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Research Article

Sensemaking and the Potential Future-focused Curriculum for Society 5.0 Knowledge Managers: A South African Perspective

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ABSTRACT
When "quality being everyone's business" coincides with the reality of a disruptive work environment, critical self-evaluation becomes an essential tool to ensure accountability. Academics who design curricula and their tuition offering have a certain degree of freedom in what and how they teach. However, academics need to be consciously discerning, yet inclusive, about the voices that should speak into curriculum design. This study operates from the principle of co-creation in curriculum design and acknowledges the multiplicity of relevant voices that speak into curriculum design. These voices are influenced by the past, present, and possibilities of the potential future. To remain relevant in the imagined future, this research identified the co-creators and curriculum design partners for the multidisciplinary field of knowledge management. The curricula of three related academic departments were analysed to determine knowledge management tuition linkages. These curricula were then compared with the Skills Framework for the Information Age (SFIA) level descriptors. Following on from this desktop analysis, Sensemaker®, a distributed digital ethnographic methodology was piloted that will be used to collect micro-narratives from emergent curriculum co-creators. This article identifies gaps in current curricula, expresses expectations for future possibilities and highlights potential niche opportunities for knowledge management curriculum design.

Keywords Knowledge manager's capabilities, Society 5.0, disruptive technologies, Skills Framework for the Information Age, knowledge management curriculum

Categories • **Knowledge management ~ Curriculum and skills competency**

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1 INTRODUCTION

Reading material about the fourth industrial revolution (4IR) the pervasive sentiment remains to be the fact that change is inevitable, at a rate never experienced before and at a scale, scope and complexity that humankind is yet to be exposed to. The future has always been uncertain, but speculation about our readiness for the disruptive and complex potential future has created anxiety among students that was last observed when the World Wide Web would have destroyed newspapers and the paper-based society in 1992. While research and development have been a constant in academic circles, research institutes and the industry at large, the most recent hype around artificial intelligence and the dangers associated with it reached mainstream media at the beginning of 2023 after ChatGPT was launched in late 2022.

In a capstone module taught to third-year students the number of queries about their readiness for work placement, their skill level and what work they can do with the degree they are about to earn escalated remarkably. Perhaps this observed insecurity of soon-to-be graduates can be ascribed to several influences of which the rapid changes in technology are merely one. Students express their concerns about being replaced by technology as they simultaneously navigate their way through studying during global lockdowns in online and hybrid modes, developing valuable experiences in transitioning almost seamlessly from face-to-face situations onto online platforms. During one-on-one conversations, the struggle they have to manage alternative solutions to pursue tasks through continuous load-shedding schedules speaks of resilience that will bode well during uncertain times in the future. These mentioned observations, historical and current realities along with anecdotal records gave rise to the guiding question for this research, namely:

> *What should be included in a curriculum to prepare potential future-focussed knowledge managers?*

While qualifications and certifications are generally the output of curriculum development and design endeavours, these form just a small part of all that is involved in preparing a student studying towards a qualification which could get them entry into a field such as knowledge management. The observations mentioned above refer to critical soft skills that can only be developed through lived experience. According to Mabe and Bwalya (2022), soft skills and competencies are critical enablers necessary to harness the possibilities that the 4IR would offer. Within the uncertainty of the 4IR, Schwab (2016) warns that the response to it must be integrated and comprehensive involving all stakeholders, much aligned with the human-centred approach that Society 5.0 advocates.

Smuts et al. (2022) distinguish between the 4IR and Society 5.0, regarding the 4IR primarily as the generation of knowledge and intelligence achieved by humans with the support of technology, while Society 5.0 focuses on knowledge and intelligence generation through machines and artificial intelligence in service of people. While the following prediction of the uncertain future by Gerber et al. (2021) will most likely turn out to be true, it also inspires the question of how the generation that is supposed to navigate this future should be skilled and what curriculum should be developed to support them in building the required competency.

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> *Nobody knows with certainty what new technologies will emerge, what new industries will materialise and what skills will be in high demand. What we do know is that the future will be radically different from the work environment today, and the pace of change will be faster than anyone expects (Gerber et al., 2021).*

So, if Society 5.0 is about service to people and aims to bring human concerns back into how we think about technological advancement and human-machine interfaces (Gerber et al., 2021), then the human concerns and expectations should receive attention when designing the curriculum that needs to equip the Society 5.0 human workforce. Curriculum design and co-creation received rising interest in research and practice with students as partners and co-created learning and teaching (Bovill, 2020), recognising the student adopting four possible roles in this process, namely a representative, consultant, co-researcher, and pedagogical co-designer (Bovill, 2020). In keeping with Schwab's (2016) recommendation of involving all stakeholders in responding to the 4IR, the other stakeholders in co-creating the curriculum would be industry partners that generally employ the university graduates and the practitioner as a partner from the discipline's association or society perspective, not only in a national capacity but also from a global society or association perspective.

Academic staff in their capacity as researchers and from their roles to teach and learn have a certain degree of freedom in what and how concepts and content is brought together within a discipline. However, the expectations from the above-mentioned partners in the process need to be acknowledged within this freedom. In this study, co-created curriculum development and design is informed by the expectations expressed by the discipline as an institution, the expressed expectations of the world of work for whom graduates are trained, the students' expectations and aspirations as well as the experiences of the academic as a researcher and an educator. The students who expressed their expectations and aspirations form part of a bachelor's degree in which they can potentially pursue KM as a career choice. These KM-linked partners are challenged throughout this research to dig into their past experiences, probe the present curriculum and predict the skills and capability requirements of the knowledge managers of the future. The objectives of this research were to:

- Identify knowledge management skills and competencies as expected by the industry and business practitioners.
- Assess current curriculum offerings and explore curriculum linkages for the multidisciplinary discipline of knowledge management.
- Pilot a distributed digital ethnographic methodology that can be used to collect micro-narratives from all relevant curriculum co-creators.

In addressing the first objective the knowledge management skills and competencies as expressed by industry and business practitioners need to be identified.

