A Conceptual Framework for Information Technology in Social Work Practice

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Abstract: *This article describes how information systems research in the human services can be facilitated with a conceptual framework that addresses the fundamental roles of data, information, and knowledge in understanding organizational information systems. Using methodologies originating in information systems and organizational research, the resulting conceptual framework explains how social work researchers are to understand information technology from the perspectives of clinical social work, supervision, social work administration, policy, and community collaborations. The article concludes by reminding social work researchers and educators that given that we have done little to educate our students on the differences between data, information, and knowledge, and to educate them based on research performed in our human services agencies, our professional practice relative to technology will not advance in the 21st century.*

Key Words: *Data, information, knowledge, information systems*

This article describes one researcher's academic journey that has focused on better understanding the roles of data, information, and knowledge and how those three entities are captured in human services information systems. As such, it may be considered a case study of what has been learned along the way thus the first person voice is used throughout. While some may consider it to be unorthodox to do so in a conceptual paper, this perspective may largely reflect the behavioral social science research paradigm dominant in social work. In contrast, much information systems research originated in the ethnography field as researchers attempted to understand the lived world of information technology users. In that vein, the use of voice, both first person and second person, was felt to be instrumental in better understanding the divergent perspectives oftentimes encountered with technology artifacts thus the use of first person voice should in no way be perceived as decreasing the rigor of that research (Boyle & Parry, 2007; Robey & Markus, 1998).

After earning my MSSW in 1984, I began my career as a caseworker in a large urban homeless shelter followed by positions as a therapist in a residential treatment center working with emotionally disturbed, adjudicated adolescents, and later with convicted sex offenders. Interspersed were positions as a medical social worker at two university teaching hospitals where I focused on child abuse and service coordination for children with neurodevelopmental disabilities.

Thus my grounding in social work practice predated the Internet age and much that is now referred to as information technology. Nevertheless, I had a keen understanding of the role of “information” and its importance in social work. With the arrival of personal computers and the Internet, and on realizing the possibilities of storing information in a digital format (i.e., no longer solely on paper), I began to understand what could be done

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with that information. Unfortunately, my practice also let me know what happens when information is not communicated.

My position as a medical social worker led to my participation on several child fatality teams. More often than not, child fatalities were marked by a breakdown in information not communicated between individuals who operated in complex systems. Interwoven with these individuals were the multifaceted interventions for children and families identified as high risk or receiving tertiary-level preventive services that extended across mental health, substance abuse, and/or domestic violence. In all of these circumstances, clinicians and program managers depended on the quality of information available to them at the time to make critical decisions. Therefore, when I made the choice to pursue a research career after fifteen years of practice, the obvious path was for me to focus on improving the information systems used across mental health and social services through research on how organizations use information to facilitate their functioning and ideally organizational decision making whether the decision is made by a line worker, agency leadership, or an interagency community group. This article will describe how information systems research can be facilitated with a conceptual framework and conclude with implications for practice and research.

Conceptual Framework

As I began to explore information systems, I focused my research on three primary components: data, information, and knowledge (Maier & Hädrich, 2011; Quinn & Fitch, 2014). I used an ethnographic approach (Lee, Liebenau, & DeGross, 1997) to understand how human services organize their systems of information largely within a "soft systems" methodology (Checkland, 1999). Conceptually this would appear as:

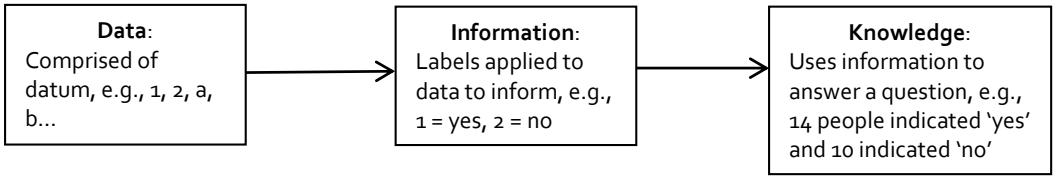

Figure 1. Data, information, knowledge conceptual framework.

