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Editorial Board

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What's in a Name? Central Themes in MIS Since the Field's Founding

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Abstract

Effective use of management information systems and related platforms is essential for the success of modern organizations. The need for use and management of the internal and external information in the private, public, and not-for-profit organizations has evolved over the years. The MIS discipline, themes, and related platforms have also evolved. We will briefly review the historical evolution of the MIS themes and discuss why and how these themes emerged and faded.

Keywords: MIS themes, MIS evolution

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1. Introduction

"What's in a name? That which we call a rose by any other name would smell as sweet."
- Shakespeare, *Romeo & Juliet* (1594-96)

The academic discipline of Management Information Systems (MIS) is known by many names, and it is housed in many different parts of the academy. In general, the field is best known as Management Information Systems (MIS), and it is most often found in business schools. Most fix its beginnings at the University of Minnesota, in 1968. Current membership in the Association for Information Systems (AIS) is over 5000 scholars. Estimates of the actual numbers of MIS scholars in the world are difficult to come by, but it is safe to assume there are at least 10,000. The field (and AIS) is truly global. MIS scholars are located in at least 100 countries, all around the world.

The intellectual foundations of the field were established in 2008 by Sidorova and colleagues: 1) IS and individuals; 2) IS and groups; 3) IS and organizations; 4) IS and markets; and 5) systems development. The relative interest in these five research areas has varied over time, with development being the most popular early in our history, and with markets taking the lead in the later periods of Sidorova's analysis. Others outside the field do not know us by the pillars of our intellectual foundation, however. They know us instead by the themes of our work, which reflect both research and practice.[1] As we use the term here, themes do not correspond to eras or epochs. Themes can increase or decline in influence; they can fade and re-emerge later; they can co-exist with other themes. We maintain that dominant themes are reflected in the names we have chosen to be known by as an academic discipline.

When the field began, it was known as MIS. Now, 50 years later, we have added "Analytics" to our name. And in between, there were multiple themes that emerged that had the power and influence to alter the name of the field. They were Decision Support Systems, Information Systems as a Competitive Advantage, and E-Commerce. In the rest of this editorial, we will discuss how themes have influenced the names we have gone by, and those we almost decided to call ourselves.

Why is it important to review these themes and (actual and potential) names? The themes reflect what has been happening in the field, and they summarize succinctly our primary focus at a given point in time. That there have been so many themes in 50 years signals to others that our field is somewhat nebulous and evolutionary in nature. But the themes also signal to our major constituencies – other academic disciplines, industry, recruiters, students, parents, administrators – who we are and what we do. There is no reason to believe the emergence of the analytics theme will be the last one, but just what will follow analytics is difficult if not impossible to discern at this point in time. But to discern and appreciate new themes as they emerge, it is important to understand what has come before and how themes have emerged and faded.

Before we review the five themes we have identified – MIS, DSS, IS as a competitive advantage, e-commerce, and analytics – we need to be clear that we are not proposing another history of the field. There are many excellent histories already (cf. Adam & Fitzgerald, 2000; Hirschheim & Klein, 2012). Nor are we attempting to re-examine the intellectual foundation of the field (Sidorova et al, 2008) or how technology had affected IS curriculum (cf. George & Marett, 2019). Instead, we review, at a high level, how we have identified ourselves as an academic discipline and how that identification has shifted over time.

2. Management Information Systems

Two of the founders of the MIS discipline, Gordon Davis and Gary Dickson, provide excellent histories of the early years of the field's development and the research and scholars that influenced its development (Dickson, 1981; Davis, 1983). According to them, the first degree program in MIS was established at the University of Minnesota in 1968. It was the "Management Information Systems major in the Master's degree program" in Minnesota's school of business, i.e., a business degree in MIS. In 1981, a survey showed that the most popular name for academic programs was MIS, with Information Systems (IS) second (Davis, 1983). Davis himself preferred "information systems" in 1983, so already, just 15 years after the beginning and initial naming of the field, the name was already starting to lose the "M." Davis defined the domain of the field as "the characteristics of the information system, the processes for developing and