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2 KNOWLEDGE MANAGEMENT SKILLS

Ehlers and Kellermann (2019) collected data between 2015 and 2019 on the expectations of competence and skills for future learning in Higher Education. They define future skills as the "ability to act successfully on a complex problem in a future unknown context of action", referring to an "individual's disposition to act in a self-organised way, visible to the outside as performance" (Ehlers & Kellermann, 2019). They classify future skills into dimensions and skills profiles. The subjective dimension relates to personal abilities to learn, adapt and develop to improve work opportunities, shape working environments and cope with future challenges. The first seven of sixteen skills profiles were identified in the subjective dimension namely, autonomy, self-initiative, self-management, need/motivation for achievement, personal agility, autonomous learning competence and self-efficacy. The object dimension refers to an individual's ability to act self-organised with an object, task or subject matter issue. Five of the sixteen skills profiles reside in this dimension, agility, creativity, tolerance for ambiguity, digital literacy and the ability to reflect. The social world dimension refers to the individual's ability to act self-organised concerning the social environment, society and the organisational environment. The remaining four skills profiles associated with this dimension are sensemaking, future mindset, cooperation skills and communication competence. Sensemaking is a term that was coined by Dervin (1983) to study how people construct information needs and use information to bridge the cognitive gap. Sensemaking has been studied extensively in the field of KM (Dervin, 1992; Dervin, 1983, 1996; Klein et al., 2006; Pirolli & Russell, 2011; Snowden et al., 2021; Snowden, 2005; Weick et al., 2005).

While Ehlers and Kellermann (2019) take a broader approach beyond digital skills demands, Rhem (2017) identifies specific knowledge management (KM) roles, responsibilities and core competencies that are essential for the success of a KM project or programme. His list of roles is not exhaustive but includes Chief Knowledge Officer (CKO), KM Program Manager, KM Project Manager, KM Director, Operations KM Director, KM Author, KM Lead, KM Liaison, KM Specialist, KM System Administrator, Knowledge Engineer, Knowledge Architect, KM Writer, Knowledge Manager, and KM Analyst. Rhem (2017) acknowledges that KM has both soft competencies and hard competencies and identifies KM responsibilities as KM principles and foundation, KM strategy, KM leaders and champions, KM culture, communities of practice/knowledge sharing and transfer, content management, metrics, processes, KM technology systems and tools, and KM governance. However, from this list, some "responsibilities" can better be described as roles (KM leaders and champions) and others could rather be described as tools (KM technology systems and tools) or methodologies (communities of practice). Rhem (2017) also recognises that a distinction can be made between soft skills and hard skills.

Mabe and Bwalya (2022) using a systematic literature review followed by a Delphi technique specifically looking at South African data, identified the critical soft skills required for information and KM practitioners in the 4IR. They define soft skills as a combination of mental and meta-cognitive skills, interpersonal, cerebral and applied skills (Mabe & Bwalya, 2022). (Table 1) summarises a list of the 49 soft skills that Mabe and Bwalya (2022) regarded as ne-

cessary to maintain a competitive advantage in the 4IR. The list is presented in alphabetical order rather than any other logical categorisation.

Table 1: Soft skills from the systematic literature review (adapted from Mabe and Bwalya (2022))

Adaptability	Analytical skills	Assertiveness	Attentiveness	Behavioural skills	Capacity for lifelong learning	**Collaboration skills**
Commitment	Communication skills	Conceptualising skills	Confidence	Conflict resolution	Courtesy	Creativity
Critical thinking	Cultural awareness	Decision-making skills	Digital literacy	**Emotional intelligence**	Empathy	Entrepreneurship
Ethical skills	**Flexibility**	Foreign language proficiency	Good attitude	Good customer service	Good judgement	Handling uncertainty
Human management	Independence	Organisational skills	Prioritisation	Proactivity	Problem-solving	Professionalism
Quick information sharing	Reliability	Resilience	Resource management	Responsibility	Self-initiative	Social skills
Teamwork	**Thinking out of the box**	Time management	Transversal skills	Trust	Versatility	Work ethic

The Delphi technique in Mabe and Bwalya's (2022) study reached a consensus on 17 soft skills. The soft skills from the Delphi technique that were also identified in the systematic review are printed in **bold** in the list that follows and in Table 1.

Mabe and Bwalya (2022) identified these as:

1. leadership
2. **adaptability**
3. flexibility
4. **emotional intelligence**
5. honesty
6. integrity
7. **collaboration skills**
8. active learning
9. willingness to learn
10. **critical thinking**
11. **ethical** awareness for the use of data and big data

12. innovation (perhaps similar to **thinking out of the box**)
13. planning skills
14. data collection and analysis
15. the ability to find, access, evaluate and transform data into information
16. the ability to use new information tools
17. being familiar with industry trends in big data systems

Perhaps those skills listed as 14–17 are not truly soft skills but rather technical competency. Ironically the skills identified by Ehlers and Kellermann (2019) and those identified by Mabe and Bwalya (2022) (excluding 14–17) are representative of skills that are developed from birth and are taught through life experiences and social interactions, such as group work, rather than through a designed curriculum. The challenge for any institution of learning is to create opportunities in the curriculum for these soft skills to be developed through learning environments, assessment opportunities, projects, and tasks.

A 2022 draft document on Knowledge Management Competency Framework (KMSA, 2022) suggests that knowledge managers should develop behavioural, core and technical competencies aligned to the ISO30401 standard. In this draft framework (KMSA, 2022), behavioural competencies are those previously described in this paper as soft skills that are applicable across occupational levels and roles. Core competencies are described to be foundational and unique to KM and correlate somewhat with the KM responsibilities described by Rhem (2017), but also include KM activities such as conducting a knowledge audit. Technical competency is described in this draft framework as "functional and technical competencies that provide for different levels of complexity described in accordance with the occupational levels" (KMSA, 2022).

The Skills Framework for the Information Age (SFIA), currently in its 8th version is a globally consulted and collaborated framework that oversees the production, design and use of skills and competencies required by professionals who design, develop and implement, manage and protect data and technology in the digital world (S.F.I.A., 2023). SFIA is therefore already geared towards establishing level descriptors, competencies and skills for occupations and roles that drive the frontiers of the information age. SFIA can be divided into seven (7) levels of responsibility with level 1 being the lowest responsibility and level 7 being the highest. Responsibilities of employees appointed at level 1 would be to follow, level 2 assist, level 3 apply, level 4 enable, level 5 ensure and advise, level 6 initiate and influence and level 7 to set strategy, inspire and mobilise. These levels of responsibility intersect with generic attributes that characterise the level of responsibility in terms of autonomy, influence, complexity, knowledge and business skills generally expected of employee roles. In other words, level 7's description of autonomy, influence, complexity, knowledge and business skills would be tantamount to the role of Chief Knowledge Officer (CKO), while a level 2 role would be

assigned to a knowledge professional that maintains a KM database. In SFIA there is no level 1 role assigned for KM, which is indicative that the most basic level of responsibility is not present in KM. SFIA furthermore distinguishes between skills (behavioural and professional), and knowledge (technical, tools and methodologies, and context) depicting where experience intersects these. Qualifications and certifications are foundational to knowledge and skills and are graphically depicted in Figure 1.