My early research revealed that agencies have multiple systems of information or ways of informing agency members. The explicit information system is best known as the system that contains information about the clients served by the agency and accessed through a computer. In addition, the implicit systems of information were paper records kept in file folders, post-it notes, agency forms, evaluation reports, and the information shared at shift change or staff meetings,. To make sense of this information and the underlying data, I needed theories and methodologies suitable for the task. Over the years I have used Checkland and Holwell's *Information, Systems and Information Systems* (1998), and Checkland's *Systems Thinking, System Practice* (1981), which led to Beer's *Diagnosing the System for Organizations* (1985) and Ulrich's *Beyond Methodology Choice: Critical Systems Thinking as Critically Systemic Discourse* (2003). Taken together, these theories and methodologies have allowed me to diagnose agency systems

to find where in the process flow of going from data to information to knowledge a breakdown has occurred and to recommend solutions that are systemic (i.e., they not only address the problem at hand but also address design issues in the systems of information that could facilitate overall organizational decision making).

Collectively, my research has not only focused on information systems at the organizational level, but it also extends down to the ways: 1) data are recorded, and 2) expanded upward as information to address, 3) knowledge management within a learning organization, and, ideally, to 4) interagency systems. Across these levels, my research challenges not only who can be involved in controlling these systems but also addresses who and what can be served by these systems. As outlined in the discussion that follows, misconceptualizations for any of these components either in *use* or in the *design* of information systems can hamper optimal organizational functioning. Before describing how my research agenda has integrated the use of Beer's, Checkland and Holwell's, and Ulrich's frameworks, each section will begin with a review of prior research to better understand how we have reached today's common understanding of information systems in human services agencies and how that understanding may or may not serve the furtherance of more social work educators having research agendas that largely focus in this one area.

Data

On the one hand, data are the most fundamental units of an information system and are often the element most overlooked. On the other hand, data are the primary focus of social work research whether they are quantitative or qualitative. For example, all social work research texts build upon the centrality of data in being able to answer research questions. Oftentimes linked to the concept of a variable (information), researchers and educators spend considerable time and energy discussing data as a way to operationalize and measure concepts of interest.

Fortunately some social work scholars, most notably Epstein, have tried to point out that our human services agencies collect a vast amount of data and that some of these data are amenable to research purposes (e.g., Epstein, 1977, 2001; Freel & Epstein, 1993; Grasso & Epstein, 1993; Joubert & Epstein, 2005; Schoech, Quinn, & Rycraft, 2000).

While the importance of entering data into statistical software is valued while obtaining a BSW or MSW degree, we devalue other forms of data by assigning them to paper or leaving them unstructured in a MS Word document. Doing so leaves the informing capacity of data with limited use unless they are manipulated again. The need for capturing this data digitally has been noted for several decades (e.g., Schoech & Arangio, 1979; Semke & Nurius, 1991), especially when doing so may facilitate organizational processes (Coursen & Ferns, 2004).

For example, I have worked in and observed many agency settings in which staff still use tally sheets to record client outcomes or copy and paste data from one form to another, over and over, for different reports, despite the presence of information systems in the agency (Fitch, 2014). This seeming disconnect between the need to capture data digitally and what many social workers experience when using their agency information

systems is quite perplexing. Part of this disconnect comes back to how social work researchers and educators conceptualize the difference between data and information. Colloquially, and sometimes professionally, people interchange the use. For example, it is not unusual to find these two sentences in the same paragraph: "…enters that information in a spreadsheet…" and "...involves the organization of data in columns." Technically, data are entered into spreadsheets in which the column headings convey the information about what the data concern. Some of this conflation might be attributable to early text in this area before the conceptual differences were more clearly identified. For example, the description of information technology applications in Geiss and Viswanathan's (1986) edited text largely focus on shifting away from analog (paper, folders, etc.) to digital ways of handling data without explicating the larger information system that would need to align this data with organizational processes in an information system.

In some of those situations, after analyzing the information and knowledge needs of the agency, I have worked with the agency database administrator to either create new structured data fields (e.g., last name, first name, address) in the agency's information system and/or convert existing unstructured data fields (e.g., text or comment boxes) into structured ones. The use of data to inform and aid in organizational decision making will be discussed in the following section.

