TechTrends
https://doi.org/10.1007/s11528-023-00870-w

ORIGINAL PAPER

Knowledge Systems Design (KSD): Rebranding the Field of Instructional Technology in the Education and Professional Development Community

Arlene Ramirez[1] · **Kimberly N. LaPrairie**[1] · **Waneta Hebert**[1]

Accepted: 7 June 2023

Abstract
A name for the field of instructional technology has long been debated. Terms such as learning design, educational technology, instructional systems design and learning systems have been used to describe the field over the past 100 years. With an exploration of the history of the field, this article rebrands the field as Knowledge Systems Design (KSD). Whether it is a knowledge of skills or concepts, knowledge is the end goal of all instruction. Systems are the processes through which knowledge is transferred to the learner. The learning processes necessary for knowledge creation must be carefully designed. Together, these three terms provide a description for an ever-changing field that transcends time and fully encompasses the transfer of knowledge in any setting.

Keywords Educational technology · Instructional technology · Knowledge management · Knowledge systems

Are definitions important? A good definition can be considered an asset if it is not vague, convoluted, or full of moving parts (Veerasamy, 2013). Definitions help us communicate more effectively by providing a common understanding of a product, position, concept, or even a field of study (Whitfield, 2012). Despite our best intentions, however, words can mean different things in different cultures and at different points in time. The famous Irish playwright George Bernard Shaw was quick to point this out when he mentioned that the division between America and Britain was their common language (Unified Compliance Mapping Team, 2018).

Shaw's proclamation, unknowingly, may have resonated with the sentiment of many in this area of study. How is this conversation about definitions relevant to the field of instructional technology? Upon closer examination of the literature associated with the definition of instructional technology, many derivatives of the term have surfaced just in the 21st century. Many scholars have discussed and even argued over the definition of the field for years (Dugger & Naik, 2001; Ely, 1963; Januszewski & Molenda, 2008; Reiser & Ely, 1997; Reiser & Dempsey, 2017; Saettler, 1998; Seels & Richey, 1994; Silber, 1972; Wagner, 2011). The definitions are many and ever-changing as the field evolves.

The definitions of what constitutes instructional technology may be well documented, but the reality is that many in the field are still unable to assimilate a standard term or its significance (Dugger & Naik, 2001). Since the use of technologies was incorporated into the creation, production, and delivery of educational and training experiences, practitioners and academics have been definitionally challenged (Wagner, 2011). The wide array of terminology creates even more confusion when attempting to distinguish the appropriate term amongst educational technology, systems design, instruction systems design, instructional theory, instructional technology, and numerous others that are often referenced under the same definition. This fact highlights a real need for a term that can be a long-term asset to the field; one that contains a description allowing for the freedoms and changes that will inevitably arise in the discipline.

As innovation continues there will undoubtedly be effects on the field by changing expectations, relationships, the resources used, and the role of the professional and technology. Past changes in the field have seen the definition becoming broader and open for future interpretation. Taking that into consideration, what if the conversation changed

✉ Arlene Ramirez
Axs272@shsu.edu

[1] College of Education, Sam Houston State University, Huntsville, TX 77341, USA

Published online: 17 June 2023

from just finding the definitive description for the field to finding new factors that should be considered? The recent term knowledge management (KM) is a scheme that involves making the use of tools [technologies] to create products and resources that represent knowledge to achieve specific objectives (Alavi & Leidner, 2001; Qwaider, 2011; Sammour et al., 2008). A KM system focuses on the human aspect of knowledge creation through collaborative efforts and incorporates technology as opposed to making it the focal point. KM tools and systems, such as computer supported collaborative work environments, data management and mining, are now being used in designing and developing instructional technologies (Baker, 2014; Foroughi, 2015; Spector & Edmonds, 2002).

The Association for Educational Communication and Technology (AECT) is a premier group in the world of education, instruction, and technological processes. AECT's professional membership includes "instructional designers, educators and professionals who provide leadership and advise policymakers in order to sustain a continuous effort to enrich teaching and learning" (AECT, 2022, About Us section, para. 1). In 2008, AECT revised its definition of Educational Technology to the following: "the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological process and resources" (Januszewski & Molenda, 2008, p. 1). This most recent AECT definition is broad and more open to freedom of interpretation. What if the definition of the field were expanded beyond the study, practice, and measurement of performance through the use of technological process and resources to include the creation, transfer and sharing of knowledge. Is there a place for the integration of knowledge management and instructional technology—Knowledge Systems Design (KSD)?

Historical Perspective of Educational Technology

Technology can be defined as "the practical application of knowledge, especially in a particular way" and "a capability given by the practical application of knowledge" (Merriam-Webster, 2022c). In terms of this definition, education has used technology since pre-historic times, where it consisted of cave drawings to pass on knowledge. Moving forward to more recent history, the handheld slate, the educational technology of the 1800s, was followed by the chalkboard. In 1915 silent film was the latest technology considered in education, which led to the Visual Instruction Movement from 1918 – 1928 (Barbousas, 2009; Howard & Mozejko, 2015; Ives et al., 1997; Johnson, 2015;). Thomas Edison, an inventor and visionary in 1922, predicted that "the motion picture is destined to revolutionize our educational system" and further elaborated that "[s]cholars will be instructed through the eye. It is possible to teach every branch of human knowledge with the motion picture" (Oppenheimer, 2003, p. 3). While Edison's prognostication did not materialize during this time, the early adoption of film for educational purposes created the dialogue which began the concept of educational technology as a field and profession. While the primary technology was visual, critical components of educational technology as a field of study were initiated during this period.