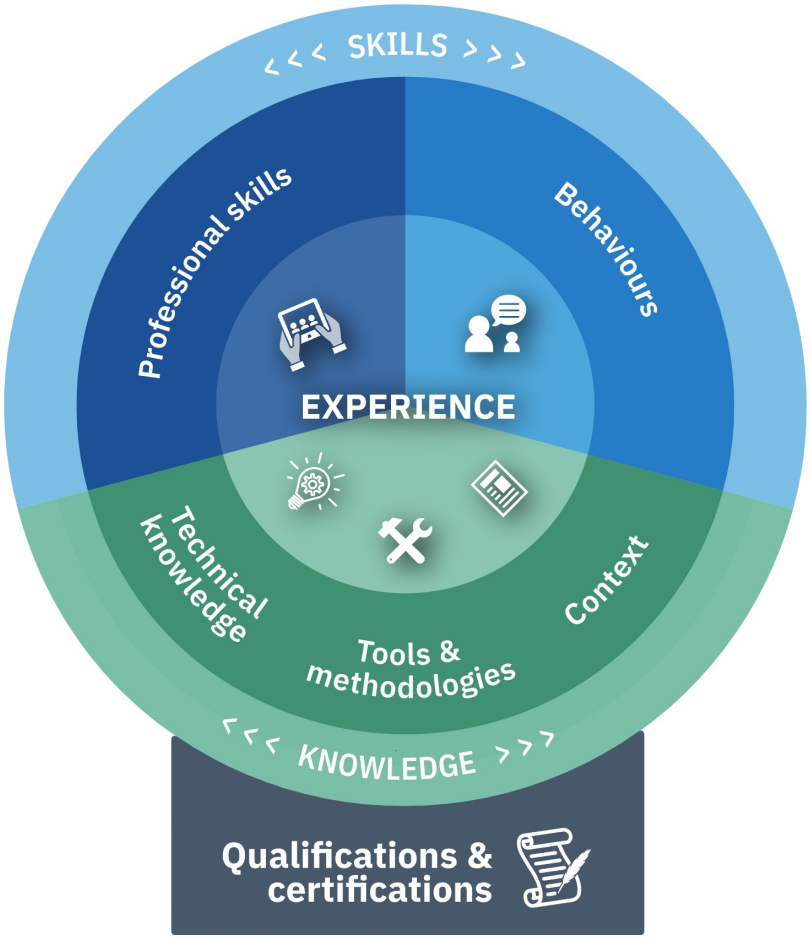

Figure 1: Graphical representation of knowledge, experience, skills, qualification, and certification (S.F.I.A., 2023)

While all the above frameworks and research on skills and capabilities for KM have been discussed (Ehlers & Kellermann, 2019; KMSA, 2022; Mabe & Bwalya, 2022; Rhem, 2017) the SFIA framework is selected for this research because it is a global common reference for skills and competency for the digital world. It is an evolving document developed by an evolving community of practice, extensively used and led by industry and business to describe the professional capability, skills proficiency and professional competency of digital world job roles and job architecture (S.F.I.A., 2023). As it is designed by practitioners for practitioners

it already represents the codified voices of the practitioners in their expectation of what incumbents should be adhering to which therefore addresses the first research objective of this study.

3 METHODOLOGY

SFIA is foundational to the methods applied in this study in order to address the second objective of the study namely to assess the current curriculum offerings and explore curriculum linkages for the multidisciplinary discipline of knowledge management. The SFIA KM level descriptors are provided in Table 2.

Table 2: SFIA KM Level descriptors (S.F.I.A., 2023)

Levels	Description
SFIA Level 2: Assist	- Maintains a KM database. - Leverages knowledge of a specialism to capture and classify content, taking expert advice when required.
SFIA Level 3: Apply	- Maintains KM systems and content to meet business needs. - Supports others to enable them to complete KM activities and form KM habits. - Supports changes to work practices to support the capture and use of knowledge. - Reports on the progress of KM activities. - Configures and develops KM systems and standards.
SFIA Level 4: Enable	- Organises knowledge assets and oversees the life cycle of identifying, capturing, classifying, storing, and maintaining assets. - Facilitates sharing, collaboration and communication of knowledge. - Implements specific KM initiatives. - Monitors the use and impact of knowledge. - Interrogates existing knowledge content to identify issues, risks, and opportunities.
SFIA Level 5: Ensure, advise	- Develops and implements KM processes and behaviours. - Provides advice, guidance, and support to help people to adopt and embed KM. Contributes to the definition of policies, standards, and guidelines for KM. - Evaluates and selects KM methods and tools. Promotes collaborative technologies, processes and behaviours to facilitate sharing of ideas and work knowledge. - Shares ideas and examples of existing practices. Implements KM at programme, project and team levels.
SFIA Level 6: Initiate. influence	- Develops organisational policies, standards, and guidelines for KM. - Champions and leads in the development of an organisational KM approach. Shares different approaches for knowledge sharing across communities of practice, business units, and networks. - Promotes knowledge-sharing through operational business processes and systems. Monitors and evaluates knowledge-sharing initiatives. - Manages reviews of the benefits and value of KM. Identifies and recommends improvements.

[continued …]

Table 2: [… continued]

Levels	Description
SFIA Level 7: Set strategy, inspire, mobilise	- Develops an organisation-wide KM strategy and leads the creation of a KM culture. - Embeds KM across business units and develops strategic KM capabilities. - Reinforces the importance of knowledge sharing by aligning individual and organisational objectives and rewards. - Identifies opportunities for strategic relationships or partnerships with customers, suppliers, and partners.

The KM level descriptors in SFIA clearly indicate the people, process, organisation and technology aspects typical in working with information and knowledge. The people-process-technology triad or the people-process-technology-content-governance quintet of knowledge-enabled organisations triggered the next multidisciplinary step of the methodology.

A desktop study using purposive sampling of study guides for the modules in the Department of Information Science at the University of Pretoria that includes KM theory and practice was thematically analysed. Six modules' study guides met the criteria. After data familiarisation, codes were generated and themes constructed and then revised. The KM content offered in each of the study guides was compared to the level descriptors of SFIA. The curricula for computer science and informatics was analysed to determine linkages or the potential for linkages for technology and tool development, system and process support for KM. These three desktop analyses form part of the past and present view into the curricula that can contribute to the skills development of KM graduates and addressed the second objective of the study.

