Amendment. 29.10.2020

The scoping review will be conducted as outlined in version 10.09.2020

An amendment has been made to include seminal and influential work to support key concepts and themes as part of the scoping review. The reviewers deem it necessary to incorporate seminal and influential work as a manuscript (in itself), as it provides greater scope and insight for a further systematic review (publication format yet to be decided*).

Academic evidence to support this includes:

Scoping reviews can be conducted to examine and clarify broad areas to identify gaps in the evidence, clarify key concepts, and report on the types of evidence that address and inform practice in a topic area (Peters et al, p. 6).

As useful tools for evidence reconnaissance, scoping reviews can be used to provide a broad overview of a topic (Davis, Drey and Gould, 2009). For instance, a scoping review that seeks to develop a "concept map" may aim to explore how, by whom and for what purpose a particular term is used in a given field (Anderson et al. 2008).

Authors should consider questions that add value from mapping concepts or through identifying the sources and types of evidence for a field of research (Lockwood & Tricco, 2019, p.1).

Types of Sources:

'Reviewers may wish to leave the source of information "open" to allow for the inclusion of any and all sources. Otherwise, the reviewers may wish to impose limits on the types of sources they wish to include. This may be done on the basis of having some knowledge of the types of sources that would be most useful and appropriate for a particular topic' (Peters et al, p. 13).

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***** Change to manuscript titles may occur.

The interconnectedness of documenting workplace-related activity to facilitate informal learning: a scoping review protocol.

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Review objective

The objective of this review is to explore the state of interconnectedness in documenting workplace-related activity to facilitate informal learning. A number of transdisciplinary themes or elements are disaggregated into categories from the existing literature and then analysed through the use of systems-based tools to investigate the phenomenon. This review specifically, provides a multi-faceted approach in addressing the two review-based research questions:

How does documenting visual representation facilitate informal learning in the workplace and; what findings from this investigation are representative of Germany's skilled crafts sector?

Findings and discussion resulting from the review will inform further research into investigating a mixed methods study undertaken in the German Mittlestand. Collectively, this research effort will be used in the development of a faceted classification and validation model for industry.

Methodology

The scoping review will follow the JBI Scoping Review methodology as outlined in the Joanna Briggs Reviewers' Manual (2020). Systems-based tools and software will assist the scoping review in exploring the existing literature.

Background:

Often, knowledge in the workplace is formed and communicated through explicit means (Probst, Raub & Romhardt, 2000). Workplace information such as operational policies, procedures and work instructions through their explicit nature are codified, subject to regulatory, compliance conditions and endorsed by the organisation. From this practical perspective, workplace information translates into documented information. When amended, altered, added to or changed, this document

becomes a record controlled by the organisation. As both a document and a record, its meaning and relevance is conveyed and validated through its linguistic function–text as object. The international management systems standard, ISO 9000:2015, relates a definition for document[ed information] that reflects this view. It conveys the 'media' and 'format' for a document as being derived from any source (ISO 9000:2015, 3.8.5 and 3.8.6, Note 1 to entry) and confers its status as information related by a medium (function).

However, this definition by appearance, is contrary to a number of theoretical views in relation to how a 'document' functions and is perceived. Information scientists, such as Lund and Buckland, cite perspectives that associate documents with objects or with having non-verbal significance (Lund, 2008; Buckland, 2016). Lund highlights an historical fact where the meaning of 'document' stems from its Latin predecessor, *documentum*, which relates to teaching and instruction. It had a place as an object and its context varied from legal importance to pictures of importance (schematics, maps, diagrams and others) (Lund, 2008). This dialogistic form made reference to social, mental and physical attributes as constituents to document inception. Buckland (1997) furthers the role played by these constituents through relating the work of Suzanne Briet and her treatise on documentation (Buckland, 1997). Briet outlines the journey of an antelope from its place in the wild to its capture, enclosure and taxidermy–signifying the entire process as integrated documentation. Very much in view, with classical Pragmatism or the Bio-Semiotic work of Jakob von Euxküll (1934), Briet's animal has significance as a document–object, sign and symbol (Briet , 2006). Briet's work in itself is an extension of Paul Otlet's, *Traite de documentation* of 1934 (Tourney, 2003). Otlet's treatise outlines a 'documentation system' where he attempts to integrate and distribute knowledge through a carefully designed classification hierarchy, incorporating images with text (van den Heuvel and Rayward, 2011).