Professional journals, research studies, and professional organizations related to the study of visual learning made their debut during this time. The National Academy for Visual Instruction (NAVI) and the Visual Instruction Association of America (VIAA) were founded, and their membership consisted of professionals in the field of visual instruction (National Academy of Visual Instruction, 1922 as cited in Johnson, 2015). In 1918 Reel and Slide was the first journal devoted to visual instruction and one year later it became Moving Picture Age. In 1921, Educational Screen was published by NAVI with the claim of being an independent magazine focused on the new influence in national education—visual instruction. During this same time NAVI also published 1001 Films, a guide for educators on picture films. Several of the journals were short-lived, as those in the educational ranks supporting the field were in the minority and funding became an issue *(Barbousas, 2009; Johnson, 2015).* Research on the specifics of the field also took place. In 1924, F. Dean McClusky published the first national survey on visual instruction for the National Education Association (NEA). The survey detailed salaries, positions, departments budgets, equipment, distribution methods and procedures used by visual instruction departments (Bowling Green State University, n.d.).

In 1923, the NEA established the Department of Visual Instruction (DVI), the beginning of today's AECT. The group was formed as interest in the visual education movement was more prominent, and the motion picture industry encouraged the use of film for educational purposes and provided financial support. As theory and methodology evolved around this aspect, so did the terminology. Audio-visual education became prevalent pre-World War II when films were used to train the military (Good, 2016). Hoban et al.'s (1937, as cited in Reiser, 2001) book Visualizing the Curriculum provided the first definition of the term which defined visual aid and its purpose:

> A visual aid is any picture, model, object or device which provides concrete visual experience to the learner for (1) introducing, building up, enriching, or clarifying abstract concepts, (2) developing desirable attitudes, and (3) stimulating further activity on the part of the learner. (p. 9)

This definition highlighted that visual learning was equal to using textbooks and instructors in education. Equally important to note in the description is the third characteristic which describes the importance of engaging the learner, a concept that was not necessarily a common objective at that time.

In 1947, DVI changed its name to the Department of Audiovisual Instruction (DAVI); the new name signaled a shift in perspective as terminology evolved and moved away from audiovisual materials toward instructional media (Reiser & Ely, 1997; Saettler, 1998). Excluding the term audiovisual from the definition was not universally accepted and was disputed and cause for much discussion. In 1963, DAVI changed the terminology again, introducing the term audiovisual communications. In *The Changing Role of Audiovisual Process in Education: A Definition and Glossary of Related Terms* (Ely, 1963) audiovisual communication was defined as a branch of educational theory where the focus was on the design and use of messages which control the learning process. The definition further explained what constituted audiovisual communications:

> (a) the study of the unique and relative strengths of both pictorial and nonrepresentational messages which may be employed in the learning process for any purpose: and (b) the structuring and systematizing of messages by men and instruments in an education environment. These undertakings include the planning, selection, management and utilization of both components and entire instruction systems. (p. D-22)

Despite the well-defined term, other terms emerged within the field, such as scholarly communication and instructional technology. Some viewed instructional or educational technology as a means for solving instructional problems, and others found it as the application of science to instructional practices (Reiser & Ely, 1997).

The continued discussion and evolution of the field did not go unnoticed; in 1968, the Lydon B. Johnson administration created the Presidential Commission on Instructional Technology. The group's primary purpose was to evaluate whether technology was of value to education. Overall, the commission had a broad scope, but in their report, *To Improve Learning* (1969), the first item was to define instructional technology. However, they provided not one but two definitions. The first, the basis for the analysis provided in the report, was described as more familiar:

> In its [*Instructional Technology*] more familiar sense, it means the media born of the communications revolution which can be used for instructional purposes alongside the teacher, textbook, and blackboard. In general, the Commission's report follows this usage. In order to reflect present-day reality, the Commission has had to look at the pieces that make up instructional technology: television, films, overhead projectors, computers, and the other items of 'hardware' and 'software' (to use the convenient jargon that distinguishes machines from programs). In nearly every case, these media have entered education independently, and still operate more in isolation than in combination. (p. 1)

The second definition was considered less familiar and went beyond a particular medium or any specific tools:

> In this sense, instructional technology is more than the sum of its parts. It is, a systematic way of designing, carrying out, and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning and communication, and employing a combination of human and nonhuman resources to bring about more effective instruction. The widespread acceptance and application of this broad definition belongs to the future. (p. 1)

The first definition seemed consistent with the one presented by DAVI in 1963 (Reiser & Ely, 1997). In contrast, the second definition put forth specifics that had not been incorporated in previous explanations of the field. The description purports the use of specific objectives based on research and evaluating these outcomes on learning and teaching. Another critical consideration was recognizing the integration of both human and non-human resources and how these are equally important for effective instruction.

