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Kodey S. Crandall
Dakota State University

Cherie Noteboom
Dakota State University

Dave Bishop
Dakota State University

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Kodey Crandall

Dakota State University, kcrandall@uvu.edu

Cherie Bakker Noteboom

Dakota State University, cherie.noteboom@dsu.edu

Dave Bishop

Dakota State University, dave.bishop@dsu.edu

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Designing Decision-Support Systems for Secondary School Counselors

Emergent Research Forum (ERF)

Kodey S. Crandall
Dakota State University
Kodey.crandall@trojans.dsu.edu

Cherie Noteboom
Dakota State University
Cherie.Noteboom@dsu.edu

David Bishop
Dakota State University
Dave.Bishop@dsu.edu

Abstract

In the current era of accountability, school counselors are expected to use data to drive program decision-making, implement evidence-based interventions to create systemic change, and utilize emerging technology. Research shows it is difficult for school counselors to meet any of these expectations. A decision-support system is a technology that takes minimal effort to learn and can assist in decision-making processes. In an attempt to solve the problems facing school counselors, this design science research focuses on building such a system using the design principles of Information Quality, Interface Quality, and Customization and measuring their influence on user satisfaction.

Keywords

Decision-support systems, data-driven decision-making, design science research, design principles.

Introduction

School counselor responsibilities have evolved over the last few decades. In the past, school counselors have spent their time meeting with and guiding troubled students, assembling class schedules, arranging vocational training, and administering standardized tests. There has been a more recent emphasis in the field on using data to drive program decision-making (Young & Kaffenberger, 2015) and keeping pace with emerging technologies (Mason et al., 2018) despite counselors limited amount of time (Fye & Rainey, 2017) and discomfort learning and using technology (Mason et al., 2018).

While numerous school counselors have had training in data analysis, most do not have confidence in their ability and struggle to meet the expectation to use data (Young & Kaffenberger, 2015). For this reason, data-driven decision-making “continues to be a stress-inducing, learner-centered pedagogical paradigm shift for which most [educators] are unprepared...” (Dunn et al., 2013, p. 88) and many become burdened when making such decisions (Schwartz, 2016). Identifying evidence-based interventions, one phase of the data-driven decision-making process has also been a more recent focus for the profession (Zyromski & Mariani, 2019). However, despite the benefits of using evidence-based or research-based interventions, it is challenging for school counselors to identify and implement them. Many school counselors are unaware of avenues for finding evidence-based interventions, and those who do find them must search national websites or school counseling and other professional journals (Zyromski et al., 2018). This search process may lead to “information overload” and impact the school counselor’s ability to effectively make decisions (Roetzel, 2019).

While technological solutions are necessary to support data-driven practices as data continues to grow beyond the capacity of humans to handle (Mandinach, 2012), research has shown school counselors’ often lack confidence, comfort, and skills using technology (Steele et al., 2015; Young & Kaffenberger, 2015). School counselors are in need of a decision-support system (DSS) that takes minimal effort to learn, saves them time, and assists them in the data-driven decision-making process, specifically when identifying

interventions for school improvement. Technology use continues to be an under-researched topic in school counseling (Mason et al., 2018). Therefore, the purpose of this design science research is to build an IT artifact to improve the information retrieval problem facing school counselors and answer the research question: “*How do specific design principles influence secondary school counselors’ satisfaction of a DSS?*”

Using Design Science Research Methodologies (DSRM) (Hevner et al., 2004; Peffers et al., 2007) is especially adept at addressing “wicked problems” in which there are “complex interactions between subcomponents of the problem and its solutions” (Hevner et al., 2004, p. 81). This framework solves problems by building and effectively evaluating an IT artifact, which is the aim of this research. Peffers et al. (2007) process of DSRM incorporates the guidelines proposed by Hevner (2004) as well as other principles, practices, and procedures required to carry out such research. The steps in this Peffers et al. (2007) process include: 1) Problem identification and motivation, 2) Define the objectives for a solution, 3) Design and development, 4) Demonstration, 5) Evaluation, and 6) Communication. This framework is well accepted in Information Systems research as it not only contributes to a well-defined process for building an IT artifact, but also contributes to the body of knowledge. Following these steps, the first section of the paper focuses on identifying the problem and defining objectives for a solution. The next section of the paper explains how the IT artifact was designed and developed by integrating design principles influencing user-satisfaction of information systems into the components of a DSS. Following this section, we propose a plan for demonstrating and evaluating the system for user-satisfaction in a school counseling setting. We conclude by discussing the expected results and contributions. For this study, a “school counselor” will refer to secondary school counselors (grades 6-12) working in public schools within the Rocky Mountain Region of the United States of America.