In perspective, these concepts align the research towards advocating a position of some implicit or non-linguistic importance. The degree of importance is not to play a secondary role as a substitute but rather, as a means to complement and validate the explicit (codified) meaning that might be given to an aspect of 'communication through documenting' in the workplace. In this context, a theme of document as a form of 'visual representation' seems relevant. Examples of dual or multi-meaning in relating objects as text and non-linguistic representations have been numerous (Mayer, 2008). Educational psychologists working in the multimedia and multi-modal learning spheres in particular, interpret physical, social and mental objects as texts (Paivio, 2006; Mayer, 2008; Molitor et al, 1989). These texts are connected through mental representations with the research design stemming from a hypothesis or stating a null hypothesis (James, 1950; Krantz, 1999). One model, Dual Coding Theory (DCT), is of empirical significance and an example of this view (Paivio, 1971). DCT consists of two distinct sub-systems – a verbal sub-system dealing with language (linguistic) and a non-verbal sub-system dealing with pictorial imagery (non-linguistic). Both systems interact and take on forms of modality that vary in accordance with the type of interaction (Paivio & Csapo, 1973). In some instances, linguistic tendencies will dominate (such as in crosswords) whilst in others, the non-linguistic tendency will dominate (such as in jigsaw puzzles) (Paivio, 2006, p. 3).

This study has been furthered by an elaboration of dual code theory (Mayer, 1997) and the development of an Integrative Model of Text and Picture Comprehension (Schnotz, 2002). Each offers a varying account of the text and picture perspective in context to its mental model. Further experimental work has been developed with a series of schematics to analyse eye movement and recognition between text and non-text documents (Acarturk et al, 2008). Similar research conducted by other educational psychologists reveals structured experiments that are designed with pre-formed schematics (as opposed to exploratory schema) to measure the role played by such visual cues (Lin et al., 2014; Rolfes et al., 2014, Carney & Levin, 2002; Mayer & Gallini, 1990). At an opposite spectrum (and sometime earlier) but still within the field of psychology, is the work

undertaken by Gestalt psychologists where the concept of percept as forming its own representation and meaning–separate to meanings or properties of the self is introduced (Henle, 1974). One such example is of sadness being attached to a drooping willow or a house that appears happy, confirming the percept as being integral to the willow or the house itself and not just a projected state of mind (by self) (Henle, 1974, p. 191). In a critique of mental imagery, a further example is illustrated with reference to a chess board and the relation between two pieces; the difference in mental representation (as opposed to a conscious image) is between that of a chess master compared to an inexperienced chess player–the former having a much richer experience with the two piece configuration (Pylyshyn, 1974). In engineering terms, views relate mental representation to visual reasoning, reiterating the importance given to non-verbal inclinations as an extension of the thinking process (Ferguson, 1977). Resoundingly, this research community conveys its own level of interest in 'how' visual representation is interpreted (cognitive and perception attributes).

The term 'informal learning' and its experiential attributes have a wide berth–in research terms and by definition (Schon, 1984). In addressing the relationship between professionals and learning practice, informal learning is seen as a process of self-direction (Cheetham and Chivers, 2001), whilst others focus learning in an informal sense with 'learner-centered systems', shifting the self-directedness of learning to being one of collective inclusiveness (situational learning) (Koper, 2009). Variations of these views appear, giving importance to 'context' for informal learning to take place and the relationship informal learning has with activities or tasks (Jarrahi and Sawyer 2013; Scheeres et al., 2010).

