into four groups representing common phases within a project lifecycle: initiate, plan, execute, and close.

Initiate Phase This phase only contained 103 of 231 (44.6%) possible elements across all sources. Only one source contained all seven elements (PMIEF, 2014a). ACARA (2022), DTiF (2020), and Fleer (2016) each contained six elements; while Boss and Larmer (2018), Edwards (2000), Ginevri and Trilling (2017), PMIEF (2015a), Project Management Institute: Portugal (PMI-Portugal, 2020), and Railsback (2002) all contained five elements. Four sources (Lenz, 2016; Modzelewski & Urias, 2017; PMIEF, 2014b; Vander Ark, 2018) contained no elements. The percentage of sources where each element was identified is illustrated in Fig. 3.

The most predominant element identified within this phase was *constraints* ($n=26$; 78.8%). Constraints within a project typically include time, scope, and cost (PMIEF, 2015a) and should be considered to see how they might affect the project (Portz, 2014). Time was the leading constraint and described in several ways, such as managing time or time management (Buck Institute for Education [BIE], 2018; Boss & Larmer, 2018; Ginevri & Trilling, 2017; Lenz, 2018; Trilling & Fadel, 2009), keeping on track (Bell, 2010; Maher & Yoo, 2017; Railsback, 2002), deadlines (DTiF, 2020; Krajcovicova & Capay, 2012; McCain, 2005; PMIEF, 2015a), timelines (ACARA, 2022; DTiF, 2020; Edwards, 2000; Railsback, 2002),

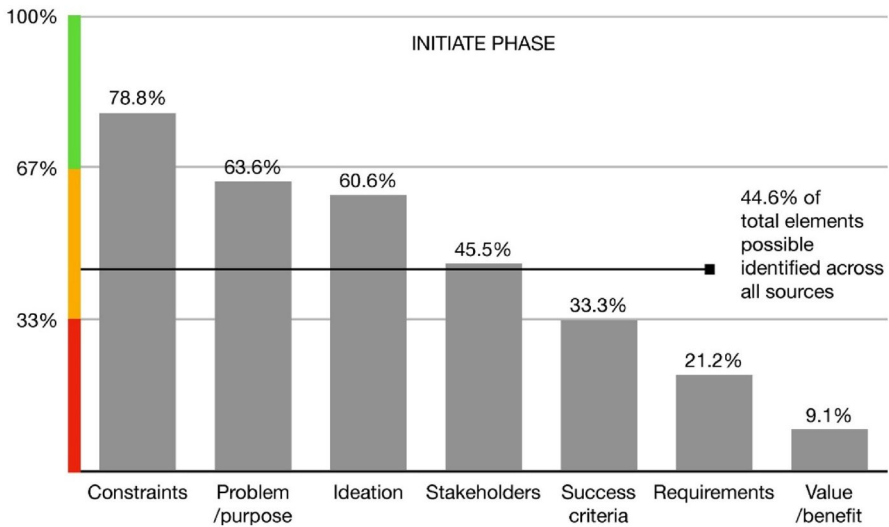


Fig. 3 Project management elements of the initiate phase identified in sources

and schedules (DTiF, 2020; Ginevri & Trilling, 2017; PMIEF, 2014a, 2015a). Time management was the number one difficulty faced by students in projects according to Akinoglu (2008). Scope (Boss & Larmer, 2018; DTiF, 2020; Ginevri & Trilling, 2017; PMIEF, 2014a), cost or budget (ACARA, 2022; Fler, 2016; Ginevri & Trilling, 2017), and quality (ACARA, 2022; DTiF, 2020; Fler, 2016; Ginevri & Trilling, 2017; PMIEF, 2014a, 2015a) were mentioned less frequently than time constraints.

The next two prominent elements identified were *problem/purpose* ($n=21$; 63.6%) and *ideation* ($n=20$; 60.6%). Most projects in a school environment begin with a purpose (DTiF, 2020; Folsom, 2000; Railsback, 2002), question (Bell, 2010; BIE, 2018; Maher & Yoo, 2017; PMIEF, 2014a, 2015a; Trilling & Fadel, 2009), or problem that needs to be solved (Akinoglu, 2008; Boss & Krauss, 2014; Fler, 2016; PMI-Portugal, 2020; Reitzig, 2019). Ideation occurs when students ‘explore, analyse and develop ideas’ (ACARA, 2022, p. 6) and illustrate these ideas (Maher & Yoo, 2017) through activities such as brainstorming (Project Management Institute: North Italy Chapter [PMI-NIC], 2015; PMIEF, 2013, 2015b; Portz, 2014) and mind mapping (Ginevri & Trilling, 2017; PMIEF, 2014a).