The methodology applied in addressing the third objective of the research was to pilot a distributed digital ethnographic methodology that can be used to collect micro-narratives from employers as a partner, students as a partner, the KM practitioner as a partner and other academics involved in KM tuition. For this section of the research, Sensemaker® as a distributed digital ethnographic methodology was used to collect micro-narratives from a context and analysed to find emergent patterns from the perceptions and experiences of the contributor. Digital or virtual ethnographies are not really different from traditional ethnographies (Pickard, 2013). This paper reports on the results of 13 respondents who formed part of the pilot test of the collector instrument design using Sensemaker® as a distributed digital ethnographic methodology.

4 FINDINGS

The three desktop studies' findings are discussed followed by a brief discussion of the interim findings from the pilot study that shows why such a comparative study is necessary and will add value to the further development of the ethnographic collector.

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4.1 Knowledge management curricula: Information Science

Information science is a discipline that explores the behaviour and properties of information (Borko, 1968). "It brings together and uses the theories, principles, techniques, and technologies of a variety of disciplines" to address information problems (Williams, 1988). These disciplines can include computer sciences, informatics, cognitive science, psychology, linguistics, sociology, management science, library science and KM (Kebede, 2010; Williams, 1988).

The demand for KM material is growing in South Africa, particularly in the discipline of information science. As a multidisciplinary field, KM blends a variety of concepts, theories, and methods from several disciplines. Although the notion of KM began in the business world, it has drawn professionals from other disciplines, notably Library and Information Science (LIS), who are interested in KM (Husain & Nazim, 2015; Roknuzzaman & Umemoto, 2010). Professionals with an Information Science degree have the knowledge and skills to successfully collect, organise, analyse, and disseminate information. In a knowledge-driven economy, firms understand the need for using their intellectual capital to obtain a competitive advantage. Businesses can use KM strategies to utilise internal information, improve decision-making processes, stimulate innovation, and improve overall organisational performance.

Within the University of Pretoria, the Department of Information Science offers numerous undergraduate as well as postgraduate modules in KM. These modules include:

- **INL 130** (Personal Information Management) on the first-year level: This module introduces students to information and KM on a personal level. It endeavours to build students' understanding of the key definitions, concepts and theories related to KM.
- **INL 310** (Information Organisation) on third-year level: This module builds on students' understanding of information management from the first-year level and takes on a more practical perspective which includes the introduction of KM enablers in organisations (e.g. organisational culture and learning organisations).
- **INL 320** (Information and Knowledge Management) on third-year level: This module focuses on information and KM at an operational level and introduces information and KM at a corporate strategic level, thus, taking on an organisational perspective of KM.
- **INY 713** (Information and Knowledge Management (I)) on Honours level: This module delves deeper into the use and application of theoretical frameworks of information and KM at a corporate strategic level. It also covers information and KM enablers in organisations (e.g. leadership, corporate culture, organisational learning, strategy, laws and policies, measurement and information technology).
- **INY 716** (Information and Knowledge Management (II)) on Honours level: This module offers students the opportunity to integrate and apply their learnt knowledge (undergraduate curricula), lived experiences (personal and business environment), competencies and skills of KM to develop, implement and evaluate KM strategies. It introduces

students to advanced KM models and frameworks, a selection of KM theories, the role of KM in resiliency management, and trending issues in the field of KM.

- **MIT 890** (Data, Information and Knowledge Management) at Master's level: This module builds on students' understanding of Data Management (DM), Information Management (IM) and KM. It highlights the role of Information Technology (IT) in IM and KM, issues underlying the design and use of KM systems and advocates the benefits and value of designing a formal KM programme for organisations.

These modules follow a building block approach to encourage the development of students' understanding of KM from lower-level cognitive skills, starting on the first-year level, to higher-order cognitive skills on the Master's level. Therefore, each module forms the basis for the next offered in the information science curriculum. It promotes the movement of lower-order thinking to higher-order thinking. Thus, requiring students to move from memorising knowledge (e.g. what is KM) to applying, evaluating and creating new knowledge (e.g. KM strategy).

Applying the methodology mentioned in Section 3, Table 3 indicates the themes that were identified in correlation to the SFIA KM level descriptors.

Table 3: Undergraduate and postgraduate KM themes identified in the information science curriculum

Theme	Modules	SFIA KM level descriptors
Information Management (definitions, concepts and theories)	INL 130 (personal KM) INL 310 INL 320 (organisational KM) INY 713 MIT 890	Level 2 Level 3 Level 4 Level 3 Level 2
Knowledge Management (definitions, concepts and theories)	INL 130 INL 320 INY 713 INY 716 MIT 890	Level 2 Level 2 Level 3 Level 4 Level 3
Lifecycle of IM and KM	INL 130	Level 2
Information Overload Information Audits	INL 130 INL 130 INL 320 MIT 890	Level 2 Level 2 Level 4 Level 5
Knowledge Audits	INL 320 MIT 890	Level 2 Level 5
Sense- and Decision-Making	INL 320	Level 3
Knowledge Worker (Skills, responsibilities and Careers)	INL 130 INL 320	Level 2 Level 3
Organisation Culture and Learning	INL 310 INL 320 INY 713	Level 2 Level 3 Level 3

[continued …]

Table 3: […continued]

Theme	Modules	SFIA KM level descriptors
KM Processes, Models, Tools and Metrics	INL 320	Level 3 Level 4
	INY 713	Level 2
	INY 716	Level 3
KM Activities (Knowledge Creation, Capture, Coding and Sharing)	INL 320	Level 5 Level 6
	MIT 890	Level 3
KM Strategy	INL 320	Level 2
	INY 713	Level 3
	MIT 890	Level 5
Knowledge Society	INL 320	Level 2
	INY 716	Level 3 Level 4

In the following section, the KM links within the Department of Computer Science at the University of Pretoria are discussed.

4.2 Possible knowledge management links with Computer Science

The discipline of computer science considers the theoretical and practical foundations for the development of algorithms and software in order to store, manage and process information. The work a computer scientist engages in affects the daily life of every human being in the world today (ACM, 2023). A curriculum in computer science will therefore include modules in coding in support of structures and techniques to logically organise and manipulate the information, amongst other foundational modules (Marshall, 2017).