After the commission's report, there was still no consensus on the field's name. Communication was still a necessary component along with integrating educational technology for any future definition. In 1971, DAVI changed its name to AECT, highlighting the importance of communication and technology for the field's future. However, the name change did not stop others from searching for the correct definition. Other organizations and scholars still aimed to find a more accurate field description. In 1970, Kenneth H. Silber (as cited in Ely, 1983) provided a definition that had some disparity with the current 1963 interpretation but had some of the aspects of the second annotation from the 1969 Presidential Commission on Instructional Technology Report:

> Instructional Technology is the development (research, design, production, evaluation, support-supply, utilization) of instruction system components (messages, men, materials, devices, techniques, settings) and the management of that development (organization, personnel) in a systematic manner with the goal of solving education problems. (p. 36)

Silber's 1972 paper, *Technology and Freedom*, continued with the theme of thinking about technology as a machine or process, discouraging individuals from emphasizing these

while excluding the crucial element—people. He considered this as the individual abdicating their responsibility for being engaged and becoming aware of the effect of technology on themselves and society and, if necessary, changing the direction of technology. He further noted that it was impossible to opt out of technology. Still, it was possible "to have either a technology where devices and processes served people, or a technology where people served devices or processes" (p. 30). Silber challenged whether true educational technology was operating as planned or distorted. He noted that teaching provided information that was unaccountable, not measured, mechanical in delivery and did not consider the student's needs. While he agreed educational technology addressed the issues of accountability and measurement, it was still lacking in meeting a student's need. Why? Silber felt the learner had no freedom to determine their path or their needs. Therefore, he felt educational technology was distorted and not being used to provide the learner with the most appropriate experience.

In 1972, AECT presented a new definition: "Educational technology is a field involved in the facilitation of human learning through systematic identification, development, organization and utilization of a full range of learning resources and through the management of these processes" (Ely, 1972 as cited in Reiser & Ely, 1997, p. 67). The revised definition changed "audiovisual communication" to "educational technology," and "learning resources" replaced "messages." As with Silber's definition, technology and the instructor needed to be equal, and the importance of management in the process was highlighted.

Four years later, in 1977, a Task Force on Definition and Terminology was created by AECT to review its 1972 definition. The task force was responsible "for giving both structure and sense to the application of technology to education" (AECT Task Force, 1977, p. xvii). Differences from previous descriptions were anticipated; however, the level of detail was not. The committee held true to its mandate and included 16 parts that only when combined would provide a complete characterization of educational technology. Each basic definition was explained in detail, and tables were provided that described the learning resources associated with the field and their relative functions, giving equal importance to people, materials, and devices (Reiser & Ely, 1997). The definition highlighted that educational technology was a complex integrated process and affirmed Silber's earlier position, underscoring the need for integrating the instructor, processes, and technology. Finding solutions to learning challenges as part of the field and the profession was also acknowledged, and the definition incorporated analysis as part of the process of finding solutions. This definition was "designed to include everything and to please everyone" (Saettler, 1998, p.55); however, many in the field did not fully embrace its complexity, as shown by Ely's (1983) description of the definition as "brash overextension" (p. 3).

The field progressed, and so did technology which fueled new approaches to instruction, such as collaborative learning. As experienced in the past, advances influence the field, and change occurs. In 1990, AECT again began to rework the field definition, and in 1994, a more concise characterization was presented, "Instructional technology is the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning" (Seels & Richey, 1994, p. 1). The new definition focused on five interrelated domains: design, development, utilization, management, and evaluation. These domains were connected to a theory or a practice. Unlike the 1977 definition, there was no mention of finding solutions, but more emphasis was placed on the field as an area of practice, research, and study.

A significant change was the shift from educational technology to instructional technology. The repositioning aimed to focus on using a term commonly employed in the field that was applicable in multiple environments, provided a fitting definition of the role of technology in education, and focused on instruction and learning. Technology and the instructor continued to be presented as an integrated component.

In the past, significant changes to the field of educational technology have prompted changes to the definition. The revisions centered around the focus of the meaning and the field, the responsibilities of professionals, the products, or resources they used, the role these products or resources played in instruction, and finally, the goal of the field (Reiser & Ely, 1997). The most recent revision to the definition occurred in 2008, and for these reasons just discussed. Educational technology returned as it was viewed as a more general term applicable to multiple settings, including those focused on training, "Educational technology is the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources" *(Januszewski & Molenda, 2008, p. 1)*.

The new version includes components of previous definitions but also differences. In the 2008 wording, the term study is used instead of research to provide a broader perspective. As it was deemed a way practitioners should approach the discipline, the ethical practice was added. Facilitating was incorporated to soften the perception of control over the learning process. Improving performance

was used to emphasize that there are many approaches to learning and assisting learners in increasing their knowledge and skills. Appropriate was used to clarify that the method or tool should fit the individual and the situation. Finally, the last words, technological process, and resources, were used to ensure understanding that tools outside of technology are not within the constructs of the field.

Others have continued their attempts at defining the term instruction in education and the use of systems. Recently, Robert A. Reiser and John V. Dempsey, in their 2017 book Trends and Issues in Instructional Design and Technology, coined the term "instructional design and technology" and defined it as "the analysis of learning and performance problems, and the design, development, implementation, evaluation, and management of instructional and non-instructional processes and resources intended to improve learning and performance in a variety of settings, particularly educational institutions, and the workplace" (pp. 4-5). Evaluating these two most current definitions, the latter definition from Reiser and Dempsey (2017) attempts to incorporate more specifics and to identify that this field, which they label differently, encompasses more than traditional schooling by applying any type of transfer of knowledge.

The significant growth of technology and digital innovation in the past few decades has “prompted many commenters to position digital technology as a key driver of societal development” (Selwyn, 2013, p. 5) and spurred new, trendy terms for the field. For example, user-centered design is defined by its move “towards more human-centered approaches to designing digital environments for learning” (Schmidt and Huang, 2022, p. 141). Meanwhile, the Learning Guild’s discussion on learning engineering purposefully leaves out the word technology to focus instead on the process (Goodell, 2019). Within the AECT websites, there lurks yet another definition for educational technology issued by the Definition and Terminology Committee which reads:

> Educational technology is the study and ethical application of theory, research, and best practices to advance knowledge as well as mediate and improve learning and performance through the strategic design, management, and implementation of learning and instructional processes and resources. (AECT, n.d.)