Like problem/purpose and ideation, the *stakeholder* element had a moderate level of representation ($n=15$; 45.5%). A stakeholder is an individual or group interested in the project (PMIEF, 2015b). DTiF (2020) recognised the importance of reporting to, and receiving feedback from, stakeholders. In the context of a primary school project, sources that mentioned stakeholders often referred to them as teachers, parents, or community members (Bell, 2010; Edwards, 2000; French, 2018; Maher & Yoo, 2017; Railsback, 2002). Some sources referred to a stakeholder as a client (Boss & Larmer, 2018; DTiF, 2020; Fler, 2016; Ginevri & Trilling, 2017; PMIEF, 2014a). One source even described a stakeholder analysis process: ‘The students

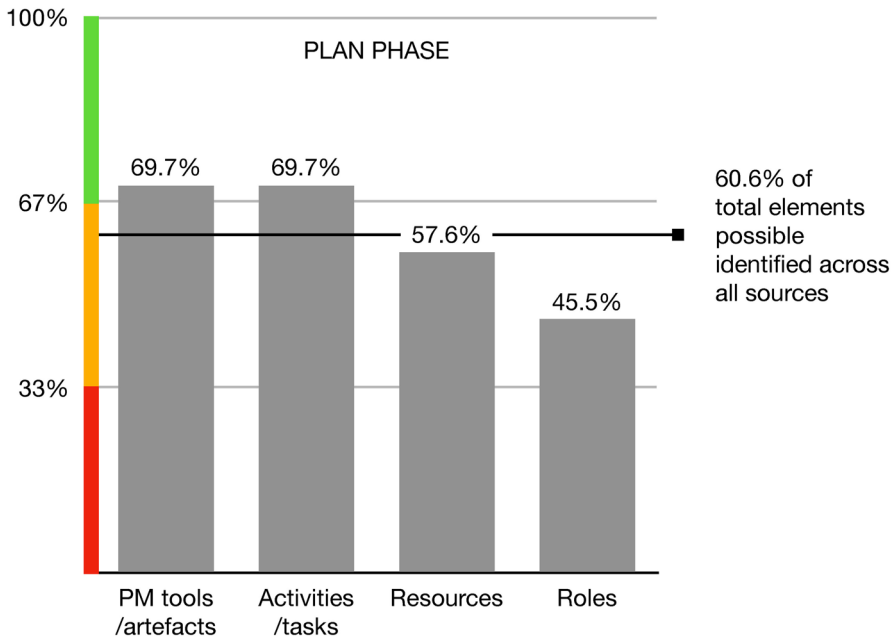


Fig. 4 Project management elements of the plan phase identified in sources

also filled out a stakeholders table that identified each person with a key interest in the project, their role, what they wanted from the project team, and how the team planned on giving them what they needed' (PMIEF, 2014a, p. 17).

The final three elements: *success criteria*, *requirements*, and *value/benefit*, had a low representation across the sources. Although the success criteria element was the best of the three ($n=11$; 33.3%), requirements ($n=7$; 21.2%) and value/benefit ($n=3$; 9.1%) were significantly lower.

Plan phase This phase had the highest representation of project management elements compared to other phases, with 80 of 132 (60.6%) possible elements identified, making it the only phase to score above 50%. Twelve sources (ACARA, 2022; Boss & Krauss, 2014; Boss & Larmer, 2018; DTiF, 2020; Edwards, 2000; Fler, 2016; Ginevri & Trilling, 2017; Krajcovicova & Capay, 2012; PMI-Portugal, 2020; PMIEF, 2014a, 2015a; Portz, 2014) included all four project management elements (tools/artefacts, activities/tasks, resources, and roles) in this phase. There were no elements with a low level of representation across all sources, as detailed in Fig. 4.