My most recent project focusing on data (Fitch, Yoo, & Mosa, 2013), with collaborators from engineering and computer science, involves the use of natural language processing to retrieve information from child and elder abuse case narrative data (i.e., text entered in a comments box on a form). This project stems back to my early research where I found that case narrative data were the most informative for abuse investigators and case managers (Fitch, 2006). Unfortunately, as unstructured data (i.e., free text), they are not amenable to data retrieval techniques available for structured data. However, in recent years the text-analysis tools available to researchers who do natural language processing have grown, so I began forming relationships with agency partners four years ago to secure access to case record data. The implications of this analysis are discussed in the next section, but the research in this one project hinges on the capacity to analyze massive amounts of text data–465,939 case records involving 9,057 children and families and a total vocabulary of 13,878,599 words. Acquiring text analysis skills using R (Wild, 2014) has taken some time, but the payoffs will be substantial as outlined in the following sections.

Information

Since information is so ubiquitous, how it is formed (data) and turned into knowledge is sometimes overlooked. Fortunately, Beer's (1985) viable system model, based on organizational cybernetics, provides a perspective on information as a component of organizational functioning that has been most helpful. In sum, information provides the means for communication up and down organizational levels as agencies seek to meet clients' needs and survive in ever-changing environments. However, it is in the unpacking of those two processes–communicating up and down organizational levels,

and the three actors–clients, agencies, and environment–that the disconnects between data, information, and knowledge are likely to occur.

Existing literature in this area seems to cover all of these processes and actors and many extend over several decades (e.g., Cnaan & Parsloe, 1989; Glastonbury, 1993, 1996; Glastonbury, LaMendola, & Toole, 1988; LaMendola, Glastonbury, & Toole, 1989; Rafferty, Steyaert, & Colombi, 1996; Steyaert, Colombi, & Rafferty, 1996). Other research has focused on applications in hospital settings (Auslander & Cohen, 1992), child welfare (Benbenishty & Oyserman, 1991, 1995; Benbenishty & Treistman, 1998; Oyserman & Benbenishty, 1997), income support (Dearman, 2005), and school settings (Redmond, 2003). Although some of these texts provide a methodology for information system design, how social work researchers think about information in its relationship to data and knowledge, while accounting for the communication needs among the actors, is usually underserved. That is, while doing a competent job describing how a particular application or system serves a need, how that system might fit into a larger conceptualization of data, information, and knowledge needs (i.e., the environment), is addressed less often. For example, missing from this literature is research in the larger information system field that addresses critical perspectives (Adam, 2002; Ulrich, 2003) and the issue of power in agency settings manifested through information system design (Markus, 1983; Wilson, 1997), which is particularly important due to fundamental power imbalances between clients and agencies and human services agencies and other organizations in the environment. For example, organizational dictates, by definition, flow down communication channels; returning communication channels are much more prone to blockage. The extent to which this upward communication is trying to convey information derived from practice data is the extent to which these data are now lost to the organization.

Using Beer's model, I have described information's use by designing and implementing an online referral system for an interagency collaboration, creating forms that delivered data entered *once* to *multiple* users for *multiple* purposes, as a means to differentiate program functioning in a multi-program setting. I have also described the role of information related to the acquisition of competencies or skills in an educational setting, as the linchpin between evidence-based practice and practice-based evidence, and as a feature of privacy and communication for youth in foster care. Each of these projects centralized the data-information-knowledge continuum prior to design of any specific application. Doing otherwise may have overlooked an important actor or the ability to communicate up and down organizational structures, especially when the organizational structure is an interagency collaboration.

Returning to my natural language processing project, once we had a data management process in place for the 13,878,599 words (information), we needed a way to organize the words into a controlled vocabulary that could capture various types of abuse (e.g., physical abuse, sexual abuse or neglect). This task required us to produce a taxonomy from the vocabulary terms by arranging them into a hierarchy of supertype-subtype relationships (e.g., words associated with various forms of physical abuse) and then building a thesaurus that combined the controlled vocabulary terms with the taxonomy to capture the associated relationships between the supertype-subtype

concepts. After developing the category terms, the dataset contained 582,132 words; these words were further consolidated based on conceptual meanings resulting in 4,755 terms. How these terms are helpful for a child or elder abuse investigator will be discussed in the next section.