[1] We do not use the term "theme" in the same way as Hirschheim & Klein (2012). They restrict the term to focus on research, as in "research themes." Our use of the term is much broader, although research is part of it.

managing the information system, and the body of knowledge that forms the conceptual foundations (1983)." Dickson (1981) defined the domain as "all informational and decision-making activity associated with operating an organization." Note the focus on the organization. Why? Because in 1968, and even into the early 1980s, that's where information systems were located. Note also that while Davis focused on managing the information system, Dickson focused on managing the organization. The MIS theme, then, is tightly coupled with the organization and those who manage it.

3. Decision Support Systems

Sprague (1980, p. 1) defined decision support systems as "an interactive computer-based systems, which help decision makers utilize data and models to solve unstructured problems." The first identified research on DSS was Michael Scott Morton's dissertation (1967) at Harvard. It was followed a few years later by Alter's dissertation (1975) at MIT. Research into systems for supporting managerial decision making continued to grow throughout the 1970s and 1980s. Key publications that promoted and defined DSS include Alter's book (1980) and Sprague's *MIS Quarterly* article (1980). Power provided an excellent history of DSS in the IS field (2004). The DSS perspective continued to grow and was soon applied to groups (DeSanctis & Gallupe, 1987; Nunamaker et al., 1991), executives (Watson, Rainer & Koh, 1991), and organizations themselves (King & Star, 1990).

Note the centrality of the manager/decision maker in the DSS theme. The shift from managing the information system resource to supporting decision makers in organizations is clear. The DSS theme co-existed with the MIS theme for several years, and at one point, the DSS theme became more prominent. In fact, as Dickson (1981) recounted, DSS was suggested by many as a new name for the field: "We have seen that many names have been applied to what we have been addressing as MIS…. There are persons who suggest that one major reason to concentrate on DSS and to throw out MIS is that MIS has failed. The claims are that MIS has not been effective."

4. Information Systems as a Competitive Advantage

As the DSS theme expanded, the field discovered information systems that in and of themselves helped organizations become more competitive. Scholars in the 1980s became well acquainted with SABRE, American Airlines' reservation system, and American Hospital Supply's ASAP, a procurement system, among others. The use of information systems as "competitive weapons" was heavily promoted by scholars at Harvard Business School (c.f. Cash & Konsynski, 1985; McFarlan, 1984; Porter & Millar, 1985), and the topic became very popular. In fact, Millar (of the Porter & Millar article in *HBR*) was one of the keynote speakers at the International Conference on Information Systems in 1986. As the focus on the topic grew, it became another theme for the field (Ives & Learmonth, 1984; Johnston & Carrico, 1988; Lederer & Mendelow, 1988). Initial research on how to build information systems that affected a company's bottom line was followed by research on whether such systems could lend sustained advantage. And as the 1990s began, along with the commercialization of the Internet, the competitive advantage theme faded. Note the progression of themes from MIS to DSS to competitive advantage swung from a focus on the organization to managers and then back to the organization.

5. E-Commerce

The commercialization of the Internet resulted in many new research directions for information systems scholars (Hirschheim & Klein, 2012). In keeping with the original organizational focus of the field, the major theme that emerged was electronic commerce, or e-commerce. E-commerce has a strong organizational connotation, but the term also grew to cover not just business-to-consumer exchange but also business-to-business and consumer-to-consumer exchanges. Although a change in perspective had been happening for some time, it was becoming clear that information systems research was no longer limited to organizations. Computers were pervasive and no longer required an organizational context for study. This view expanded greatly with the introduction of the Apple iPhone in 2007 and iPad in 2012. In essence, anything with a processor became fair game for information systems scholars to study. Still, being based primarily in business schools, the theme of e-commerce dominated, even though it was shorthand for a much larger universe of information systems and their investigation. Although the e-commerce theme never translated into a new name for the field, several universities established e-commerce research centers and e-commerce majors. Many of these still exist (cf. https://libguides.rutgers.edu/c.php?g=336740&p=2267125). After the Internet bust in 2001, academic interest in e-commerce, and in information systems, faded. From then until the beginnings of the Great Recession, the academic field of information systems struggled to find a new theme. We wandered in the wilderness, waiting and looking for the next theme to emerge.