Project management *tools/artefacts* and *activities/tasks* were two elements that had a high level of representation across sources ($n=23$; 69.7%). Project management tools/artefacts are any items that assist project team members in conducting project management activities. While the list of items can be extensive depending on the size and complexity of the project, several sources cited what is arguably the most important document or artefact in every project: the project plan (ACARA, 2022; Akinoglu, 2008; Boss & Krauss, 2014; Boss & Larmer, 2018; DTiF, 2020), or master plan (Edwards, 2000). Other project management tools and artefacts

identified were task boards, project walls, project journals (Boss & Krauss, 2014), Gantt charts, contingency plans, risk registers, work breakdown structure, communication plan (DTiF, 2020), visual maps, project binders, resource plans, project goal statement (Edwards, 2000), posters, mind maps, process diaries (Fleer, 2016), activity tree, project traffic light (Ginevri & Trilling, 2017; PMI-NIC, 2015; PMI-Portugal, 2020; PMIEF, 2014a, 2015b), project organisation chart (PMIEF, 2014a), project scoring rubric and task lists (Portz, 2014).

Activities/tasks were used interchangeably by several sources (BIE, 2018; Edwards, 2000; Ginevri & Trilling, 2017; Larskikh et al., 2016; Maher & Yoo, 2017). The purpose of this element is to define all the necessary activities or tasks to complete the project (PMI-Portugal, 2020; Portz, 2014). Edwards (2000, p. 63) calls on students to 'think through the activities they must complete to meet their project goal...compose a master list of activities...which need to be broken out into smaller tasks'. The concept of an *Activity Tree* (Ginevri & Trilling, 2017; PMI-NIC, 2015; PMI-Portugal, 2020; PMIEF, 2014a, 2015b) provides a graphical representation of the tasks necessary to complete the project. Each leaf on the tree represents an activity or task. These tasks are then assigned deadlines and owners (Ginevri & Trilling, 2017) with a 'logical sequence of steps they (students) intend to follow to accomplish the tasks' (McCain, 2005, p. 59).

Both *resources* ($n = 19$; 57.6%) and *roles* ($n = 15$; 45.5%) were moderately represented. Project resources include people (Edwards, 2000; Fleer, 2016); equipment, tools, materials, funding, technology, books (PMIEF, 2015a), whiteboards, cameras, USB drives, computers, printers, scanners, data projector, internet (Krajcovicova & Capay, 2012), components (ACARA, 2022), and supplies (Folsom, 2000). Students are encouraged to consider why resources are necessary and how they will be managed for each activity (Nodzyska et al., 2018).

During a project, students 'negotiate roles and responsibilities' (ACARA, 2022, p. 57), with roles defined for both individuals and groups (DTiF, 2020). School projects leverage the abilities and strengths of individual team members when assigning roles (Fleer, 2016; Reitzig, 2019) and provide opportunities for students to take on leadership roles (Trilling & Fadel, 2009). Some sources also recognised the dual nature of roles and responsibilities in project work (ACARA, 2022; DTiF, 2020; Railsback, 2002).

Execute Phase The execute phase contained 62 of 132 (47.0%) possible elements across all sources. Students spend most of their time during the execution phase of the project (PMIEF, 2014a). Only three sources (DTiF, 2020; Fleer, 2016; Ginevri & Trilling, 2017) included all four elements (project manager, project products, present products, and risk) in this phase. None of the elements had a high representation across sources, as detailed in Fig. 5.

The first two elements identified within the execution phase are *project products* and *present products*. Two-thirds of the sources ($n = 22$; 66.7%) demonstrated that a product of some kind was the end result of projects undertaken in the primary school classroom. Other terms that reflected a product included scale model (Boss &