Customised training workshops facilitated on-site to organisations and course content developed by a review team member familiarise these views as experiential happenings (Schon, 1984). Delegates often bring their experiences to training sessions and these experiences are more often associated with ways in 'doing things' or 'getting the job done'. A group of mining site supervisors attending a training workshop in Western Australia referred to the importance of 'fatherhood training' in passing down habits, techniques or skills to perform tasks or activities. Collaboration and partaking in an informal learning environment where each felt dependent and responsible to the other, were essential factors for learning to take place (Mears, 2014). An informative view that supports the consistency of these themes states that informal learning embraces, 'recognition of the social significance of other people and … something that takes place in the spaces surrounding' (Eraut, 2004, p. 247). A similar view implies that themes are developed in project-based learning environments, giving emphasis to 'practice' as a form of 'action' (Scarbrough et al., 2004). A number of researchers refer to the term 'knowledge practices' with a clear association between know how and providing learning in the work environment (Appleby et al., 2003; Eraut 2004; Hermans et al., 2013; Scheeres et al., 2010).

From the above, it is apparent that views, concepts and theories exist for exploring, investigating and evaluating the research questions. A preliminary search of the literature, undertaken in Scopus and Web of Science databases, with reference to systematic literature review, found only one systematic literature review article of interest (Mladenovic and Krajina, 2018). Whilst, the article explores themes in tacit knowledge, explicit knowledge and knowledge sharing; no connection or inference between 'document', 'workplace-related activity' and 'visual representation' as a means to facilitate informal learning is evident. The article's methodology leading into the findings and discussion reveals a different stance (applied to social media) in comparison to the review objective of this study. No previous systematic scoping review has addressed this study's topic. As the international standard organisation (ISO) has provided a clear definition to what a document is (and is not), a multi-faceted approach to this study to explore the research questions is required. By exploring and reviewing the available literature, it will be possible to create a methodology that

leads from the scoping review and becomes the input for developing a model to inform policy and guidelines in industry.

Inclusion criteria

Participation

The interested parties deemed of importance for review include leading hands, supervisors, workers, business owner and other parties who constitute 'a workplace-related' role or undertaking. The scoping review will not discriminate by industry type or geographic region. However, interested parties from the Mittelstand industry and in particular the Handwerk sector as *Fokusgruppe,* contribute to the review's value. Germany's Handwerk sector contributes significantly to the German economy. Specialisation, flexibility, dedicated culture and long term orientation together with long term vocational training are attributes that distinguish the sector's value to the German economy. The sector is governed by Zentralverband des Deutschen Handwerks (ZDH) which is the German confederation of skilled crafts. ZDH drives policy with financial and non-financial initiatives to ensure the Handwerk sector is maintaining its competitive advantage in domestic and global markets. ZDH is also active in building sector awareness through innovation, tackling the skills shortage, building organisational culture, supporting SMEs as they globalise and amongst others promoting entrepreneurship (ZDH, 2018). Awareness building in these areas is a directive shared by the broader German government and industry (BMWi).

The German Mittelstand:

> "refers to small and medium-sized enterprises (SMEs), either according to the German definition (up to 500 employees and up to €50m annual turnover) or according to the European definition (up to 250 employees or up to €50m annual turnover)" (BMWi, 2016).

The Handwerk sector:

> "The skilled crafts sector is an autonomous economic sector in Germany. With its one million mainly small and medium-sized companies and 5.5 million employees, Skilled Crafts are at the heart of the Germans economy. They provide vocational training in 130 different trades ranging from: building and finishing, electrics and metalworking, wood - and plastic-working, clothing, textiles and leather, food, health and personal care, to chemicals and cleaning, and graphic design" (ZDH, 2020).