Problem Identification & Defining A Solution

As technologies and computerized dependencies have advanced, school counselors have been encouraged to adopt and use digital tools to complete daily tasks and comply with regulations. While technology can broaden a school counselor’s ability to efficiently and effectively contribute to student achievement and success, recent research shows many counselors are cautious of embracing it within their profession (Mason et al., 2018) and continue to use “paper-pencil” processes over technology (Shea et al., 2018). One possible explanation for this resistance is the lack of comfort and skill school counselors have reported learning and using technology (Steele et al., 2015; Young & Kaffenberger, 2015), resulting in low computer self-efficacy (CSE). Mason (2018) states, school counselors that do not follow the technology trends of today may find their role in the education system as irrelevant. Therefore, this research is relevant, timely, and essential for all school counselors, whether they’ve been in their role for three years or three decades.

Data use and analysis have also become expected to keep publicly funded schools accountable to governments and local taxpayers (Rubeiro, 2016). Legislation, such as No Child Left Behind, introduced new requirements for public schools to demonstrate their educational practices are effective. The Every Child Succeeds Act (ESSA) has since replaced No Child Left Behind but continues to hold schools accountable for how students learn and achieve (U.S. Department of Education, 2017). Dimmitt et al. (2007) define data-driven decision-making (DDDMM) as “a school improvement approach that uses quantitative data analysis techniques to help describe problems and to direct activities and resource allocations” (p. 17). The objective of DDDMM is to move educators, schools, districts, and states from being “data rich but information poor” to using data and transforming them into actionable knowledge (Mandinach, 2012).

Identifying and implementing evidence-based interventions is one phase of the DDDMM process. Using evidence-based or research-based interventions can help school counselors feel more confident that what they are doing will make a difference and meet the needs of their students, but finding these interventions is challenging. School counselors frequently collect and analyze student data but then implement interventions chosen due to their ease, affordability, or availability (Zyromski et al., 2018). The field of school counseling is similar to other organizations that must search extensively for relevant information (Aladwani, 2002) and do not know what information is available, where to find it, and what information is consistent, up-to-date, and correct (Laumer et al., 2017).

A DSS is an advanced software that can assist school counselors in overcoming these problems. A DSS sifts through and analyzes massive amounts of data, and compiles comprehensive information that can be used to solve problems and aid in decision-making (Power, 2013).

Artifact Design & Development

A DSS for school counselors must be designed in a way that will easily assist them in identifying interventions. We believe that the system should limit the amount of information provided to them through a semi-structured programmed decision-making process coupled with expert knowledge. Almost all DSSs include a knowledge base, an inference engine, and a user interface. To develop the DSS, the design principles, information quality, interface quality, and customization were incorporated into the three components of a DSS, as outlined in Table 1. These design principles not only correlate with the components of a DSS, as discussed below, but prior research has shown they positively influence user satisfaction (Lewis, 1995; Parasuraman et al., 1988). The assumption is that using multiple constructs, or design principles, to measure a concept (user satisfaction) will be more likely to represent all the different aspects of that concept (Hair, 2017).

Components of DSS	Design Principle
Knowledge Base/Data Sources	Information Quality
Inference Engine	Customization
User Interface	Interface Quality

Table 1: Correlation of DSS and Design Principles

Knowledge Base: The knowledge base serves as a data bank for the DSS. Data in a knowledge base is stored in such a way that information can be accessed through computerized applications. Three different data sources were used to build the knowledge base in this research: CTEsurveys.com, What Works Clearinghouse, and school improvement plans from over 200 school counselors in the Rocky Mountain Region of the United States. Information Quality (ImQ), focuses on the data used in the system. If the information is deemed adequate and sufficient to improve understanding or assist in the decision-making process, the users' will be satisfied with the system.