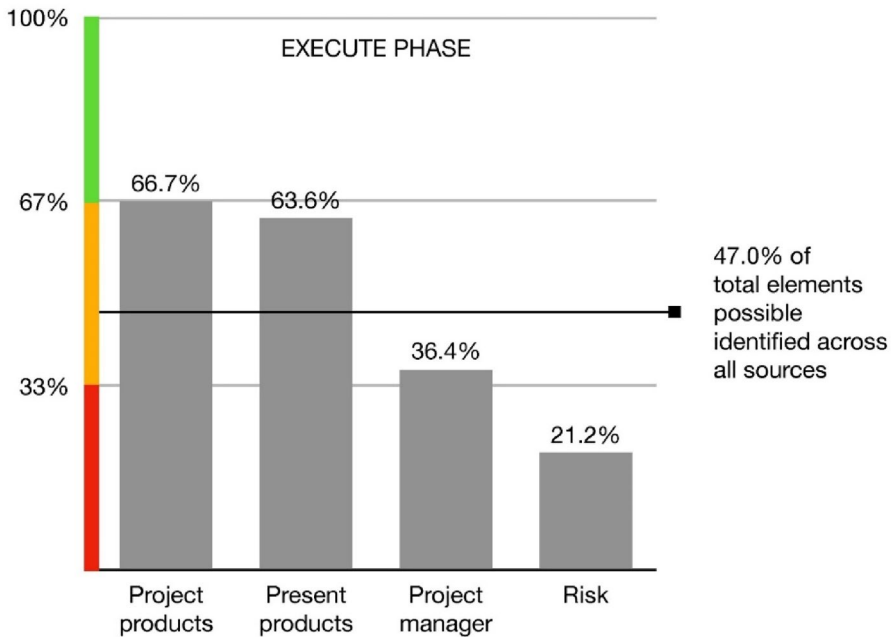


Fig. 5 Project management elements of the execute phase identified in sources

Larmer, 2018; French, 2018), prototype (Ginevri & Trilling, 2017; PMIEF, 2015a), solution (ACARA, 2022; PMIEF, 2015a; Reitzig, 2019), service (PMIEF, 2015a), and design (Reitzig, 2019). In every source where a project product was identified, it was a tangible product. As Railsback (2002, p. 10) points out, a tangible product is an important feature of authentic classroom projects and should be shared with an intended audience. The presentation of project products was evident in many sources ($n=21$; 63.6). Whether it was a presentation (BIE, 2018; Edwards, 2000; Fler, 2016; Folsom, 2000; Maher & Yoo, 2017; Railsback, 2002), contest/competition (Akinoglu, 2008; Reitzig, 2019), performance (Bell, 2010), showcase (Reitzig, 2019), exhibition or portfolio (Maher & Yoo, 2017), a final product of some kind was presented to interested stakeholders.

The *project manager* is responsible for ensuring that the project meets its goals (PMIEF, 2014a, p. 41). However, this element was only moderately represented ($n=12$; 36.4%). ACARA (2022, p. 52) states that ‘students manage projects independently and collaboratively from conception to realisation’. Two sources (Boss & Larmer, 2018; Larskikh et al., 2016) specifically refer to students as project managers, while one (DTiF, 2020) refers to students managing their own projects. However, some sources appear to suggest that students should manage projects independently once they enter secondary school. Fler (2016, p. 233) argues that students can manage their projects but should build upon the concepts of project management

in primary school and then become more independent in secondary school. This gradual progression to independently managing projects is supported by Ginevri and Trilling (2017, p. 51): ‘As project learning experiences grow, so does the need for students to take more control of the entire project management processes.’ Other sources discussed student involvement in the process of managing projects without specifically referring to them as a project manager or managing their own individual projects (BIE, 2018; Folsom, 2000; Lenz, 2016; Maher & Yoo, 2017). A handful of sources ($n=4$) referred to teachers playing the role of a project manager (Boss & Krauss, 2014; Boss & Larmer, 2018; DTiF, 2020; Folsom, 2000) in addition to students.

The final element is *risk*. This element was identified in a low number of sources ($n=7$; 21.2%). Some sources understood the importance of identifying and managing risks in the project management process. The project team should identify risks (PMI-Portugal, 2020), create a list of risks (Ginevri & Trilling, 2017) or risk register (DTiF, 2020), manage the risks (ACARA, 2022), and consider creating a risk management or backup plan (Fleer, 2016).

Close Phase This phase contained 26 of 66 (39.4%) possible elements across all sources. This scoping review searched for two elements in the closing phase: *review/reflect* and *archive project*. Given the temporary nature of projects, they must eventually be closed. One of the final activities for a project team is to discuss and document the lessons learned (PMIEF, 2015b). Five sources (Boss & Krauss, 2014; Boss & Larmer, 2018; DTiF, 2020; Edwards, 2000; PMIEF, 2014a) included both elements, while 12 sources did not refer to either element (Fig. 6).