This definition supports the advancement of knowledge through the use of methodologies and processes and ultimately the development of competency through practical application. As Mishra and the Deep-Play Research Group (2012) noted, “whether it’s a stone-age tool, a Guttenberg printing press, the simple crayon, or a high-tech digital simulation, any form of technology is a tool for living, working, teaching and learning” (p. 14), and we need not lose sight of this when determining how to define the field.

Knowledge Systems

Knowledge systems and educational technology have similar backgrounds in that they both were present in the earliest civilizations. As technology advances, so does the need to harness, collect, create, and preserve knowledge. In organizations, the accumulation and management of employee knowledge are considered an asset. Knowledge systems provide a competitive advantage by promoting organizational learning and increasing effective decision-making (Rao and Osei-Bryson, 2007).

The American Productivity & Quality Center (APQC, 2021a) defines KM as "the application of a structured process to help information and knowledge flow to the right people at the right time...help[ing] employees efficiently and effectively find, understand, share, and use knowledge to create value" (What is Knowledge Management section, para. 1). Another definition is "the deployment of a comprehensive system that enhances the growth of an organization's knowledge" (Salisbury, 2003, p. 128). KM has become an important component to many organizations because of the volume of data that is available today that needs to be available to an end user, which could be an employee or a student. The COVID-19 pandemic increased remote and hybrid work and highlighted the challenges in collecting and organizing data into repositories. A September 2021 Knowledge Management Trends survey reflected that 34% of employees were frustrated when information repositories were disorganized, which diminished their ability to access knowledge needed to perform their job more effectively (APQC, 2021b). The same survey noted that 28% of leaders felt that KM was essential to reskill and upskill employees.

Knowledge management today is where instructional technology was in the 1930s, an emerging discipline. The same challenges faced by those trying to define educational technology are being faced today by KM as, to date, there is no industry-wide accepted definition or framework that aligns it with specific or various professions (Ives et al., 1997). Information or educational technology is used in the process of supporting knowledge creation. A goal of KM is to facilitate the convergence of implicit knowledge (i.e., culture, collaboration, etc.) into explicit knowledge (i.e., books, policies, procedures, regulations, etc.). In a way, that implicit knowledge is easily accessible and relevant to users and can be applied in problem-solving and creating a culture of organizational learning (Spector & Edmonds, 2002).

Mishra et al. (2009) noted that a “new way of thinking about technology that allows for flexibility of thought” is necessary to fully understand the use of technology in creating knowledge. In the educational field, KM can use

student-created knowledge and share it across courses, programs, and semesters, providing students the ability to learn from current and past students (Edmonds and Pusch, 2002). KM when combined with instructional design (ID) can increase the effectiveness of the latter. Consider that the field of ID has a wide span from assessing the learner's needs to developing the best approach for effective knowledge transfer, planning the delivery, and accessing the results to ensure the proposed outcome is achieved (Spector, 2002). KM in the context of instructional design or educational technology can support communication, coordination, collaboration, and control (Alavi and Leidner, 2001). KM supports these efforts by leveraging access to relevant information and subject matter experts, facilitating collaboration, and efficiently disseminating access to reusable learning artifacts. The advancements in the availability of storing and accessing information, such as cloud-based systems, learning management systems, and other course management software, have increased the opportunities for collaboration and sharing of knowledge. KM supports, through the use of technology, the "acquisition, generation, codification, storage, transfer, retrieval, and use of knowledge within organizations" (Qwaider, 2011, p. 62). While the concept of KM is not new, the opportunities that exist through the use of technology can significantly impact the field of instructional technology and design.

Rebranding the Field

The field of instructional technology has continued to evolve in the last decade amid constant technological advances. Predictions indicate further acceleration that will revolutionize learning and knowledge management (Foroughi, 2015). The field of instructional technology began with a focus on audiovisual technology. Much of the past change has focused on systems and how information has been presented to the learner. Technology aided in identifying solutions, facilitated this process, and engaged the learner (Salisbury, 2003). Today, technological advances are instead creating knowledge.

Internet technology has contributed to the speed at which advances have taken place. The use of Web 2.0 provided opportunities for sharing and collaborating with availability anytime and anywhere. Web 3.0 is promising "the seamless interconnection and autonomous coordination of massive number of computing elements and sensors, inanimate and living entities, people, processes and data through the Internet infrastructure" (Internet of Everything, 2022, IoE section, para. 1). The focus once again is on knowledge creation and management by virtually anyone.

Therefore, defining the field requires a different approach that is comprehensive and has prospicience, or else risks immediate obsolescence. A future interpretation of the field must consider the essence of learning in the digital age of the future, taking into account the following (Foroughi, 2015):

- The decreasing lifespan of knowledge, from its generation, introduction to its obsoletion.
- The speed at which knowledge is created through the internet and by the sources (i.e., individual people, businesses, and global organizations).
- The availability of open sources for information where traditionally these were found in universities, libraries, instructors, or textbooks.
- The shift from formal to informal education and learning is continuously happening via social interactions, networks, and multimedia.
- The need for expertise in finding needed knowledge versus factual knowledge.