Inference Engine: The inference engine sets logical rules for the system to help the user make a decision based on stored information as well as new information added (Hayes-Roth, Waterman, & Lenat, 1983). To build the inference engine, an expert in the field provided the knowledge needed to link the issues counselors are facing to interventions by following Straus & Corbin's (1998) open coding method. Open coding was used to conceptualize raw data by naming and categorizing the phenomena through a close examination of the data. Two independent coders examined both the interventions as well as the questions asked on CTEsurveys.com and classified them into categories that fit the objectives and competencies of the American School Counseling Association (ASCA) model. Having two independent coders ensured that there was no coding bias. This coding process set the logical rules for the system to help the system make recommendations from the stored information in the knowledge base. These rules set the bounds to ensure the content provided to counselors meets their specific needs. Customization (C) is the second design principle presented in this research. Parasuraman et al. (1988) state that customization will attend to the user's needs, capture interests, and adapt services to improve user satisfaction.

User Interface: The user interface provides the link between the user, the data in the knowledge base, and the inference engine (Sugumaran & Degroote, 2011). A widely accepted user interface design ensures consistency in the interface. Consistency involves the end-user throughout the design and development of the system to facilitate ease of learning and use of the system (Satzinger & Olfman, 1998). The design of the interface from CTEsurveys.com was used to build a similar interface for this DSS. This allowed the researcher to ensure consistency and facilitate ease of learning and using the new system. Interface Quality (IfQ), will help the researcher understand if the user is satisfied with the system as the interface functions as expected.

Demonstration & Evaluation

To demonstrate the utility of the IT artifact, a field study will be conducted for the initial evaluation. Field studies are non-experimental inquiries occurring in natural systems (Boudreau et al., 2001) and allow the researcher to evaluate the artifact in multiple settings (Hevner et al., 2004). An email invitation asking for participation will be distributed to school counselors who have recently used CTEsurveys.com, an information system licensed by the State Board of Education, which assists them in identifying the needs of their school counseling programs.

To measure the constructs, an online survey will be administered to school counselors participating in the study. Yin (1989) states a survey design in an appropriate method for answering questions relating to who, what, where, how many and how much, focuses on contemporary events, and does not require control over behavioral events. For these reasons, a field study and online survey were deemed appropriate methods for answering the research question, “*How do specific design principles influence secondary school counselors’ satisfaction of a DSS?*” The survey will modify questions from The Computer System Usability Questionnaire (CSUQ) (Lewis, 1995) and the SERVQUAL (Parasuraman et al., 1988). To evaluate if the IT artifact helped school counselors in the DDDM process and in identifying meaningful interventions, user satisfaction will be calculated for each of the design principles. Lewis (1995) states user satisfaction for each principle is determined by calculating the average response of each question relating to the principle. The overall evaluation and calculation of the average scores from the seven-point Likert scale of the constructs will show the overall user’s satisfaction.

Expected Results & Contributions

According to Hevner (2004), a design artifact is complete and adequate when it satisfies the requirements and constraints of the problem it was meant to solve. It is expected that school counselors will be satisfied with the DSS if they are satisfied with each of the theoretically derived constructs (design principles). However, if the evaluation reveals school counselors are not satisfied with the system, the researchers will iterate back to the design process and make necessary revisions.

While designing systems to improve school counselor processes helps the school counselors themselves, it also indirectly impacts students and parents. Using this system will decrease the time school counselors spend identifying evidence-based interventions, enabling them to dedicate themselves more fully to serving students in ways technology cannot. Each evidence-based intervention that is implemented addresses the real and relevant problems facing parents, students, and faculty. When school counselors are unable to identify evidence-based or research based-interventions, the strategies they employ may not solve the identified problems of their stakeholders. Thus, if the proposed IT artifact does improve the processes and the counselors are satisfied with the system, school counselors, students, parents, and faculty will be positively impacted.

This research also contributes to the field of Information Systems by providing evidence on how design principles correlate to DSSs and how they influence the user-satisfaction of DSS. This research may also demonstrate the efficacy of DSR to solve problems and build theory. The proposed IT artifact is not hypothetical or simulated, but instead will be tested using an actual system in multiple counseling settings. Thus, researchers may decide to replicate this study in other fields outside of school counseling or education and may find the benefits extend to other possible areas of interest.

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