The modules presented in the computer science curriculum at the University of Pretoria that will enable the management of knowledge include modules that focus on (Marshall, 2011):

- Programming. COS 132 (Imperative programming) and COS 110 (Program Design: Introduction) provide the foundations in programming on which the modules at a higher year level rely.
- Organisation of data (or information) and the storage thereof in terms of data structures and algorithms; and structured, semi-structured and unstructured database systems. Data structures and algorithms (COS 212) make use of the programming building blocks to provide structures coded to manage the organisation of data/information in memory. The same algorithms and data structures are used to manage the efficient querying and retrieval of data/information from database systems (COS 221 (Database systems) and COS 326 (Advanced database systems)) for use in KM.
- Software development and the development of a relatively large project following a software engineering approach for a client. Software development and engineering rely on being able to model software systems. These software systems manage and present the

data and information in the data structures and database systems. These concepts are taught in COS 214 (Software modelling) and COS 301 (Software Engineering) respectively.

- Artificial intelligence. The principles required to develop and consequently design algorithms for a system that can assimilate data and information and populate knowledge systems are provided in COS 314. On the postgraduate level further artificial intelligence techniques, including clustering, heuristics, natural language processing and generative algorithms are presented.
- Programming. COS 132 (Imperative programming) and COS 110 (Program Design: Introduction) provide the foundations in programming on which the modules at a higher year level rely.
- Organisation of data (or information) and the storage thereof in terms of data structures and algorithms; and structured, semi-structured and unstructured database systems. Data structures and algorithms (COS 212) make use of the programming building blocks to provide structures coded to manage the organisation of data/information in memory. The same algorithms and data structures are used to manage the efficient querying and retrieval of data/information from database systems (COS 221 (Database systems) and COS 326 (Advanced database systems)) for use in KM.
- Software development and the development of a relatively large project following a software engineering approach for a client. Software development and engineering rely on being able to model software systems. These software systems manage and present the data and information in the data structures and database systems. These concepts are taught in COS 214 (Software modelling) and COS 301 (Software Engineering) respectively.
- Artificial intelligence. The principles required to develop and consequently design algorithms for a system that can assimilate data and information and populate knowledge systems are provided in COS 314. On the postgraduate level further artificial intelligence techniques, including clustering, heuristics, natural language processing and generative algorithms are presented.

Computer science does not directly present modules in KM. It does present modules that will enable the development of tools for specific KM requirements. The same analysis was done for Informatics.

4.3 Possible knowledge management links with Informatics

Informatics is concerned with the design and development of information systems that support organisational processes, to make them more efficient and effective. The field of informatics education is dynamic (Smuts & Hattingh, 2019) in support of the dynamic nature of the

organisational environments in which informatics graduates will be employed. Informatics graduates are required to understand, interpret and analyse the context of organisational system problems, have the technical skills to design and develop information systems to address organisational system problems, and have soft skills to accomplish this.

The informatics curriculum, therefore, needs to be designed in such a way as to expose students to the complexities of an organisational environment and develop technical and soft skills. At the University of Pretoria, the informatics curriculum that will enable KM focuses on:

- Systems analysis and design (INF 171 and INF 271). The first-year curriculum introduces students to systems thinking, business processes, systems development methodologies, requirements-gathering techniques, project management and modelling languages. Students are introduced to the concept of data and the flow and modelling of data through a system. The knowledge is internalised through small, often independent case studies. In the second year, the curriculum expands on these concepts by exploring the concepts more in-depth, in addition to learning additional modelling techniques. Students are introduced to input (interface) and output design principles. Students internalise their knowledge by working in a team to plan and design a solution to a complex case study using project management and modelling tools.

- Programming (INF 154, INF 164, INF 272 and INF 354). Students are not required to have any programming knowledge before commencing their informatics studies. Consequently, the first-year programming modules introduce programming concepts and foundational knowledge needed for the forthcoming years of study. In the second year of study, students apply the model view controller (MVC) paradigm for web development, connect to a database, do object-oriented programming, and create a full client-server web-based application. During the final year of study, students are required to learn an additional programming language and advanced concepts that will enable them to choose a programming environment in which they can deliver their capstone project.

- Database design and development (INF 214 and INF 261). One of the key components of an Information System is a database. Students are introduced to the concept of data and the modelling of data in their first-year systems analysis and design modules. In the second year, students are required to extend their knowledge to the design and development of a relational database.

- Elective subjects. Students are required to combine their informatics modules with different streams of electives, depending on their interests. However, all of the informatics students are required to have an introduction to Business Management.

- Capstone module (INF 370). The learning across the above-mentioned learning areas is presented in a scaffolded approach (Matook et al., 2023) by exposing students to new terminology (data) and concepts in their first and second year of studies where they make

sense of it through case study scenarios. However, in their third year of study, students are required to demonstrate their knowledge through project-based learning (Weilbach & Hattingh, 2022), employing a capstone project for a "real-life" client. During the capstone project, students demonstrate the knowledge they acquired throughout their preceding years of study by planning, designing and developing a turn-key solution for a client with an existing business problem. Whilst working on set deadlines, students demonstrate their technical skills and soft skills, a requirement for "industry-ready" graduates (Smuts & Hattingh, 2019).

Similar to computer science, informatics does not have specific KM modules on the undergraduate level, it rather presents modules that promote the transfer and conversion of knowledge. However, informatics offers a module dedicated to Data, Information and Knowledge Management (MIT 846) in the Master's (with coursework) programme. A requirement for this programme is that students need work experience within an Information Technology (IT) role for a required number of years. The reason for this requirement is that the programme, and the module specifically, require that students understand the importance of knowledge as an organisational asset. The module provides students with an overview of KM, and how IT can be used to enable KM. It further exposes students to the appropriate data analytics methods and modelling techniques.

Through the three desktop studies the existing curriculum offerings and the connections with KM were analysed. The second part of the methods applied in the research forms a part of ongoing research to collect ethnographic narratives from employers as a partner, students as a partner, the KM practitioner as a partner and other academics involved in KM tuition. Sensemaker® as a distributed digital ethnographic methodology was piloted and these results are reported here.

4.4 Interim curricula results from a global perspective

The first contributors to this portion of the research were participants that were part of a panel discussion on making sense of the KM curriculum. This group of 13 academic respondents (Table 4) formed part of the pilot test of the instrument designed as a collector. Their data is reported as an indication of why such a comparative study is necessary and will add value to the further development of the ethnographic collector.