Knowledge

Beer's Viable System Model asserts that any information system should be assessed by whether it facilitates acquiring knowledge because a viable system is one which can survive changing environments by having practices in place that insure the flow of information, beginning with data, up through the agency, processing that information, and then implementing operational changes via feedback back down through the levels of the agency. See Figure 2.

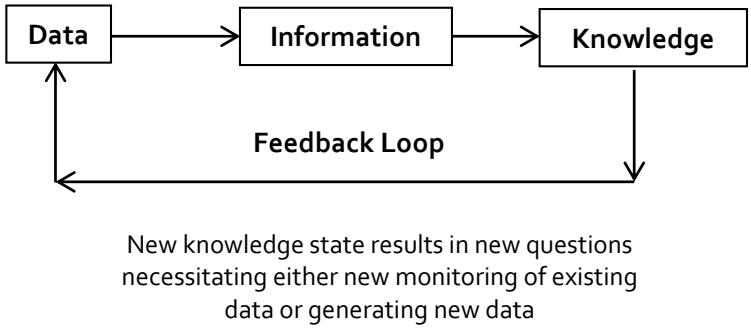

Figure 2. Data, information, knowledge feedback loop.

Making sure this feedback loop is operational is an essential aspect of systems theory in that all of the components are dependent upon feedback in order for the system to perform as designed. For example, referring back to Figure 1, once we know 14 people indicated "yes" and 10 people indicated "no," it would be perfectly reasonable to use a feedback loop to ask the question *why*? Doing so might entail gathering additional data organized via information such that the question might be answered.

From an agency-based perspective, we can see clinicians making treatment decisions, program managers deciding on the design of their programs, and the executive leadership for the agency needing to decide the types of programs they are offering as an agency. All of these decisions are based on information comprised of data entered into the agency's information system and hopefully fed back to the user in a timely manner for their decision-making processes.

On the one hand, most likely due to the dearth of information systems in the human services that function in a way that meets all of these decision-making needs, there is a concomitant lack of empirical social work research in this area. On the other hand, our profession has a tremendous amount of social work research taking place, evidenced by several journals and conferences, which is purportedly producing knowledge. The extent to which our research products are de-coupled from the information systems social work

practitioners use is the extent to which we may be experiencing a fundamental feedback breakdown in the data-information-knowledge continuum in our profession.

Fortunately, some social work researchers have broached this topic over the years, most notably Monnickendam (e.g., Monnickendam, Savaya, & Waysman, 2005). To guide other social work researchers in this area and extend conceptual frameworks beyond Beer, information systems and other researchers have approached this topic via decision support systems (Ba, Stallaert, & Whinston, 2001; Eom, 2000; Mohan, Muse, & McInerney, 1998), decision-making (Bharwani, 2006), design science (Carlsson, 2007), and knowledge management (Henry, 1974). Indeed, Maier and Hadrich's (2011) text on knowledge management systems covers the fundamentals of knowledge management from the inception of data, to information, and on to the culmination of knowledge that impacts organizational functioning. They specifically note that feedback is essential to improving the "quality of information" (p. 357) within the organization. While not delving into the depths of "how to," this text more than compensates by describing the broad range of data and information sources modern organizations must manage and use.

Many of my projects have used this conceptualization to understand agencies and how they work. Specifically, I used organizational cybernetics to assess whether a public child welfare agency is viewed as a learning organization to the extent it leverages the skills gained by Title IV-E graduates (Fitch, Watt, & Parker-Barua, 2014). My research was also the first study to use organizational cybernetics as the axial coding scheme for the qualitative analysis of the focus group data. My other applications of organizational cybernetics involve its use in understanding the need to balance the flow of evidenced-based practice data with practice-based evidence data (Fitch, 2014). In this particular application, clinicians made treatment *decisions*, program managers *decided* on the design of their programs, and the executive leadership for the agency *decided* on the types of programs they were offering as an agency. All of these *decisions* were based on information comprised of data entered into their information system.