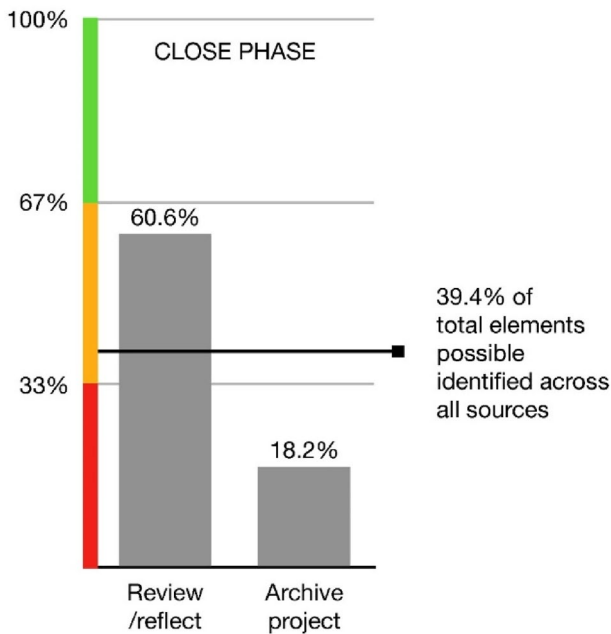


Fig. 6 Project management elements of the close phase identified in sources

A moderate level of sources ($n=20$; 60.6%) included or recommended a review/reflect process. The project review process involves feedback from stakeholders, celebrating project success, informal and formal recognition, and self-reflection, which 'may hold the most important learning experiences in the whole project' (Ginevri & Trilling, 2017, p. 53). The quality of the project results can be analysed (Larskikh et al., 2016), lessons learned reviewed (PMIEF, 2015a), and project processes improved (Boss & Krauss, 2014). Further, reflecting on how successful the project was in meeting the client's needs (ACARA, 2022) and suggestions for improvement can make the next project even better (Edwards, 2000, p. 82). The Buck Institute for Education suggests that the review and reflection process will assist students to 'retain project content and skills longer, develop a greater sense of control over their own education, and build confidence in themselves' (BIE, 2018, p. 5). As such, the entire review process can often be applied to future projects (Trilling & Fadel, 2009).

The archive project element, where project artefacts or products are stored away for future use or showcasing, was one of the lowest performing of all 17 elements ($n=6$; 18.2%). While several sources throughout the review/reflect process produced material that could be archived, only six sources were clear about the need to document project success/failure, performance, and lessons learned for future use (Boss & Krauss, 2014; Boss & Larmer, 2018; D'Orio, 2009; DTiF, 2020; Edwards, 2000; PMIEF, 2014a). These archives can be used to discuss previous projects (DTiF, 2020), review artefacts, and recall certain challenges (Boss & Larmer, 2018) that can inform future projects.

Teaching project management to primary school children

Despite a wide range of project management elements and activities identified in this review, no empirical studies of comprehensive approaches to teaching project management to primary school children were identified. A moderate level of sources ($n=14$; 42.4%) described or promoted project management teaching in the classroom. Four sources (DTiF, 2020; Fleer, 2016; PMI-NIC, 2015; PMIEF, 2015b) clearly identified project management teaching in a primary school setting, although DTiF (2020) and Fleer (2016) briefly referred to a secondary school setting. Some sources discussed project management concepts that should be taught in the classroom (ACARA, 2022; Boss & Krauss, 2014; Boss & Larmer, 2018), while others provided evidence through photographs, project artefacts, or descriptions of actual project management activity (DTiF, 2020; Fleer, 2016; Ginevri & Trilling, 2017; PMIEF, 2013, 2014a, 2015b). The only source with a clear definition of project management was ACARA (2022, p. 40), defining it as 'a responsibility for planning, organising, controlling resources, monitoring timelines and activities, and completing a project to achieve a goal that meets identified criteria for judging success'.

Two government sources (ACARA, 2022; DTiF, 2020) recognised the importance of scaffolding techniques to transition primary school students through

increasingly complex project management concepts. The Australian Technologies curriculum is written in bands of year levels for primary school: Foundation to Year 2; Years 3 and 4; and Years 5 and 6 (ACARA, 2022). In Foundation to Year 2, and with teacher guidance, students plan simple steps to complete projects. In Years 3 and 4, students begin to clarify their ideas, manage their time, plan and sequence major steps, and identify project success criteria. In Years 5 and 6, students develop project plans, consider project resources, define roles, set milestones, and reflect on the success of their project product and how improvements in the project process can be made next time. This approach transitions project management learning from basic planning steps through to more complex activities such as analysing cost, time, scope, and quality constraints (ACARA, 2022). DTiF (2020) also suggested the use of templates and checklists that students can adapt to their own projects, with the teacher providing connections between theoretical principles and practical application of project management concepts. Scaffolding strategies like these may be necessary as some concepts, such as Gantt charts and Work Breakdown Structures, mentioned by multiple sources in the review, are too complicated for primary school children to understand (Nodzynska et al., 2018).