As an ethnographic approach, Sensemaker® enables the capture of the multiplicity of voices in what they notice and observe in their encounters, speculative thinking and experiences of the KM curriculum and the changing demands for KM competencies in the workplace. This has the potential to complement and expand on the thematic analysis of the curriculum as approved by the university (and other relevant authorities) and informed by standards and frameworks. The Sensemaker® results can be used to clarify and contextualise the thematic analysis but also have the potential to identify potential discrepancies, gaps, redundancies and lack of coherence between the approved curriculum and the curriculum as experienced by academics, the student and the KM practitioner in the workplace. Sensemaker® gives access to

Table 4: Profile of responses

I am located in		
Sub-Saharan Africa	8	62%
North America (US & Canada)	3	23%
Europe and UK	1	8%
Prefer not to say	1	8%
In my institution, KM is situated in		
Information Science programmes	9	69%
IT programmes	3	23%
LIS programmes	2	15%
Business and management programmes	–	
Other	–	
My reflection is mostly on		
KM curricula in my institution	5	38%
KM curricula in general	4	31%
N/A	4	31%
Who should hear about my entry		
Institutions across the world	8	62%
N/A	3	23%
Only my department or institution	2	15%
Other institutions in my country	–	
Other institutions in my region	–	

everyday forms of social knowledge (thoughts and experiences) and helps reveal elements that inform the decisions and actions that shape our realities, collectively painting a bigger picture of perspective on a given issue (Snowden et al., 2021). It enriches and nuances captured thoughts and experiences (called micro-narratives or stories), as respondents are invited to self-analyse and interpret them via different forms of signifiers such as triads, dyads, and multiple-choice questions (see Figure 2 and the forthcoming discussion). The quantitative data collected through these signifiers provides a means to profile, analyse and compare the nature and prevalence of demands on the KM curriculum from the relevant voices in narrative or qualitative form.

With the small sample size of this pilot collection, comparative analysis based on demographic categories, such as region, is not included in the analysis. The profile of responses received is summarised in Figure 2.

The first emerging pattern from the preliminary results shows that the perception from academics is that the KM curriculum development should focus on functional knowledge and

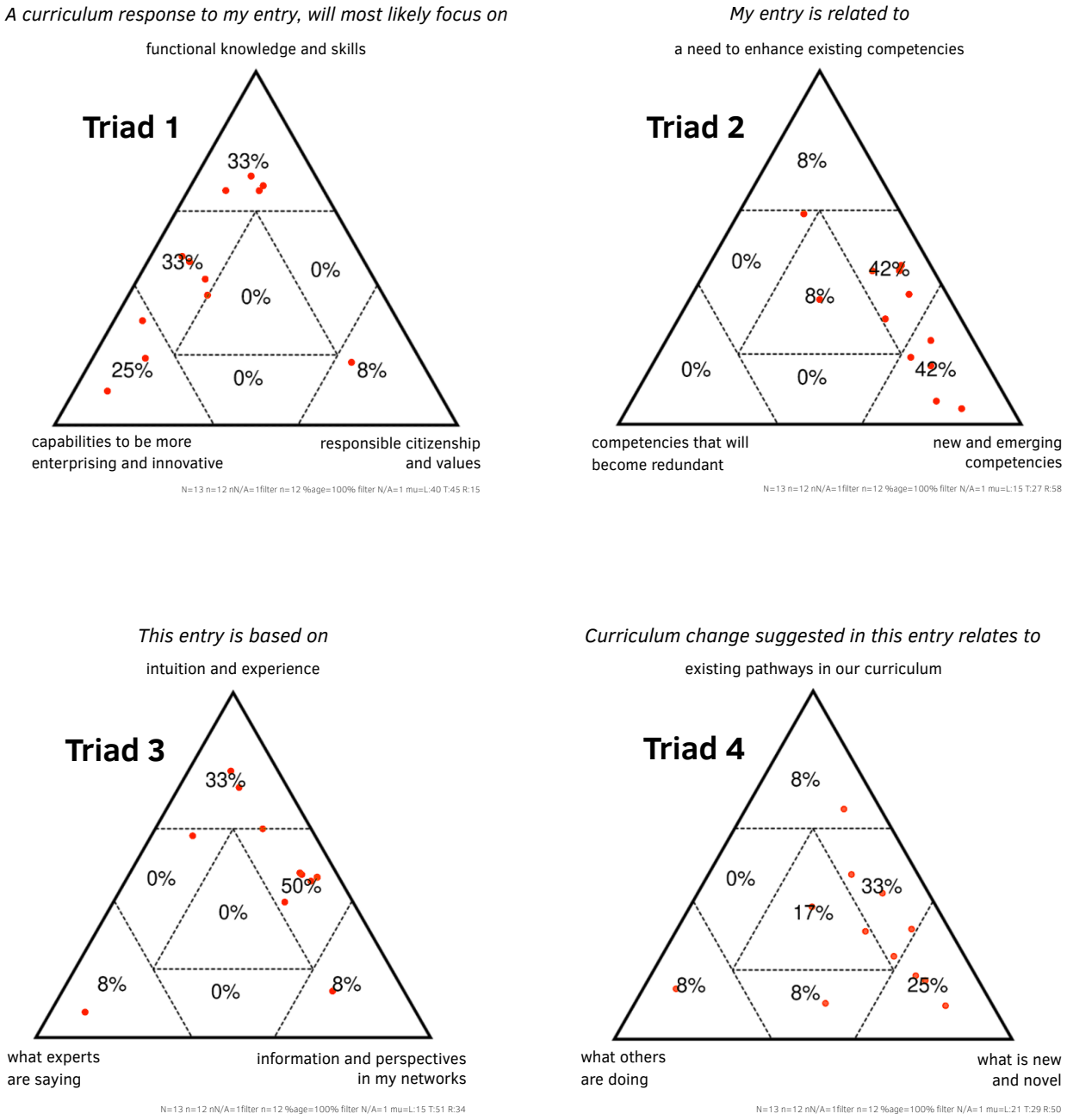

Figure 2: Overview of results from the triads

https://doi.org/10.18489/sacj.v36i1.18880

skills combined with the capabilities to be more enterprising and innovative (Figure 2, Triad 1). The low prevalence of *responsible citizenship and values* in Triad 1 requires further analysis in comparison with the perceptions from a broader pool of academics, students and practitioners, to ascertain if there is a potential negligence or understatement of this aspect in the outlook on the KM curriculum going forward in academic circles or if this aspect is already sufficiently covered. The outlook as represented in Triad 2 indicates that academics acknowledge that the curriculum should take cognisance of changes to existing competencies (42%), as well as new and emerging competencies (42%). The perspective in Triad 4 is that these are both building on existing competencies covered in the curriculum (33%) and inclusion of new content in the curriculum (25%). There is, in this initial pool of respondents, no explicit recognition of potential redundant competencies that should be removed from the curriculum in Triad 2.