If we just focus on the creation and transfer of knowledge, a broader, more all-encompassing term should be used to identify the focus of the field. In selecting a label, consideration should be given to one that can also transcend through the advances in the subject matter and still hold the same understanding and connotation, regardless of how the definition may be refined. Knowledge Systems Design (KSD) represents the creation and transfer of knowledge to the individual through the use of various methods that allow for the application of that knowledge that is supported through analytics and feedback. Knowledge Systems Design considers many facets that encompass the advancement of knowledge (Fig. 1). The environment and socio-economic factors involved in knowledge transfer must be considered as these may enhance or become detrimental to the process (Reychav & Weisberg, 2010). These extraneous factors will impact the methodology being adopted to initiate the motivation and knowledge transfer. Feedback and measurement play a pivotal role in moving on to the practical application

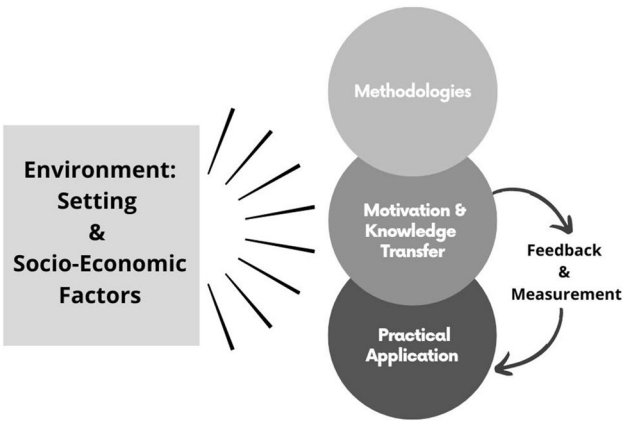

Fig. 1 The facets that encompass Knowledge Systems Design (KSD)

of the knowledge that has been acquired and, eventually, a higher level of competency (Lustri et al., 2007). Evaluating each word used in this proposed rebranding will provide a greater perspective and understanding of why this term is a unification of the expressions now used in this field of study.

Knowledge

Merriam-Webster defines knowledge as "fact or condition of knowing something with familiarity gained through experience or association" (Merriam-Webster, 2022b). The word knowledge illustrates the ultimate goal of any instruction, that of providing the optimal environment for an individual to learn a new skill or concept. In this instance, knowledge is defined as going beyond a simple understanding of a concept or skill to the ability of the learner to apply what has been learned. Strategically planned instruction can focus on an individual mastering tasks or concepts, resulting in knowledge. Individuals exposed to a sequence of learning environments (i.e., microworlds) will perform tasks with increasing complexity which then leads them to use these new skills to achieve competence or understanding of a concept (Gibbons, 2020, pp. 2802-2803). Knowledge is gained by transferring the how or the why through various methods to achieve the ultimate goal of instruction. To be clear, knowledge in this context does not imply that an individual will have experience in a field of study; instead, that instruction gives people the knowledge to gain understanding and perform activities that are further strengthened through practice and experience (Wilson, 2015).

The components of KM that have been discussed further cement the use of the word knowledge in a new descriptive of the field. Using technology to create systems that allow for collaborative learning helps create knowledge which can then be preserved and disseminated. The current AECT definition of the field proports the use of technology to facilitate learning and improve performance, which in essence is the creation of knowledge.

The use of knowledge encompasses much of the sentiment of previous descriptions of the field. Using the term is more inclusive, providing a broader reach and one that can transcend time.

Systems

A systems approach in the use of educational technology was first taken by the military in the post-war period, where they aimed to combine “the human element with the machine elements in man-machine systems” (Molenda, 2008, p. 13). Processes are important in instruction in order to effectively illustrate or present how to perform a new skill or introduce a concept or idea. Using systems as the second component of KSD was meant to be vague. Like AECT's 1994 definition, the term system is used to avoid specific references to "computers, artifacts or instruments" (Moore, 2006, p. 401), giving it a quality of instrumentalism, which is "the idea that anything that is used to accomplish work can be considered a tool, technology or instrument" (p. 402). Hickman (1990) explains that becoming a tool requires being used in the course of work, and if something is used in instruction, it can be deemed Instructional Technology. Using that premise, if a methodology, process, or tool can be used to effectively transfer knowledge via instruction or knowledge management, it can be defined as a system.

The definition of systems can be somewhat deceiving. In the context of technology, for some, the term immediately conjures images of computers processing data (Mishra et al., 2009). Others define systems as processes or a way of thinking (Goodman, 1997; Molenda, 2008). In considering the rebranding of the field of educational technology, careful consideration needs to be given to how this term is defined in relation to the other two components of KSD. Amissah et al. (2020) refer to a system as “a purposeful assembly of components” (p. 1) and define systems thinking as understanding the relationships between various components and their impact on intended and unintended outcomes within the context of a specific environment. A system can consist of using technology such as computers, social media, the internet, or cloud computing (Rao and Osei-Bryson, 2007; Silber, 1972). Systems can also consist of technology and human collaboration working together to achieve a specific outcome (Molenda, 2008). The role that systems play can also vary from one that focuses on observation, to the collection of data to that of analysis (Goodman, 1997).

The change in technology is swift and the associated terms change at equal speed. Recalling the work of Silber (1972), it is critical to consider that technology is not just hardware, software, or processes. The term system encompasses these and more importantly, the interaction of individuals. The systems approach is to “subdivide the instructional planning process into steps, to arrange those steps in a logical order, then to use the output of each step as the input of the next” (Molenda, 2008, p. 12). Utilizing this approach allows a need to be identified, communicated, and the solution developed or produced. Individuals need to have the ability to control the application of the results in their environment and to meet their needs.

Systems can also be flowcharts, infographics, step-by-step instructions, videos, recordings, or simply drawing a picture on a piece of paper. The ability to broaden our perspective to solve, articulate and address learning and design challenges is addressed through systems thinking, irrespective of technology. Regardless of future innovations or discoveries, the word systems can adapt and continue to be relevant in the term KSD.