6. Analytics

The next theme to emerge was analytics. Growing out of the study of business intelligence and data science, and coming to be known as "Big Data" in the popular press, the study of analytics in the information systems field was firmly established by 2007, with the creation of multiple degree programs. By 2018, there were over 400 analytics degree programs in 230 business schools worldwide (Hassan, 2019). Hassan (2019) provides an extensive history of the study of analytics in the information systems field. Unlike the DSS theme, which almost became the name of the field, the analytics theme has been incorporated into the names of the academic departments associated with the study of information systems. Department names like "Information Systems and Business Analytics" have become commonplace. And note how the theme has swung back to the early days of the field, to a focus on the organization and its managers.

7. Conclusion

In this brief, non-comprehensive overview of the themes that have dominated the field of academic information systems over the past 50 years, we have seen that the themes, and their focus, have shifted over time, and the themes have affected the names we have (or have almost) given to our discipline. The original name, Management Information Systems, was instrumental in defining the field, and the name is still with us (although largely missing "Management.") The initial focus was on the management of the information systems resource, expanded to include a focus on managing the organization with information systems. The Decision Support Systems theme, which almost became the name of the field, focused on supporting managers. The IS as a Competitive Advantage theme shifted back to the organization, while the E-Commerce theme expanded the field of information systems to include all things Internet and just about anything with a processor. The latest theme, Analytics, brings us back to a focus on the organization and its managers.

As we said at the beginning, knowing about past themes helps us prepare for the next one(s) to come. As Dickson presciently said 40 years ago: "Although new terms will come along that may be substituted for MIS as the umbrella term for the area, one must keep in mind that virtually all proponents are speaking of similar concepts (Dickson, 1981)." We don't know what the next theme will be, but we know for sure that there will be a new one.

How does this understanding of themes apply to scholars of information systems in the Midwest? Scholars located in the midwestern US are part of the larger global community of IS scholars. What affects the field as a whole affects us as well. In fact, the next theme may emerge from the Midwest, just as the field itself emerged from a midwestern state, Minnesota, over 50 years ago. The themes that define us drive how our many constituencies see us and what they expect of us. This is as true in the Midwest as it is anywhere in our global IS community.

During 2022, both Gordan Davis and Gary Dickson passed away, on May 6 and on October 31, respectively. They, along with Tom Hoffman, are widely considered the founders of the academic field of information systems. All of us in the discipline owe them a great deal. Our sincere condolences to their families and colleagues.

8. Overview of the Contents of this Issue

This issue of the journal includes two traditional research articles.

Toni Taipalus in his important article looks at the systematic mapping study in the information systems area. The author suggests that although systematic mapping should not be the only research method for a researcher but should be one of the important early methods in a researcher's career. Pros and cons of systematic mapping is presented in the article.

In this timely article, John Muraski suggests that to fill the gap between available IT related jobs and the existing shortages of IT related talent, MIS departments should initiate and promote an "IS Career Day." The idea is to engage potential college students with IT professionals to learn about careers in IT. Quantitative and qualitative data is collected for this study to evaluate students' interest in such events.

We appreciate and wish to acknowledge the contributions of reviewers for this issue of the journal, including Gaurav Bansal (University of Wisconsin, Green Bay), Queen Booker (Metropolitan State University), Mari Buche (Michigan Technological University), Sean Eom (Southeast Missouri State University), Yi "Maggie" Guo (University of Michigan, Dearborn), Rob Johnson (State Farm), Barbara Klein (University of Michigan, Dearborn), Dahui Li (University of Minnesota, Duluth), Jeffrey Merhout (Miami University), Alanah Mitchell (Drake University), Kevin Scheibe (Iowa State University), and Troy Strader (Drake University).