The evaluation of the KM curriculum by academics as either faddish (42%) or stagnant (58%) in Dyad 1 (Figure 3), stems then from the need to update or expand on existing competencies to be relevant to the new and emerging competencies perceived to be required in the workplace, and not the exclusion of potentially redundant competencies that are included in the curriculum. This pattern also requires further inspection and comparison with more voices from all co-creators of the curriculum.

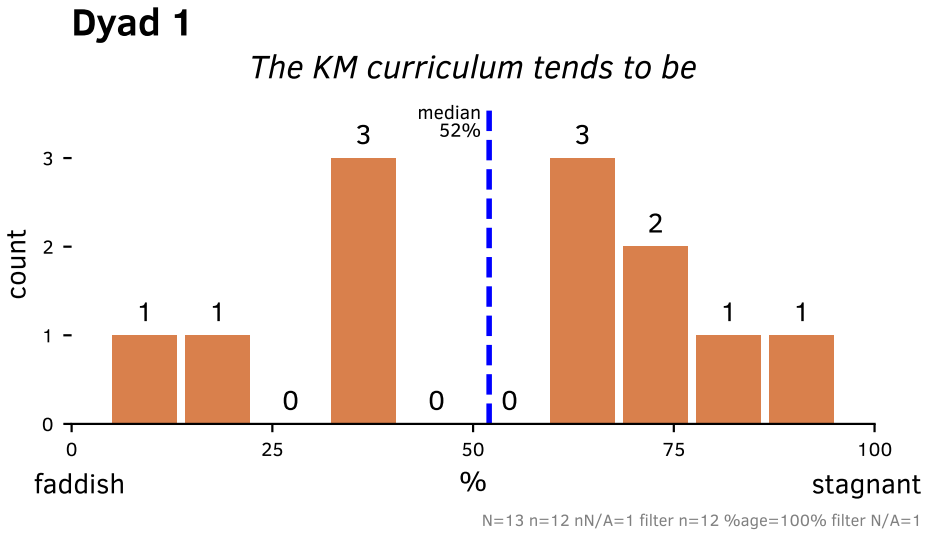

Figure 3: Overview of results from the dyad

A second emerging pattern shows a pattern of expansion and update of the existing curricula (labelled as existing pathways) in Triad 4, which is similar to the pattern in Triad 2. There is also a correlation in the perception that KM Curriculum development will be about what is new and novel (Triad 4), and new and emerging competencies (Triad 2). New and emerging competencies are of higher prevalence (42%) than the perception of what is new and novel for the KM curriculum (25%), which suggests that the perception is that the demand for

capabilities from the workplace in the context of accelerated change will not be completely disruptive and will to a large extent be an adaptation of the existing curricula (33%)in Triad 4). A pattern that is relevant to the transdisciplinary nature of this study, is a low attribution of noticings and reflections that are informed by experts (Triad 3) or by others (Triad 3). This could be indicative of a siloed approach in curriculation, and a need for comparative analysis across curricula and actors as is proposed in this study. It will also enhance and supplement the formative role of autobiographical referencing in curriculum development and enactment which is a marked pattern in Triad 3 where 33%)indicated that their curriculum reflections are based on intuition and experience (label selected as a proxy for autobiographic memory or referencing) and a further 50%)that is based on a combination of intuition and experience with information in their networks that includes students, industry partners and practitioners. Autobiographic references are thus a strong filter for information from networks. The role of autobiographic referencing in curriculation is discussed by Short (1991). It is recommended that the signification framework is reviewed to include a signifier to gauge the potential implications of siloed tendencies as experienced by students and practitioners, like duplication, potential confusion and difficulty for students to understand and bring together the synergies in the curricula of different subjects in a programme and demands of the workplace.

The third pattern is based on a thematic analysis of the narrative fragments offered by the respondents. The diversity of the fragments received, even from such a small sample in the pilot, is a positive indicator of the value of the Sensemaker® method as part of a curriculum study. Three themes were identified:

- The demand to be enterprising and innovative is supported by the necessary functional skills (Triad 1), to be able to keep up with the development of new technologies, methods and societal needs such as more accessible knowledge for those with disabilities.
- The second theme is related to the first theme and speaks to the relevance and demand for soft skills to be able to keep up and respond to the changing demands.
- The last theme puts the identity and understanding of KM as a distinct discipline and practice on the agenda, and how KM relates and interacts with other disciplines and practices. This theme also supports the need for a transdisciplinary curriculum study that is informed by a multiplicity of voices.

These interim results from the pilot study allow for the further development of the collector and will be reported on once a larger sample has been collected.

4.5 Summary of the findings

The desktop analysis first revealed that the information science curriculum offering for KM focuses teaching concepts on the SFIA level descriptors 2 and 3 mostly with limited teaching happening for levels 4, 5 and 6. While this is to be expected considering that higher levels of

SFIA level descriptors require job experience, there are most likely opportunities to develop curriculum offerings in these levels, especially postgraduate curriculum levels.

With information science mostly focussed on the people side of the people-process-technology triad the desktop study further emphasised the potential for process and technology linkages that could collaborate with computer science and informatics.

The pilot study confirmed Sensemaker® as a potentially valuable ethnographic methodology and while the 13 academic responses already revealed interesting patterns as indicated in Section 4.4 the pilot now needs to be rolled out to collect micro-narratives from all relevant curriculum co-creators that have been identified.

5 CONCLUSION

This project afforded the authors the opportunity to critically reflect on the current reality of curriculum design for KM practitioners. By assessing the future skills discourse and comparing current curricula to what is potentially expected to be needed in future, dedicated academics critically question the relevance of content and tuition for graduates. The research also afforded the opportunity to analyse the Sensemaker® collector in its piloting stage to test the applicability of the instrument for further collection from co-creating curriculum partners as the multitude of voices that should be acknowledged and listened to in the process of curriculum design.

As uncertain as the future always has been, the reality remains that institutions of higher learning are required to push the boundaries by offering qualifications that are relevant to whatever the future may hold. Graduates need to be skilled to face the future. Although foundational and technical knowledge, or discipline tools and methodologies are needed, it has become clear that it is through behaviours and soft skills that graduates will find the real resilience to face whatever the future may hold.

This study is at its inception and the collective voices of all co-create curriculum partners are needed to form a holistic view of what is required to mould the KM professional that would serve knowledge workers in Society 5.0. Without endangering the freedom of academics and researchers to develop curricula at the frontiers of a discipline, the student, industry and KM practitioner as a partner are now needed more than ever before to co-create the curriculum for the KM practitioner of the future.