Several sources described various phases of a project lifecycle: Initiation, Planning, Execution, and Closing (PMI-Portugal, 2020); Creation, Planning, Execution/Control, and Closing (PMI-NIC, 2015; PMIEF, 2015b); Define, Plan, Do, and Review (PMIEF, 2014a, 2015a). DTiF (2020) listed Planning, Scheduling, Monitoring/Controlling, and Closing but did not include an initiation phase, although they listed several steps under *planning* that would normally belong to an initiation phase, such as defining the problem or need, determining the project objectives, and identifying who is involved in the project (Ginevri & Trilling, 2017; PMI-Portugal, 2020).

Six sources (DTiF, 2020; Ginevri & Trilling, 2017; PMI-NIC, 2015; PMI-Portugal, 2020; PMIEF, 2015a, 2015b) were prescriptive in their recommendations for teaching project management in primary schools, detailing numerous activities undertaken and artefacts produced throughout each phase of the project. In the initiation phase, these sources recognised that a key activity was to identify a problem or need and define the project objective. Other activities included generating ideas (PMIEF, 2015b), brainstorming (PMI-NIC, 2015; PMI-Portugal, 2020; PMIEF, 2015a, 2015b), the identification of stakeholders, determining the resources needed, project success criteria, project team, and deadlines (DTiF, 2020; Ginevri & Trilling, 2017; PMIEF, 2015a). Project management artefacts produced during this phase included resource lists (DTiF, 2020), project identity cards, mind maps (PMI-NIC, 2015; PMI-Portugal, 2020; PMIEF, 2015b), project definition document, and a teamwork agreement document (Ginevri & Trilling, 2017; PMIEF, 2015a).

In the planning phase, the same six sources included defining activities or tasks, roles and responsibilities, sequencing tasks, and assigning people to tasks. PMI-Portugal (2020) highlighted the importance of defining dependencies between tasks. Artefacts produced during this phase included activity trees, project calendars

(PMI-NIC, 2015; PMI-Portugal, 2020; PMIEF, 2015b), work plans and checklists (Ginevri & Trilling, 2017; PMIEF, 2015a), and a work breakdown structure (DTiF, 2020).

In the execution phase, monitoring the project progress and adjusting the plan were activities mentioned in all six sources. Reporting project progress was also important (DTiF, 2020), as was checking to see if the product met original expectations (Ginevri & Trilling, 2017). Project management artefacts identified in this phase included project traffic lights (PMI-NIC, 2015; PMI-Portugal, 2020; PMIEF, 2014a, 2015b) and meeting notes (Ginevri & Trilling, 2017; PMIEF, 2015a). Project traffic lights are used to gauge how project activities are progressing. Green signifies that the activity is progressing as expected; amber means that an activity could be delayed, and the project team should work to avoid the delay; and red means the activity is delayed and a solution should be implemented, such as adding resources, shortening the duration of activities, or simply accepting the delay (PMI-Portugal, 2020).

Finally, in the closing phase, all six sources agreed that capturing lessons learned was a key activity, while reviewing the project against success criteria (DTiF, 2020), discussing improvements in the project process (Ginevri & Trilling, 2017; PMI-NIC, 2015; PMIEF, 2015a), and celebrating project success (DTiF, 2020; PMI-Portugal, 2020) were also important. Boss and Krauss (2014) even included an assessment rubric that includes project management elements such as developing project plans, managing time, meeting milestones, and project reflection. A few sources described or showed evidence of a project wall that displayed common project management artefacts such as activity lists, project calendars, mind maps and a project identity card (PMI-Portugal, 2020; PMIEF, 2014a, 2015a). This allowed teachers and students to visualise the project as a whole and keep track of project progress.

Discussion

This scoping review identified the range of existing literature on teaching project management to primary school children. The review identified 33 sources containing data that met the pre-defined inclusion criteria. A distinction between this review and other scoping reviews in Education journals was the low number of journal articles ($n=7$) and high number of other sources ($n=26$), such as books, web documents, and blogs.