Design

The final term in the new name KSD is design, the piece that puts together the systems that allow for the knowledge transfer to take place. Merriam-Webster's definition of design is "to create, fashion, execute, or construct according to plan" (Merriam-Webster, 2022a). There are several words in that definition that relate directly to the term KSD. First, in order to effectively transfer knowledge, systems will need to be created to facilitate this process. Second, the systems will need to be fashioned in order to execute the intended goal of knowledge transfer. Finally, to make sure the systems of knowledge transfer are constructed according to plan, there needs to be an element of feedback built in.

Design can have various definitions when considering educational technology. Instructional design and learning design are terms that are often used interchangeably (Saçak et al., 2022; Waqar, 2013). The latter, ID, is more focused in the development, assessment, and evaluating of learning while learning design centers on engaging the learner and creating an experience which can be enhanced through analysis of feedback and outcomes. Design can also encompass the physical environment in which the transfer of knowledge takes place such as a classroom, training room, or a virtual breakout room (Willoughby-Petit, 2021; Barrett et al., 2015).

Design is the key ingredient that binds the term KSD to provide systems that transfer and manage knowledge that consider the environment and the socio-economic factors involved. All of these are relevant in order to facilitate learning and knowledge creation. Design is the conduit that can allow knowledge to transfer and systems to transcend boundaries such as language, culture, and setting and enhance the learning experience and desired outcome.

The use of design in KSD reflects the intentional and strategic process of creating or improving the learning experience in a systematic and learner-centered approach that considers the learning environment (McNaught et al., 2012, Waqar, 2013). Together these three components, knowledge, systems, and design, provide a term that describes the goal of effective instruction to facilitate the transfer of knowledge to the learner. Understanding why each word was selected to develop the term KSD is key to understanding the definition of the term.

Considerations

The field of study known as Instructional Technology has been defined and redefined by many since the 1940s, when psychologists and educators were tasked with producing training materials en masse to ready troops for war. As culture and technological advances occur, the definition has been continually adjusted to meet what experts in the field deem to be an appropriate purpose of the field. The goal of what is known as Instructional Technology is primarily to foster the effective transfer of knowledge by various means of instruction, whether it is using technology or low-tech artifacts (Saçak et al., 2022; Mor et al., 2015). Defining this field requires a dynamic term that transcends time and does not lead the reader to perceive it is focused on one type of learning or one artifact (i.e., technology) to be the sole conduit of the knowledge to the learner. The definition used needs to incorporate the final goal clearly, the transfer of knowledge to the learner. Using the term Knowledge Systems Design provides an understanding of what the end result should be--that the creation of knowledge takes place. As defined, knowledge needs to include the applicability of what has been learned, and this is achieved by providing feedback and measurement to the learner and adjusting the methodology and systems accordingly to meet the ultimate objective of instruction, the transfer of knowledge, in any setting, which is achieved through the final component, design.

As the various aspects of the new term are discussed, new technologies such as machine learning and artificial intelligence will need to be incorporated as they become more commonplace, to support the words selected to describe the future of this industry. The goal of this discussion is to arrive at a definition that is meaningful and not vague, convoluted, or full of moving parts. A term that will clearly identify this field is an asset in the future of education.

Appendix A

Author Biographical Information

Arlene Ramirez is a Hospitality Industry Finance Professional who brings over 20 years of professional experience to the classroom at the C.N. Hilton College of Global Hospitality Leadership at the University of Houston. In 2019 Arlene founded Ascend, which focuses on curriculum development, delivering online learning, and certification programs designed to address opportunities for professional growth within organizations. She is currently a doctoral candidate in the Instructional Systems Design and Technology program at Sam Houston State University, Huntsville, Texas, USA.

Kimberly N. LaPrairie, Ph.D., is the Director of the Instructional Systems Design and Technology doctoral program at Sam Houston State University in Huntsville, Texas, USA. She has over 20 years of education experience focusing on technology integration to improve educational and training systems in organizational settings, instructor effectiveness, and content accessibility.

Waneta Hebert is an instructional designer and adjunct lecturer at the University of Houston. She started her career as a public-school English teacher before transitioning to higher education. With experience on all sides of instruction – as the student, the instructor, and the designer– Waneta is an expert in course design and instructional technology in K12 through higher education. She is a doctoral candidate in the Instructional Systems Design and Technology program at Sam Houston State University, Huntsville, Texas, USA.

Declarations

Conflicts of interests/Competing interests We wish to confirm that there are no known conflicts of interest associated with this publication, and there has been no financial support for this work that could have influenced its outcome. We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us. We confirm that we have given due consideration to the protection of intellectual property associated with this work and that there are no impediments to publication. In so doing, we confirm that we have followed the regulations of our institutions concerning intellectual property. We further confirm that the work covered in this manuscript has not involved any experiments on animals or human patients. We understand that the Corresponding Author is the sole contact for the Editorial process (including Editorial Manager and direct communications with the office). She is responsible for communicating with the other authors about progress, submissions of revisions, and final approval of proofs. We confirm that we have provided a current, correct email address which is accessible by the Corresponding Author.