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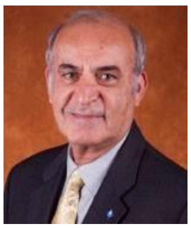

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Systematic Mapping Study in Information Systems Research

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Abstract

A systematic mapping study is a type of secondary study with the goal of providing an overview of a subject as it is reported in primary studies. A systematic map often describes research trends over time, uncovers possible research gaps and focus points, and provides a synthesis of the chosen subject. We believe that while a systematic mapping study should not be the sole research method for a researcher, it is a noteworthy candidate for one of the first research methods in a researcher's career. In this study, we argue for and against utilizing a systematic mapping study as one of the first research methods in information systems research and provide accessible guidelines for conducting a systematic mapping study. Although these instructions are for educators, we have strived to communicate these guidelines for an undergraduate or graduate thesis writer by providing examples of other mapping studies, giving our opinions on the numbers of primary studies regarding each step of the mapping process to manage a feasible workload, and presenting hints and tips on applicable tools.

Keywords: systematic mapping study, information systems research, research method

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1. Introduction

As the number of scientific studies on a particular field or subfield grows, it is arguably and understandably more and more difficult to understand current research trends, subject areas, and research gaps. In such cases, it is intuitive to map the studies in the field to achieve a high-level understanding. This process is called a systematic mapping, and the result of the process is a systematic map (Petersen et al., 2008). The word systematic typically implies that the steps a researcher or researchers have taken follow a process that is reported in explicit detail so that the process can be replicated by other scholars. In contrast, many scientific studies include a background section that discusses prior studies which are selected and described in a non-systematic way.

The method behind a systematic mapping study is closely related to systematic literature review. The difference between a systematic literature review and a systematic mapping study can be summarized in the depth and breadth of the methods. That is, a systematic literature review often strives for an in-depth understanding of a particular topic through previously published studies, while a systematic mapping study is often interested in a higher-level understanding of, e.g., topics, approaches, and bibliographic summarization of previously published studies. As summarized by Petersen et al. (2008), a systematic mapping study is often concerned with a broader range of primary studies, but the analysis is not as deep as in a systematic literature review because of different goals. Furthermore, the authors commend a systematic mapping study's accessibility through visualizations and broad focus that makes a systematic mapping study potentially a more accessible introduction to a topic than an in-depth systematic literature review. However, some systematic mapping studies also describe phenomena on a detailed level, making the definition and separation between the two methods often blurry (e.g., López et al., 2021; Novais et al., 2013).

While there are several guidelines for performing systematic mapping studies in the field of software engineering (Petersen et al., 2008; Kitchenham & Charters, 2007), to our understanding, there are no guidelines targeted specifically for information systems, and above all, for novices. In this study, we present arguments for and against using the systematic mapping process as a way to teach novices the basics of the scientific method and provide accessible guidelines for conducting a systematic mapping study. These guidelines were initially formed by applying and particularizing previously established guidelines (Petersen et al., 2008) in information systems research. The guidelines were subsequently refactored for novices through novice feedback and expert opinions, and by observing and supervising novices applying the guidelines. This was not done in a systematic fashion, and therefore, this study presents an iterated expert opinion and examples from prior studies, rather than a systematic mapping on how to conduct a systematic mapping study.

The rest of the study is structured as follows. In the next section, we provide a high-level overview of systematic mapping study steps. These steps are detailed in the following sections. Section 3 describes the initial steps such as defining the scope, research questions, and exclusion criteria, Section 4 details the database searches, Section 5 the study selection process and snowballing, and Section 6 guides in reporting the results and limitations of a systematic mapping study. In Section 7, we discuss the incentives and limitations of using a systematic mapping study in general. Section 8 concludes the study.