Several gaps in the literature were observed. Firstly, the review did not identify any empirical studies into the teaching of project management to primary school students, although it did reveal several examples of suggested approaches to teaching project management. For example, several sources described four main phases within the project lifecycle and the project management activities, processes, and artefacts produced within each phase (DTiF, 2020; Ginevri & Trilling, 2017; PMI-NIC, 2015; PMI-Portugal, 2020; PMIEF, 2014a, 2015a, 2015b). Students

need to plan, organise, control and monitor these activities and artefacts over the entire project lifecycle in order to achieve project success (ACARA, 2022). Further, scaffolded learning in a project environment was suggested by several sources (Bell, 2010; Boss & Larmer, 2018; DTiF, 2020; Maher & Yoo, 2017; Vander Ark, 2018) and, more specifically, as a way to introduce project management skills with increasing complexity at each year level (ACARA, 2022). Therefore, students are already engaged in the building blocks of project management. However, the lack of research studies highlights the need for more empirical investigation in this area. Qualitative and quantitative studies are required to examine the teaching of project management in primary schools, and the effectiveness of holistic approaches that seek to integrate the project management skills required for students to successfully manage a project from beginning to end in contrast to approaches that focus on these skills in isolation. This would enable a fuller understanding and informed approach to the development of such skills within the Australian Technologies curriculum.

Secondly, while the Technologies curriculum promotes the explicit teaching of project management in primary schools (DTiF, 2020), there is no empirical research into teachers' perspectives on how this should be achieved. Teachers' understanding of project management, and their views on how, when, and what exactly should be taught, impacts student learning. The review revealed some teacher experiences (Modzelewski & Urias, 2017) of using project management teaching resources promoted by PMIEF (PMI-NIC, 2015; PMIEF, 2014a, 2015a, 2015b), but these were anecdotal and not published in peer-reviewed journals.

Thirdly, project management is a professional discipline with complex processes and activities required for project success. This presents a dilemma. How can the technical and complex nature of project management be interpreted, modified, and presented to primary school students so that they understand all of the separate interconnecting parts, but also apply these in a holistic way to manage a project from beginning to end? While project management professionals may be the best choice to advise on the minimal core components required to manage simple projects, it is teachers that are best placed to jointly create and apply such a learning framework in the classroom. Further research is recommended on bridging the disciplines of education and project management so that each may inform the other in ways that further increase the development of the teaching of project management in primary school settings.

Limitations

The sparseness of peer-reviewed articles necessitated the search for other sources such as websites, web documents, videos, and blogs. While that search was extensive, it was not exhaustive due to the vast amount of information available on the internet. As a result, some relevant literature may have been excluded, which is the primary limitation reported in scoping reviews (Pham et al., 2014). The following limitations are related to the nature of scoping reviews. Although a rigorous process was applied using the

JBI methodology, PRISMA-ScR checklist, and a scoping review protocol, scoping reviews do not appraise the quality of included studies (Grant & Booth, 2009; Levac et al., 2010; Rumrill et al., 2010). Grant and Booth (2009) believe that the absence of a quality assessment excludes scoping reviews from making recommendations for policy or practice. However, Tricco et al., (2018a, 2018b) argue that the purpose of scoping reviews is to characterise the literature rather than assess the quality of included studies. Further, scoping reviews are often a precursor to more rigorous knowledge synthesis methods, such as systematic reviews, which do assess quality (Munn et al., 2018; Peters et al., 2020). Finally, as the information presented in scoping reviews provides more breadth than depth, this review only sought to present the extent, range and nature of the literature rather than a detailed analysis (Tricco et al., 2016). Future research may narrow the focus of the topic to include more specific research questions.

Conclusion

This scoping review sets the foundation for a deeper discussion and further research on the topic of teaching project management to primary school children. While the literature revealed that project management is being taught to a certain degree in the primary school classroom, several unanswered questions remain. How can project management be taught holistically to enable students to manage a project successfully from beginning to end? What project management skills should be introduced to primary school children, and at which year level? What can the perspectives of educators add to the effective teaching of project management? Is there a role for project management practitioners to play in informing how project management is taught in a primary school setting? The lack of research studies highlights the need for more empirical investigation in this area. Qualitative and quantitative studies are needed that examine the teaching of project management in primary schools, and the effectiveness of comprehensive approaches to teaching project management in contrast to less comprehensive approaches that focus on these skills in isolation. It is hoped that this scoping review will assist researchers, educators, and project management practitioners to understand more fully the current literature on project management teaching approaches in primary schools. Collaboration between educators and project management practitioners may be the best approach to equip primary school students with the knowledge, skills, and behaviours to manage projects effectively in school, in the community, at work, and throughout life. This represents a significant area of research as project management is one of the most critical skills for students to achieve success in the twenty-first century.

Appendix

See Table 1.