References

Alavi, M., & Leidner, D. E. (2001). Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly, 25*(1), 107–136. https://doi.org/10.2307/3250961

American Productivity & Quality Center. (2021a). *Understanding knowledge management.*. https://www.apqc.org/resource-library/resource/understanding-knowledge-management/html

American Productivity & Quality Center. (2021b). *Knowledge Management Trends.* https://www.apqc.org/system/files/resource-file/2021-09/K011896%20Knowledge%20Management%20Trends%20Survey%20Report_0.pdf

Amissah, M., Gannon, T., & Monat, J. (2020). What is systems thinking? Expert perspectives from the WPI systems thinking colloquium. *Systems, 8*(1). https://doi.org/10.3390/systems8010006

Association for Educational Communication and Technology. (1977). *The definition of educational technology. AECT task force on definition and terminology.* (ED192759). ERIC. https://files.eric.ed.gov/fulltext/ED192759.pdf

Association for Educational Communication and Technology. (2022). *About us*. https://www.aect.org/about_us.php

Association for Educational Communication and Technology. (n.d.). *The definition and terminology committee*. https://aect.org/news_manager.php?page=17578

Baker, R. S. (2014). Educational data mining: An advance for intelligent systems in education. *IEEE Intelligent Systems, 29*(3), 78–82. https://doi.org/10.1109/mis.2014.42

Barbousas, J. (2009). The visual education movement: The emergence of visual technology in education. *International Journal of Learning, 16*(10).

Barrett, P., Davies, F., Zhang, Y., & Barrett, L. (2015). The impact of classroom design on pupils' learning: Final results of a holistic, multi-level analysis. *Building and Environment, 89*, 118–133. https://doi.org/10.1016/j.buildenv.2015.02.013

Bowling Green State University. (n.d.). *Nineteenth century technology for visual instruction.* Student Digital Gallery. https://digitalgallery.bgsu.edu/student/exhibits/show/literacy/visualinstruction

Commission on Instructional Technology. (1969). *To improve learning* (ED034905). ERIC. https://files.eric.ed.gov/fulltext/ED034905.pdf

Dugger, W. E., & Naik, N. (2001). Clarifying misconceptions between technology education and educational technology. *The Technology Teacher, 61*(1), 31–35. https://www.iteea.org/File.aspx?id=49264

Edmonds, G. S., & Pusch, R. (2002). Creating shared knowledge: Instructional knowledge management systems. *Journal of Educational Technology & Society, 5*(1), 100–104. http://www.jstor.org/stable/jeductechsoci.5.1.100

Ely, D. P. (1963). *The changing role of the audiovisual process in education—A definition and a glossary of related terms* (ED016409). ERIC. https://files.eric.ed.gov/fulltext/ED016409.pdf

Ely, D. P. (1983). The definition of educational technology: An emerging stability. *Educational Considerations, 10*(2), 2–4. https://doi.org/10.4148/0146-9282.1793

Foroughi, A. (2015). The theory of connectivism: Can it explain and guide learning in the digital age? *Journal of Higher Education Theory and Practice, 15*(5), 11–26. http://m.www.na-businesspress.com/JHETP/ForoughiA_Web15_5_.pdf

Gibbons, A. S. (2020). What is instructional strategy? Seeking hidden dimensions. *Education Tech Research Development, 68*, 2799–2815. https://doi.org/10.1007/s11423-020-09820-2

Good, K. D. (2016). Making do with media: teachers, technology, and tactics of media use in American classrooms, 1919–1946. *Communication and Critical/Cultural Studies, 13*(1), 75–92.

Goodell, J. (2019). Are you doing learning engineering – Or instructional design? *Learning Guild*. https://www.learningguild.com/articles/are-you-doing-learning-engineering-or-instructional-design/

Goodman, M. (1997). Systems thinking: What, why, when, where, and how? *The Systems Thinker, 8*(2), 6–7. https://thesystemsthinker.com/wpcontent/uploads/pdfs/080202pk.pdf

Hickman, L. A. (1990). *John Dewey's Pragmatic Technology*. Indian University Press.

Howard, S. K., & Mozejko, A. (2015). Considering the history of digital technologies in education. In M. Henderson, M. J. Henderson, & G. Romeo (Eds.), *Teaching and digital technologies: Big issues and critical questions* (pp. 157–168). Cambridge University Press.

Internet of Everything. (2022). The i*nternet of everything*. https://ioe.org/

Ives, W., Torrey, B., & Gordon, C. (1997). Knowledge management: An emerging discipline with a long history. *Journal of Knowledge Management, 1*(4), 269–274. https://doi.org/10.1108/EUM0000000004598

Januszewski, A., & Molenda, M. (Eds.). (2008). *Educational technology: A definition with commentary* ((2nd ed.) ed.). Routledge.

Johnson, W.G. (2015). "*A happier way of learning": The visual instruction movement, 1918 – 1928.* [Unpublished doctoral