2. Overview

This section provides an overview of the steps involved in conducting a systematic mapping study. The steps are described in more detail in the subsequent sections, named identically to the leftmost column in Table 1. Other examples of the systematic mapping process are presented in Figure 1. The process illustrated on the left side of Figure 1 is a common approach starting from database searches and ending with the final study selection. *E*s in the figure refer to exclusion criteria. The process on the right side of Figure 1 presents a different approach starting from a previous systematic mapping study and continuing with several rounds of snowballing, i.e., using citations or references in finding more relevant primary studies. Notice how the snowballing ends when new papers are no longer found. Snowballing is discussed in more detail in Section 5.5.

What to do (Section number)	Document for reporting in the Subsequent Manuscript	The number of potential primary studies after the step	Section
Refine study scope			3.1
Phrase the research questions	Your research questions.		3.2
Judge and justify whether a mapping study is needed	Motivation for your systematic mapping, other similar or tangential systematic maps and literature reviews.		3.3
Draft inclusion and exclusion criteria	Your criteria as a numbered list.		3.4
Select relevant databases	Your selected databases.		4.1
Define the search terms	Your search terms for each of your selected databases.		4.2
Extract metadata and the articles	How many articles were returned by your searches from each of your selected databases? All available article metadata, at the very least the title, authors, publication year, publication forum, and the source database.	Hundreds, but more than 2,000 may make the selection process overly arduous for a single researcher.	4.3
Selection based on title	Which articles were removed and why? Refer to a specific exclusion criterion.	Dozens or hundreds.	5.1
Selection based on abstract	Which articles were removed and why? Refer to a specific exclusion criterion.	Dozens or hundreds.	5.2
Selection based on full text	Which articles were removed and why? Refer to a specific exclusion criterion.	Dozens.	5.3
Refine criteria	Your refined criteria as a numbered list.	Dozens.	5.4
Snowballing (*snowballing* refers to finding relevant works by using references or citations)	How many rounds of snowballing was conducted? How many articles for each round of snowballing were added? Report the type of snowballing, i.e., backward, forward or both.	Dozens.	5.5

Table 1. An overview of steps involved in conducting a systematic mapping study

3. Initial Steps

3.1 Refine Study Scope

As with many other research approaches, designing a systematic mapping study starts with refining the scope of the study. In contrast to empirical studies, the scope of a systematic mapping study or a systematic literature review is typically limited to three distinct approaches. First, *a precision mapping* of a single theme, as Pahl and Jamshidi (2016) did in their mapping study on microservices. Second, the mapping by Rios and Paredes-Velasco (2021) in their article on augmented reality in education is a fitting example of systematic mapping in the *intersection of two themes*. Finally, a *theme can be reflected from the viewpoint of a theory*, as Murillo et al. (2021) did in their mapping regarding Moodle and the Technology Acceptance Model.

3.2 Phrase the Research Questions

Systematic mapping studies often have two types of research questions. First, there are research questions typical for systematic mapping studies. These questions map the selected primary studies in terms of publication years, publication fora, research approach, and theme. A little less common is the mapping of the geographical distribution of the primary study author countries and evaluating the primary studies in terms of validity and reliability. Publication trends in gamification: A systematic mapping study by Kasurinen and Knutas (2018) is an example of a systematic mapping study focused on research questions such as these. Second, systematic mapping studies may also include other, more domain-specific research questions. For example, Paternoster et al. (2014) aimed to answer the question "What are the reported work practices in association with software engineering in startups?", and Taipalus and Seppänen (2020) attempted to answer "Which practices have been proposed for teaching SQL?" in addition to answering research questions typical for a systematic mapping study.