Finally, referencing the natural language processing project, the goal is to develop a system that will go by the moniker SAFETY (Semantic Analysis for Efficient Text Yield.) Our next step will be to link the information produced from the vocabulary and taxonomy to an indexing algorithm so we will be able to detect severity of abuse, classify case narratives according to the abuse type, and alert the user to the case narratives that will be most informative for risk assessment decision making, saving invaluable time, effort, and possibly lives. Already, our comparative analysis has shown that child and elder abuse terms drawn from articles in PubMed differ from the terms contained in the case narratives. The significance of this finding lies in that very difference. That is, most *information* retrieval algorithms rely on publicly available *data* for creating their vocabularies and taxonomies that, in turn, play a crucial role in the functioning of the algorithm. If we were to develop our algorithm based up PubMed articles, then we would be losing a large amount of information contained in the case records. Instead, we used the data source most informative for that purpose, existing agency records.

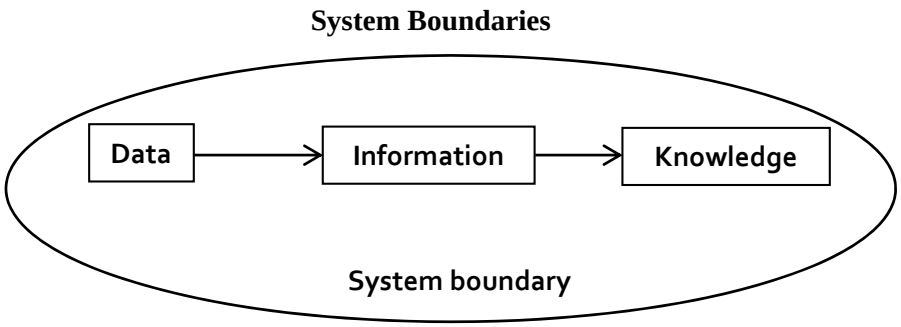

Figure 3. Agency system boundaries.

When analyzing agency information systems, there always comes a point when the boundaries for the system have to be delimited because clients have lives before and after interacting with agency services. In previous iterations, agency information systems were referred to as management information systems (MIS) because they were designed for *management's* purposes. Other iterations included decision support systems (DSS), executive information systems (EIS), etc., all largely serving the needs of management or administration. However, beginning in the late '80s, the notion of an EIS being *everyone's* information system began to take hold. The democratization of digital information access was beginning to be viewed as the only way to improve organizational efficiency since it is the operational level, or line workers, that creates the initial data. The human services are still uneven as far as the democratization of digital information access, and my research has shown that the delimitation of system boundaries (where the system entails all information systems and systems of information) plays an important role.