Table 1 Project management elements and contextual information identified in reviewed sources

Author(s)	PM elements																	
	Initiate			Plan				Execute			Close							
	Prob-lem / pur-pose	Idea-tion	Stake-hold-ers	Require-ments	Con-strains	Suc-cess	Value / ben-e-fit	PM tools / arte-facts	Activ-ities / tasks	Resources	Roles	Pro-ject man-ager (T)	Pro-ject man-ager (S)	Pro-ject prod-ucts	Risk	Review / reflect	Archive project	
ACARA (2022)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Akinoglu (2008)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Bell (2010)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
BIE (2018)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Boss and Krauss (2014)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Boss and Larmer (2018)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
D’Orio (2009)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
DTIF (2020)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Edwards (2000)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Fleer (2016)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

Table 1 (continued)

Author(s)	PM elements																
	Initiate			Plan				Execute				Close					
Prob-lem / pur- pose	Idea- tion	Stake- hold- ers	Require- ments	Con- straints	Suc- cess crite- ria	Value / ben- efit	PM tools / arte- facts	Activ- ities / tasks	Resources	Roles	Pro- ject man- ager (T)	Pro- ject man- ager (S)	Pro- ject prod- ucts	Pre- sent prod- ucts	Risk / reflect	Review / reflect	Archive project
Folsom (2000)	•			•	•		•	•	•		•	•	•	•			•
French (2018)		•		•		•	•					•	•	•			
Ginevri and Trilling (2017)	•	•		•	•		•	•	•		•	•	•	•			•
Krajcovi- cova and Capay (2012)	•			•		•	•	•	•			•	•	•			
Larskikh et al. (2016)	•		•	•			•	•	•			•	•	•			•
Lenz (2016)												•					
Lenz (2018)																	
McCain (2005)	•		•	•	•		•	•	•				•	•			•

Table 1 (continued)

Author(s)	PM elements																	
	Initiate			Plan				Execute				Close						
	Prob-lem / pur- pose	Idea- tion	Stake- hold- ers	Require- ments	Con- straints	Suc- cess / crit- eria	Value / ben- efit	PM tools / arte- facts	Activ- ities / tasks	Resources	Roles	Pro- ject man- ager (T)	Pro- ject man- ager (S)	Pro- ject prod- ucts	Pre- sent prod- ucts	Risk	Review / reflect	Archive project
Maher and Yoo (2017)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Modzelewski and Urias (2017)																		
Nodzynska et al. (2018)					•			•	•	•								
PMI-NIC (2015)		•						•	•					•				•
PMI-Portugal (2020)	•	•	•	•	•	•		•	•	•				•		•		
PMIEF (2013)		•																
PMIEF (2014a)	•	•	•	•	•	•		•	•					•		•		•
PMIEF (2014b)																		

Table 1 (continued)

Author(s)	PM elements																
	Initiate			Plan				Execute				Close					
	Prob-lem / pur-pose	Idea-tion	Stake-holders	Require-ments	Con-strains	Suc-cess / crite-ria	Value / ben-e-fit	PM tools / arte-facts	Acti-vities / tasks	Resources	Roles	Pro-ject man-ager (T)	Pro-ject man-ager (S)	Pre-sent prod-ucts	Risk	Review / reflect	Archive project
PMIEF (2015a)	•	•			•	•	•	•	•	•	•			•	•		
PMIEF (2015b)	•	•			•		•	•	•					•	•		
Portz (2014)	•	•			•	•	•	•	•	•	•			•			
Railsback (2002)	•	•			•	•	•	•	•	•	•			•	•		
Reitzig (2019)	•								•					•			
Trilling and Fadal (2009)	•				•				•					•			
Vander Ark (2018)																	

Acknowledgements The authors wish to thank Dr. Tricia Kelly for her assistance in developing the scoping review search strategy.

Author contributions All authors have contributed in varying degrees to the development of this manuscript. SD: original idea, conceptualisation, methodology, search and selection, data analysis, drafting. DE: search and selection, data analysis, reviewing, revision. CD/MA/SC: reviewing, revision.

Funding Open Access funding enabled and organized by CAUL and its Member Institutions. None.

Declarations

Competing interest The authors declare that they have no conflict of interest.

Ethical approval The development of the submitted manuscript adheres to ethical standards. The University of Southern Queensland's Human Research Ethics Committee has granted approval for this research. USQ HREC ID: H20REA139.

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Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

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