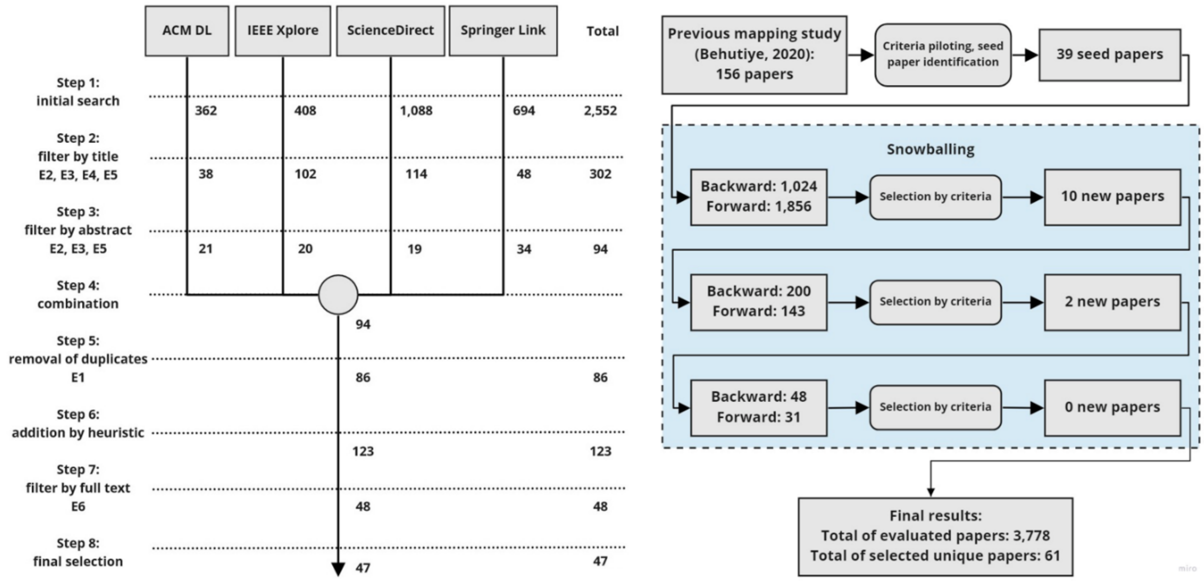


Figure 1. Two examples of reporting the process of selecting primary studies (left side adapted from Bischoff et al., 2019, right side adapted from López et al., 2021)

Research questions	Source
"*What is the annual trend of publications?*"	Akoka et al. (2017)
"*What research methods have been used?*"	Bischoff et al. (2019)
"Which topics for testing product lines have been investigated and to what extent?"	Engström & Runeson (2011)
"What analysis tasks does the SEV [software evolution visualization] *claim to support?"*	Novais et al. (2013)
"What tools are used to manage and visualize these QMIs [quality management indicator]*?"*	López et al. (2021)
"Which practices have been proposed for teaching SQL?"	Taipalus & Seppänen (2020)
“Which factors influence successful adoption of dataspaces?”	Hutterer & Krumay (2022)
“How are developed maturity models validated?”	Wendler (2012)

Table 2. Examples of research questions (RQ) in systematic mapping studies – the three first rows show RQs typical for mapping studies, and the five last rows subject specific RQs

Another diligently followed example concerning the outcomes of a systematic mapping study is the categorization of primary studies according to both the primary study theme and research approach. As perhaps the most suitable example, Petersen et al. (2008) categorize their selected primary study themes into metric, tool, model, method, and process. This categorization by study theme is typically context-dependent. Further, the authors categorize their selected primary study research approaches into evaluation research, validation research, solution proposal, philosophical paper, experience report, and opinion paper. Categorizations such as these are an accessible way of identifying research gaps as well as focus points. Both categories and themes should be explicitly defined. The research approaches utilized by Petersen et al. (2008) are summarized from the work of Wieringa et al. (2006) and are relatively common. Sometimes, however, these categories of research approach may be unsuited for a particular subject. For example, Taipalus and Seppänen (2020) redefined these categories for their mapping study to more adequately fit educational research. Some examples of research questions in systematic mapping studies are presented in Table 2.

3.3 Judge and Justify Whether a Mapping Study is Needed

Once you have defined your research questions, one thing to evaluate is whether a systematic mapping study is needed. Evidence to the contrary might simply be that there are not enough primary studies that would form a feasible map. After all, the goal of a mapping study is to provide an overview of a subject, but if the number of primary studies is counted in single digits, an overview might be better formed by simply reading these primary studies rather than conducting a systematic mapping study.