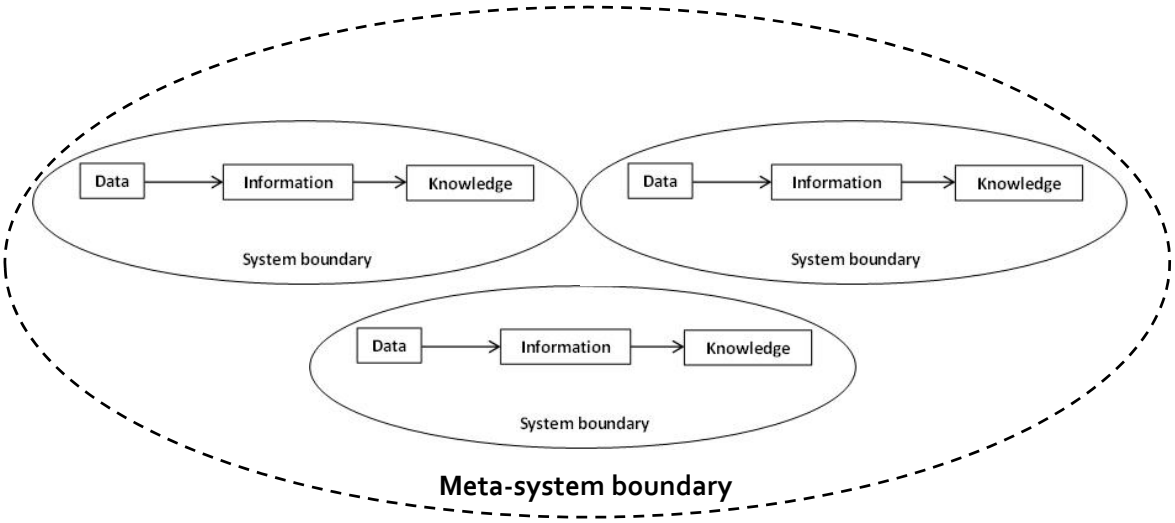

Figure 4. Interagency system boundaries

Fortunately, there has been relatively more social work research in the area of interagency information sharing (see Figure 4) related to knowledge. This research has addressed the need for interorganizational systems in mental health (Bloomfield & McLean, 2003; Manderscheid & Henderson, 2004), welfare services (Harlow & Webb, 2003), substance abuse services (Hile, 1997), child welfare (Howell, Kelly, Palmer, & Mangum, 2004), homelessness (Peressini & Engeland, 2004), and juvenile justice (Savaya, Spiro, Waysman, & Golan, 2004). Paradoxically, the Internet has both facilitated and hampered interagency information sharing in this area. Regarding the former, it is much easier to share information between agencies using secured and encrypted file exchange systems. Regarding the latter, though, vendors have developed systems that have sometimes grouped agencies together into silos. For example, the Homeless Management Information System (HMIS) initiative been of tremendous help to homeless shelters that lacked any kind of information system, and it allows for the networking of these agencies in a community to facilitate information and referrals, service acquisition, and community-level outcome monitoring. Unfortunately, if an agency serves the homeless as well as other client populations, then workers are forced to double (or triple) enter data into the HMIS and any other system the agency might use (Fitch, 2010). Researching in this arena requires a careful assessment of decision-making needs across agency boundaries linked via information to the data that is already being entered by social workers.

The most useful methodology has been Ulrich's CSH, which determines the boundaries by identifying who is involved and who is affected. The CSH then delineates the former into who is served and for what purpose as well as who is a decision maker, which resources are used by the decision maker, and on what basis. Those affected, the latter, serve the purpose of legitimation by acting as witnesses representing embodying values and worldviews. My most explicit application of this methodology was identifying the role of youth in foster care and shifting from a system where their use of social media was controlled by agency-set privacy policies to a system where the youth were allowed to decide about (or control) their own information (Fitch, 2012). Extending the boundaries in the other direction, one can easily see a foster care agency as a subsystem to a larger child welfare agency. Each, in turn, would have its own information system. Taken together, the “system” boundary then becomes a meta-system captured in Figure 4. One can also envision a community collaborative on child well-being consisting of a child welfare agency, a mental health agency, and the school system. A quantitative application of CSH occurs in Fitch and Jagolino (2012), where we employed system dynamics modeling using output data from three such agencies in Minneapolis. Here, too, the feedback emblematic of organizational cybernetics is prominent and illustrates the broad range of applications for these theories and methodologies. Most importantly, all the knowledge gained from these studies was based solely on information *already existing* in human services agencies, information gathered as digital data.

Two Caveats

As with any conceptual framework, some issues are included while others are excluded. Two are notable in this area. The first pertains to the term "capta" used in Checkland and Holwell's text (1998, p. 90) and how they use it in their formulation of the continuum, specifically, data to capta to information. Checkland prefers to speak of data as "facts" with selected facts becoming capta and meaningful facts becoming information. Larger or longer-living meaningful facts are felt to be knowledge. While I find this conceptualization to be helpful in understanding some aspects of this issue, my preference is to examine the continuum from the perspective of users of information technology systems. All social work researchers certainly have a sense of capta, as not all pieces of data are used when we begin to operationalize information. For example, while it may be helpful to know an at-risk young adult's high school GPA, we may not need to know what grade they made in social studies in fifth grade. That data may be helpful (capta) for a junior high guidance counselor, but not necessarily when that person is a young adult. As such, social workers most likely engage in capta identification behavior, but only the results of that behavior will be seen in the data we gather in our information systems.

The second caveat addresses the continuum, acknowledging the literature that has the continuum ending with wisdom (i.e., data, information, knowledge, and wisdom), especially as explored by Rowley (2007). While many aspects of her article are absolutely fascinating, specific aspects of her argument extend beyond my use of data, information, and knowledge as represented in information technology systems. For example, Rowley refers to "the hierarchy" in which she views one transforming into the other (i.e., data as an entity at a lower level in the hierarchy becomes information at a higher level in the hierarchy), which, in turn, becomes knowledge that can be used to create wisdom (p. 164). Wisdom is further described as representing one's values, ethics, and aesthetics. While each of these elements certainly plays a role in practice, I am limiting my focus to those processes we can more operationally define and capture in agency information systems. For, as Rowley notes in her conceptualization of wisdom, it is not an entity suitable for algorithms nor is it programmable. To the extent social work needs to engage in more formal research with information technology systems, it may be conceptually easier for us to focus on the first three parts of the continuum at this point in our profession.