References

ACM. (2023, March). ACM/IEEE/AAAI joint task on computing curricula [Accessed 16 July 2024]. https://csed.acm.org/wp-content/uploads/2023/03/Version-Beta-v2.pdf Computer Science Curricula 2023 (Beta).

Borko, H. (1968). Information science: What is it? *American Documentation*, *19*(1), 3–5. https://doi.org/10.1002/asi.5090190103

Bovill, C. (2020). Co-creation in learning and teaching: The case for a whole-class approach in higher education. *Higher Education, 79*(6), 1023–1037. https://doi.org/10.1007/s10734-019-00453-w

Dervin, B. (1992). From the mind's eye of the user: The sense-making qualitative-quantitative methodology. *Qualitative research in information management, 9*(1), 61–84. https://search.worldcat.org/en/title/733067211

Dervin, B. (1983). An overview of sense-making research: Concepts, methods, and results to date [Accessed 15 July 2024]. https://www.ideals.illinois.edu/items/2438/files/Dervin83a.htm

Dervin, B. (1996). Given a context by any other name: Methodological tools for taming the unruly beast. *ISIC'96 Information seeking in context*. https://www.ideals.illinois.edu/items/2438/files/Dervin96c.htm

Ehlers, U., & Kellermann, S. (2019). Future skills: The future of learning and higher education – Results of the International Future Skills Delphi Survey [Accessed 15 July 2024]. https://nextskills.wordpress.com/future-skills-report-2019/

Gerber, A., Smuts, H., & van der Merwe, A. (2021). Society 5.0: This is why it absolutely does matter [ITWeb] [Accessed 18 June 2024]. https://www.itweb.co.za/content/j5alr7QaQzX7pYQk

Husain, S., & Nazim, M. (2015). Exploring the need of knowledge management education within library and information science educational courses: An Indian perspective". *New Library World, 116*(11), 711–727. https://doi.org/10.1108/NLW-07-2015-0051

Kebede, G. (2010). Knowledge management: An information science perspective. *International Journal of Information Management, 30*(5), 416–424. https://doi.org/10.1016/j.ijinfomgt.2010.02.004

Klein, G., Moon, B., & Hoffman, R. (2006). Making sense of sensemaking 2: A macrocognitive model. *Intelligent Systems, 21*(5), 88–92. https://doi.org/10.1109/MIS.2006.100

KMSA. (2022, April). In the know – newsletter of Knowledge Management South Africa (K. Chauke, Ed.) [Accessed 16 July 2024]. https://www.kmsa.org.za/_files/ugd/44f1b0_6d64a45b5a9a4937aa2f32f23cfa0c63.pdf

Mabe, K., & Bwalya, K. (2022). Critical soft skills for information and knowledge management practitioners in the fourth industrial revolution. *South African Journal of Information Management, 24*(1), 1–11. https://doi.org/10.4102/sajim.v24i1.1519

Marshall, L. (2011). Developing a computer science curriculum in the South African context. *Computer Science Education Research Conference 2011, CSERC 2011*, 9–19. https://dl.acm.org/doi/10.5555/2043594.2043595

Marshall, L. (2017). A topic-level comparison of the Association of Computing Machinery/ Institute of Electrical and Electronic Engineers computer science curriculum volumes. *SACLA 2017, Revised selected papers in Communications in Computer and Information Science, 730*, 309–324. https://doi.org/10.1007/978-3-319-69670-6_22

Matook, S., Wang, Y., Koeppel, N., & Guerin, S. (2023). Metacognitive skills in low-code app development: Work-integrated learning in information systems development. *Journal*

of Information Technology, *39*(1), 41–70. https://doi.org/10.1177/02683962231170238

Pickard, A. (2013). *Research methods in information*. Facet.

Pirolli, P., & Russell, D. (2011). Introduction to this special issue on sensemaking. *Human–Computer Interaction*, *26*(1), 1–8. https://doi.org/10.1080/07370024.2011.556557

Rhem, A. (2017). *Knowledge management in practice*. CRC Press.

Roknuzzaman, M., & Umemoto, K. (2010). KM education at LIS schools: An analysis of KM master's programs. *Journal of Education for Library and Information Science*, *51*(4), 267–280. http://www.jstor.org/stable/25764643

Schwab, K. (2016). The fourth industrial revolution: What it means and how to respond [World economic forum] [Accessed 3 June 2024]. https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/

S.F.I.A. (2023). Skills framework for the information age [Accessed 16 July 2024]. https://sfia-online.org/en/sfia-8

Short, E. (Ed.). (1991). *Forms of curriculum inquiry*. SUNY Press.

Smuts, H., Gerber, A., & Merwe, A. (2022). The Society 5.0 landscape and research agenda. *Proceedings of the Society 5.0 Conference 2022 – Integrating Digital World and Real World to Resolve Challenges in Business and Society*, *84*, 153–168. https://doi.org/10.29007/qz1m

Smuts, H., & Hattingh, M. (2019). Towards a knowledge conversion model enabling programme design in higher education for shaping industry-ready graduates. *ICT Education: 47th Annual Conference of the Southern African Computer Lecturers' Association, SACLA 2018*, *47*, 124–139. https://doi.org/10.1007/978-3-030-05813-5_9

Snowden, D., Greenberg, R., & Bertsch, B. (2021). When disease requires a complexity framework. In *Cynefin: Weaving sense-making into the fabric of our world*. Cognitive. https://thecynefin.co/library/cynefin-weaving-sense-making-into-the-fabric-of-our-world/

Snowden, D. (2005). Multi-ontology sense making: A new simplicity in decision making. *Journal of Innovation in Health Informatics*, *13*(1), 45–54. https://doi.org/10.14236/jhi.v13i1.578

Weick, K., Sutcliffe, K., & Obstfeld, D. (2005). Organizing and the process of sensemaking. *Organization science*, *16*(4), 409–421. https://doi.org/10.1287/orsc.1050.0133

Weilbach, L., & Hattingh, M. (2022). Moving a project-based information systems development (ISD) capstone module online: Lessons learnt. In Y. Huang, S. Cheng, J. Barroso & F. Sandnes (Eds.), *Innovative technologies and learning. ICITL 2022. Lecture Notes in Computer Science* (pp. 334–342, Vol. 13449). Springer. https://doi.org/10.1007/978-3-031-15273-3_37

Williams, M. (1988). Defining information science and the role of ASIS. *Bulletin of the American Society for Information Science*, *14*(2), 17–19.