On the other hand, there might be several mapping studies on the same topic with similar research questions already published, which raises the question of whether yet another mapping study would contribute to the increased understanding of the topic. As an example, from another field of science, healthcare data analytics has received several dozen systematic mapping studies or systematic literature reviews over the past twenty years. It follows that novel secondary studies on healthcare data analytics are arguably expected fresh perspectives, rather than stating similar findings as previous studies. This perspective can be derived from the combination of new themes, new data analytics methods or healthcare subfields, or simply time, as a mapping study written in 2010 can only look at primary studies published in 2010 or before. If there are mapping studies published on the same or even a tangential topic, be sure to discuss them in your research, position your mapping study accordingly, and justify the need for your mapping study.

3.4 Draft Inclusion and Exclusion Criteria

Inclusion and exclusion criteria define which primary studies you include in your systematic mapping. These criteria are reported as explicitly as feasibly possible. Some researchers define both inclusion and exclusion criteria, but as effectively every inclusion criterion can be swapped as an exclusion criterion by negation (and vice versa), other researchers simply define only inclusion or only exclusion criteria.

The criteria can be diverse. Typically, researchers exclude studies that are not written in a particular language or languages. Other common criteria concern the availability of full texts, a range of accepted publication years, and limiting the primary studies to those published in scientific peer-reviewed fora, which typically leaves out whitepapers, blog and forum posts, etc. All in all, the criteria can be whatever serves the process of answering the research questions, e.g., Švábenský et al. (2020) did in their mapping study on cyber security education, limited solely to articles published in ACM's SIGCSE and ITiCSE conferences, and Da Silva et al. (2014) limited their primary studies solely on replication studies. It is worth noting that the criteria utilized by Švábenský et al. typically require solid arguments on why other similar fora were not considered in the mapping process.

In addition to the aforementioned criteria concerning article *metadata*, systematic mapping studies usually also define criteria concerning article *content*. These criteria can be related to how concepts are defined, which definitions are acceptable, whether an article focuses on the topic or merely mentions it, or whether the articles present empirical findings. For example, Oliveira et al. (2019) defined one of their exclusions criterium as "*the study does not present any type of findings or discussion about Data Ecosystems*."

Whatever you choose as your criteria, unless you are an expert on previously conducted research on the topic, prepare to iterate your criteria as your research progresses. That is, define your criteria as accurately as possible, but as you familiarize yourself more with the topic by reading potential primary studies, you are likely to learn more about the topic. This process may reveal that your initial criteria were ill-defined, inaccurate, unfeasible for a systematic mapping study, or simply based on incorrect assumptions.