Concept(s)

The current concepts of interest for this scoping review have a dual purpose. Firstly, the review will clarify key concepts associated or related with visual representation (Diagram 1, A and B) and document extant. By undertaking a comprehensive search of the literature to clarify these concepts, knowledge gaps might ensue–how informal learning is documented and facilitated together with document perceptibility (Diagram 1, C) is one such example.

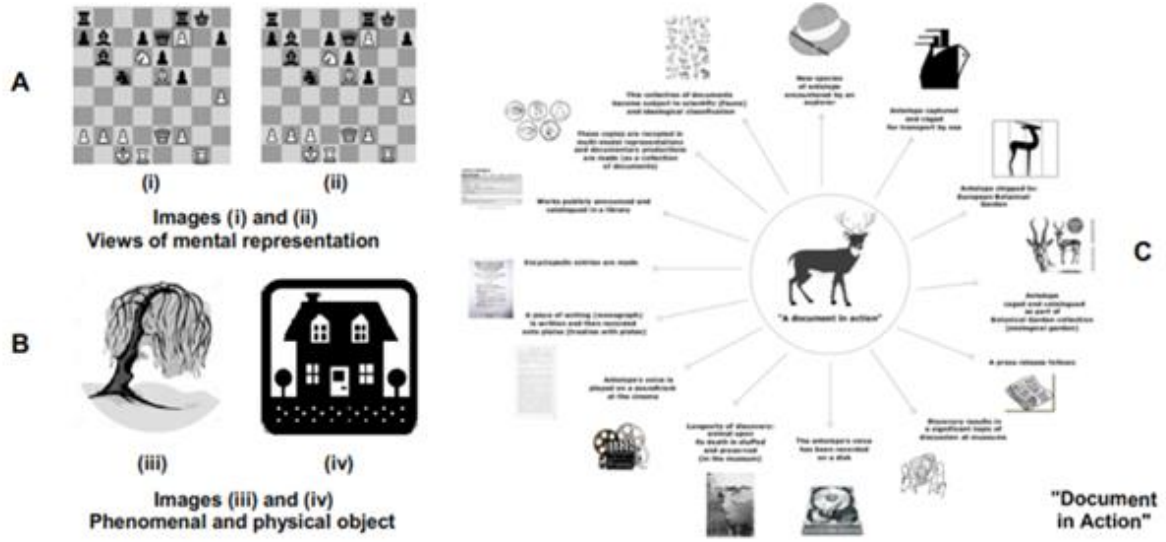

Diagram 1. Clarifying key concepts

Context

The workplaces represented in this current review, consist of a mixture of workplace-related environments where the investigation of the concept(s) might take place. Interested parties such as supervisors, leading hands, business owner and workers (amongst others) occupy the role as facilitators within these environments. As the nature of workplace varies in accordance with a number of factors–location being one of those factors; the review does not alienate workplace settings based on industry, place or type.

A definition for place of work is:

> "The place of work is the location in which a currently employed person performs his or her job, and where a usually employed person performs the primary job used to determine his/her other economic characteristics such as occupation, industry, and status in employment". (OECD, 2008)

A definition of activity is:

> "An activity is a process, i.e. the combination of actions that result in a certain set of products". (OECD, 2008)

A definition of facilitate:

> "to make something possible or easier" (Cambridge, 2020).

A definition of Informal Learning:

> "Forms of learning that are intentional or deliberate but are not institutionalised. It is consequently less organized and structured than either formal or non-formal education. Informal learning may include learning activities that occur in the family, workplace, local community and daily life, on a self-directed, family-directed or socially-directed basis" (UNESCO, 2012).

Types of sources

Sources that are qualitative, quantitative and mixed methods studies will be considered for inclusion for this current review. Where possible, systematic literature reviews or other kinds of reviews, if determined appropriate by the inclusion criteria, will be selected for review. All grey literature (unpublished) and primary and secondary studies (journals, abstracts and articles) will be included.

Search strategy

The search strategy's aim is to comprehensively search published and unpublished material in accordance with the inclusion criteria. The strategy will adopt a three-step approach.