dissertation]. Northern Illinois University. https://huskiecommons.lib.niu.edu/allgraduate-thesesdissertations/1
Lustri, D., Miura, I., & Takahashi, S. (2007). Knowledge management model: Practical application for competency development. *The Learning Organization, 14*(2), 186–202. https://doi.org/10.1108/09696470710727023
McNaught, C., Lam, P., & Cheng, K. F. (2012). Investigating relationships between features of learning designs and student learning outcomes. *Educational Technology Research and Development, 60*, 271–286. https://doi.org/10.1007/s11423-011-9226-1
Merriam-Webster. (2022a). Design. In *Merriam-Webster.com dictionary.* Retrieved August 12, 2022, from https://www.merriam-webster.com/dictionary/design
Merriam-Webster. (2022b). Knowledge. In *Merriam-Webster.com dictionary.* Retrieved August 12, 2022, from https://www.merriam-webster.com/dictionary/knowledge
Merriam-Webster. (2022c). Technology. In *Merriam-Webster.com dictionary.* Retrieved August 12, 2022, from https://www.merriam-webster.com/dictionary/technology
Mishra, P., & Deep-Play Research Group. (2012). Rethinking technology & creativity in the 21st century: Crayons are the future. *TechTrends, 56*(5), 13. https://doi.org/10.1007/s11528-012-0594-0
Mishra, P., Koehler, M. J., & Kereluik, K. (2009). Looking back to the future of educational technology. *TechTrends, 53*(5), 49.
Molenda, M. (2008). Historical foundations. In *Handbook of Research on Educational Communications and Technology* (pp. 3–20). Routledge.
Moore, D. (2006). The technology/inquiry typology: Defining instructional technology. *Journal of Interactive Learning Research, 17*(4), 401–406.
Mor, Y., Craft, B., & Maina, M. (2015). Introduction: Learning design: Definitions, current issues and grand challenges. *The Art & Science of Learning Design*, 9-26.
Oppenheimer, T. (2003). *The flickering mind: Saving education from the false promise of technology*. Random House.
Qwaider, W. Q. (2011). Integrated of knowledge management and E-learning system. *International Journal of Hybrid Information Technology, 4*(4), 59–70.
Rao, L., & Osei-Bryson, K.-M. (2007). Towards defining dimensions of knowledge systems quality. *Expert Systems with Applications, 33*(2), 368–378. https://doi.org/10.1016/j.eswa.2006.05.003
Reiser, R. A. (2001). A history of instructional design and technology: Part 1: A history of instructional media. *Educational Technology Research and Development, 49*(1), 53–64. https://www.jstor.org/stable/30220299
Reiser, R. A., & Dempsey, J. V. (2017). *Trends and issues in instructional design and technology* ((4th ed.). ed.). Pearson Education.
Reiser, R. A., & Ely, D. P. (1997). The field of education technology as reflected through its definitions. *Educational Technology Research and Development, 45*(3), 63–72. https://doi.org/10.1007/BF02299730
Reychav, I., & Weisberg, J. (2010). Bridging intention and behavior of knowledge sharing. *Journal of Knowledge Management, 14*(2), 285–300. https://doi.org/10.1108/13673271011032418
Saçak, B., Bozkurt, A., & Wagner, E. (2022). Learning design versus instructional design: A bibliometric study through data visualization approaches. *Education Sciences, 12*(11). https://doi.org/10.3390/educsci12110752
Saettler, P. (1998). Antecedents, origins, and theoretical evolution of AECT. *TechTrends, 43*, 51–57. https://doi.org/10.1007/BF02818140
Salisbury, M. W. (2003). Putting theory into practice to build knowledge management systems. *Journal of Knowledge Management, 7*(2), 128–141. https://doi.org/10.1108/13673270310477333
Sammour, G., Schreurs, J., Zoubi, A. Y., & Vanhoof, K. (2008). Knowledge management and elearning in professional development. In *The Open Knowlege Society. A Computer Science and Information Systems Manifesto: First World Summit on the Knowledge Society, WSKS 2008, Athens, Greece, September 24-26, 2008. Proceedings 1 (pp. 178-183)*. Springer. https://doi.org/10.1007/978-3-540-87783-7_22
Schmidt, M., & Huang, R. (2022). Defining learning experience design: Voices from the field of learning design & technology. *TechTrends, 66*(2), 141–158. https://doi.org/10.1007/s11528-021-00656-y
Seels, B. B., & Richey, R. C. (1994). *Instructional technology: The definition and domains of the field*. Association for Educational Communication and Technology.
Selwyn, N. (2013). *Distrusting educational technology: Critical questions for changing times*. Routledge.
Silber, K. H. (1972). Technology and freedom. *Educational Technology, 12*(1), 27–34. https://www.jstor.org/stable/44418605
Spector, J. M. (2002). Knowledge management tools for instructional design. *Educational Technology Research and Development, 50*(4), 37–46. https://doi.org/10.1007/BF02504983
Spector, J.M., & Edmonds, G.S. (2002). *Knowledge management in instructional design* (ED465376). ERIC. https://files.eric.ed.gov/fulltext/ED465376.pdf
Unified Compliance Mapping Team. (2018). *The definitions book: How to spot good ones, how to write better ones.* Network Frontiers; Unified Compliance Framework; Schaser-Vartan Books. https://www.unifiedcompliance.com/education/definitions/
Veerasamy, V. (2013). The importance of good definitions (Or: How to think clearly). *ReferralCandy*. https://www.referralcandy.com/blog/importance-of-good-definitions
Wagner, E. (2011). Essay: In search of the secret handshakes of ID. *The Journal of Applied Instructional Design, 1*(1), 33–37. https://docs.wixstatic.com/ugd/c9b0ce_4c5d961291de41e58e08576d3c9ee868.pdf
Waqar, Y. (2013). The impact of learning design on student learning in technology integrated lessons. *Procedia-Social and Behavioral Sciences, 93*, 1795–1799. https://doi.org/10.1016/j.sbspro.2013.10.119
Whitfield, G. (2012). The importance of proper definition. *Performance Improvement.* https://piadvice.wordpress.com/2012/06/13/the-importance-of-proper-definition/
Willoughby-Petit, P. (2021). The importance of design in e-learning content development. *eLearning Industry*. https://elearningindustry.com/the-importance-of-design-in-elearning-content-development
Wilson, L. (2015). *Knowledge, education, and identity: Basic problems of philosophy*. [Scholarblogs]. Emory.edu. https://scholarblogs.emory.edu/basicproblems002/2015/01/21/the-inextricable-connection-between-knowledge-and-experience/