Perhaps in the near future, when we have robust knowledge management systems, we should certainly revisit this issue incorporating the insights of Rowley and others (e.g., Bernstein, 2011; Bierly, Kessler, & Christensen, 2000; Zeleny, 2006).

Implications for Social Work Practice

The implications for social work practice must begin with the education of our BSW and MSW students. Our schools of social work need to examine how we prepare our students to be digital professionals of the 21st century. While our peer professions are educating their students via medical informatics and nursing informatics, social work has no such explicit curriculum. Instead, we focus on some of the most complex aspects of

knowledge generation in our research classes where students are exposed to "data" analysis using SPSS. This approach has two consequences. One, with the traditional research class as their only formal exposure to the data-information-knowledge continuum, our students' awareness that all three are much more ubiquitous in agency settings is foreshortened. Two, agencies do not routinely analyze their data using SPSS. If we are to expose our students to any data analysis tool, then we need to be teaching them the tools available in their agencies (e.g., MS Excel). While the level of statistical sophistication in MS Excel may not be commensurate to SPSS, SAS or Stata, perhaps that analysis is not needed for program-level data.

In practice, we need to continuously train our staff to be aware of what they do when they handle data. Do they find themselves entering the same data into multiple systems? Do they find themselves using tally sheets to track client outcomes? Are they spending more time managing paperwork than working with clients? The extent to which the answer to any of these questions is *yes* is the extent to which we are depriving our clients of the time and resources they should be receiving in face-to-face interactions. We have machines that can manage data, but those machines cannot do the work of social work.

Implications for Social Work Research

One might assume that as we are now more than a decade into the 21st century, almost fifty years after the advent of information technology in the corporate sector, thirty years after the arrival of the personal computer, and twenty years after the birth of the public Internet, there would be a whole host of social work researchers focusing on the use of information technology in the human services. While many in the social work profession and academy do publish about information technology, we could probably count on one hand the number of tenured faculty members in our schools of social work who have an exclusive focus on information technology encompassing the whole of their research agenda.

Why? In his farewell editorial for the *Journal of Technology in Human Services*, Schoech (2014), founding editor of said journal, made the following statement:

> Walter Hudson, an early IT pioneer in practice software, years ago advised young faculty not to specialize in IT until they earned tenure. His rationale was that few human service faculty understood IT and the difficulties involved in IT research and development. Therefore, their IT development work would be unappreciated and tenure could easily be lost. This advice probably still holds today. (p. 249)

Shoech was able to focus on IT research and development and still achieve tenure, but he is a notable exception. Most other tenure-seeking faculty have to include projects that are more easily accessible to our colleagues as we often define our research agendas by issues (e.g., poverty, domestic violence, etc.) or the populations we serve. How can we explain that our research agenda focuses on data, information, and knowledge?

This article attempts to do so. While technology has evolved, the information requirements of human services agencies have remained largely unchanged. Given that we have done little to educate our students on the differences between data, information,

and knowledge and to educate them based on the research that we ourselves perform in our human services agencies, our professional practice relative to technology will not advance in the 21st century. We need to ignore Hudson's advice, and, in doing so, we need to embrace our junior colleagues as they seek to advance social work practice.

Conclusion

While our society continues to move in a more technological and digital direction, we have significant gaps in our field on what that progress will entail. If social work is not involved in the design of technological and digital systems for the human services, we will be left using tools designed by others who may not have our profession's epistemological and values base. I have outlined the components of the systems used by the human services, namely data, information, and knowledge. My research has focused on distinguishing the unique aspects for each component and how they can relate to each other in performing stated functions. Taken together, they can comprise systems whose boundaries must be determined and not left to assumption. If advocating for the rights of clients is the heart of social justice in social work, then the democratization of digital information access can rightly be viewed as one of those rights. Future research as outlined above should and can seek to make those rights more explicit as we use information systems across the human services sector to improve organizational functioning and decision making.

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