1. The first step will start with a non-indexed Boolean search (basic search including Google Scholar). From this search, an analysis of text words in the title together with the abstract will be undertaken from retrieved papers.
2. A second search will identify relevant and concept specific keywords. This information organised into elements (concept specific keywords) will be 'parked' for further analysis using an affinity diagram (Diagram 2, A). Research clusters (Rcl) or themes will be developed from the parked information (Diagram 2, B) and with the help of senior research librarians, organised into search strings. Each search string will be applied to a number of databases.
3. A third (hand) search will be undertaken where all relevant primary and secondary studies collected over a three year period will be reviewed using the elements developed from the second search. Reference lists from studies collected as a result of the hand search performed will be searched for possible inclusion (by element).

All articles will be assessed for inclusion as outlined in accordance with the inclusion strategy examining studies by title, abstract and concept specific keywords. Subject to this requirement, full text articles will be retrieved for further examination. One reviewer will undertake the initial search for steps one, two and three. Two other reviewers will independently verify the suitability of this process.

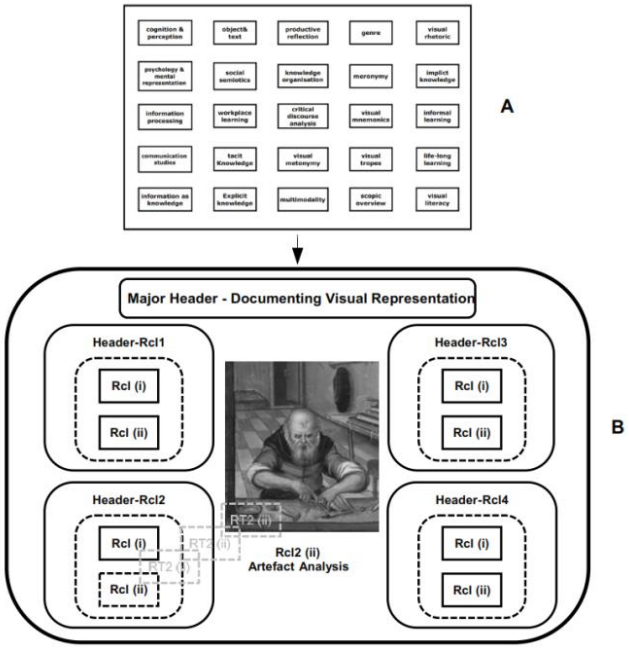

Diagram 2. Information organised into parked elements (A). These elements become inputs for themes or research clusters (Rcl). Each cluster group has its own header (master cluster).

From these studies, a selection of full text articles (including grey material and published material in the form of book chapters) will be organised for further review. All three reviewers will independently assess the suitability of these studies for inclusion and analysis. A limitation on studies published from January 2015 to December 2020 will be applied to full text articles (excluding seminal work, book chapters and some grey literature). Studies published in English and translated from German to English will be considered for inclusion in this review. A fourth reviewer will be consulted (if necessary) in connection to the phenomenon of interest, to identify further published and unpublished material in the German language.

Databases to be searched:

Ebsco Host (megafile)
Sage
Emerald
Scopus
Science Direct

Initial search terms include:

cognition and perception; object & text; document; productive reflection; genre; visual rhetoric; psychology & mental representation; social semiotics; knowledge organisation, meronymy; implicit knowledge; information processing; workplace learning; critical discourse analysis; visual mnemonics; informal learning; communication studies; tacit knowledge; visual metonymy; visual tropes; life-long learning; information as knowledge; explicit knowledge; multimodality, scopic overview; visual literacy

Data extraction

The studies identified from the three-step search will be imported into QIQQA. QIQQA's optical character recognition (OCR) allows it to read all PDF files (including scanned images) and build themes (research clusters) from large groups of data. Relevant themes will be identified by one of the reviewers and verified by two independent reviewers. Identified studies from this process will then be transferred and imported into QDA Miner Lite to classify codes and generate categories from these identified studies.

Results

As per the JBI scoping review guidelines to illustrate and summarise the findings, a T-Matrix will be used to map and annotate in narrative form the relevance of the key concepts to the review. Appendix 1 is an example of how a T-Matrix will review studies–key review concepts will be reviewed against the controls and mechanisms derived from data extraction (Diagram 3). This will allow a final clustering of studies and to provide scope around addressing further sub-questions of each review-based research question. These include:

RQ1> How does documenting visual representation facilitate informal learning in the workplace;

SQ1. What is the relationship of "document" to "object" as linguistic and non-linguistic representations?
SQ2. What transdisciplinarity research themes complement and critique this perspective?
SQ3. How is this knowledge mapped in relationship to informal learning? and;
SQ4. What research methods have been used in carrying out research to investigate this phenomena and
SQ5. How have these methods been researched?

RQ2> What findings from this investigation are representative of Germany's skilled crafts sector?

SQ6. How does current workplace-related activity account for informal learning?

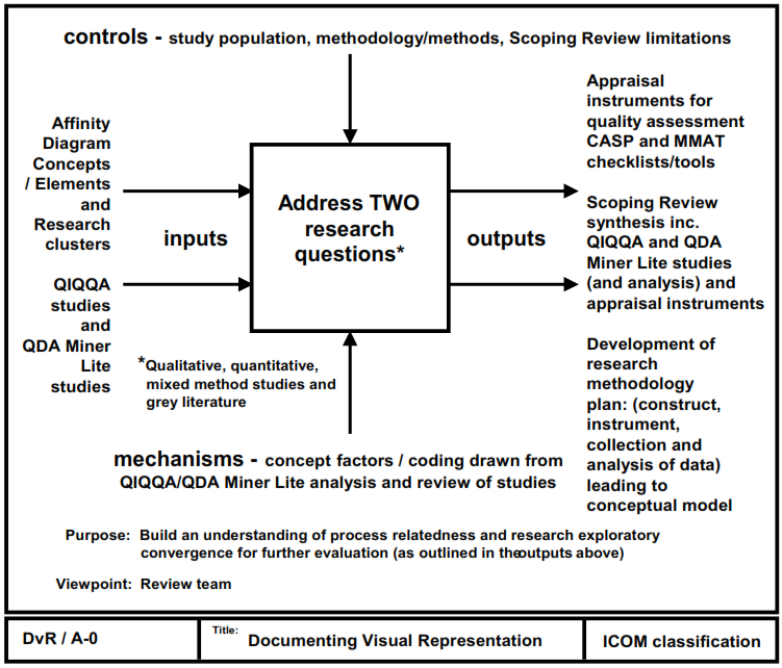

Diagram 3.
ICOM classification to illustrate data extraction process

The final, clustering of studies (as an output of Diagram 3) will be evaluated by using an appraisal tool (CASP) to: i) validate the results of the review; ii) clarify the findings of the review and iii) provide a guidance for future research directions that can benefit from the review. All three review members will be involved in the final clustering of studies and transfer of these studies into the Critical Appraisal Skills Programme (CASP) checklist. It is anticipated that core key concepts and their attributes will ensue from these findings. However, as the scoping review is exploratory in both principle and undertaking, the entirety of the review finding–start to finish–is of review importance. This will both complement and enhance the concept inclusion criteria by creating boundaries and revealing knowledge gaps for further research to take place.

Conflict of interest

Studies that have been included in this review and authored by review members will be checked for quality by other review members and senior library staff. This will be documented in the scoping review so as to reduce or limit any bias that may result from such inclusion.

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Appendix 1. Example only of T-Matrix to review studies (classifications to be determined from review analysis and synthesis)

Controls																			
i] represented ii] not represented									object/tools	transdisciplinarity	informal learning	workplace environment	research approach	research methods/ evidence	schema/tools	capability			
Mechanisms																			