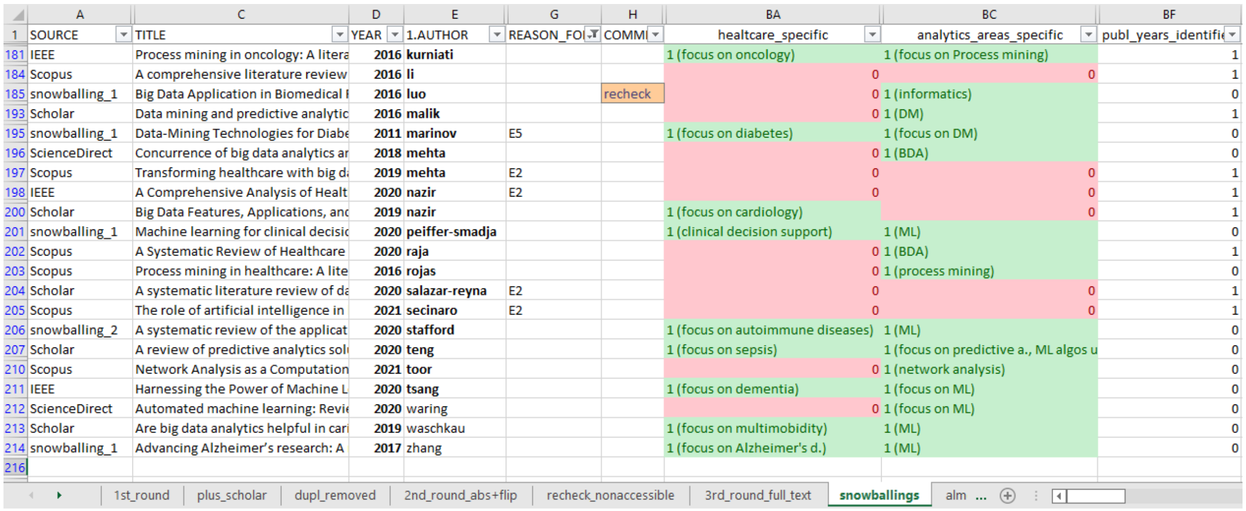
4. Database Searches

4.1 Select Relevant Databases

Selecting relevant databases to search for primary studies is a crucial step in finding and arguing for finding relevant prior works. In the field of information systems which lies in the intersection of information technology and several other disciplines such as business and economics, psychology, and management, it is arguably required to apply a wide selection of databases. Perhaps the most prominent database focused on information systems science fora is the Association for Information Systems (AIS) eLibrary. Other common and related databases are Association for Computing Machinery's (ACM) Digital Library, and the Institute of Electrical and Electronics Engineers' (IEEE) Xplore. ScienceDirect indexes journal articles and book chapters published by Elsevier, and Scopus indexes these and additional sources from scientific fora counted in tens of thousands. The databases listed here are also suitable for systematic mappings in fields such as software engineering, computer science, or information technology in general. Another approach is to utilize databases of selected journals if these are available. While Google Scholar indexes effectively all research, we have found it unsuitable for systematic mappings or systematic reviews because searches return stochastic results which number typically in tens or hundreds of thousands, making the selection process unnecessarily arduous and the search non-replicable by other researchers. If your criteria do not apply to publication fora, it is common to select two to five databases for the search.

Search term	Source
(("software develop* OR "system* develop*" OR "software engineer*") AND (competence*))	Assyne et al. (2021)
TITLE-ABS-KEY ((“IoT” OR “Internet of Things”) AND (medic* OR health* OR hospitals OR clinic* OR diseases))	Sadoughi et al. (2020)
((uml OR unified modeling language OR unified modelling language) AND (consistency OR inconsistency))	Torre et al. (2014)

Table 3. Examples of search terms and their reporting in selected systematic mapping studies



	A	C	D	E	G	H	BA	BC	BF
1	SOURCE	TITLE	YEAR	1.AUTHOR	REASON_FO	COMMI	healtcare_specific	analytics_areas_specific	publ_years_identifie
181	IEEE	Process mining in oncology: A litera	2016	kurniati			1 (focus on oncology)	1 (focus on Process mining)	1
184	Scopus	A comprehensive literature review	2016	li			0	0	1
185	snowballing_1	Big Data Application in Biomedical I	2016	luo		recheck	0	1 (informatics)	0
193	Scholar	Data mining and predictive analytic	2016	malik			0	1 (DM)	1
195	snowballing_1	Data-Mining Technologies for Diabe	2011	marinov	E5		1 (focus on diabetes)	1 (focus on DM)	0
196	ScienceDirect	Concurrence of big data analytics ar	2018	mehta			0	1 (BDA)	0
197	Scopus	Transforming healthcare with big da	2019	mehta	E2		0	0	1
198	IEEE	A Comprehensive Analysis of Healt	2020	nazir	E2		0	0	1
200	Scholar	Big Data Features, Applications, and	2019	nazir			1 (focus on cardiology)	0	1
201	snowballing_1	Machine learning for clinical decisio	2020	peiffer-smadja			1 (clinical decision support)	1 (ML)	0
202	Scopus	A Systematic Review of Healthcare	2020	raja			0	1 (BDA)	1
203	Scopus	Process mining in healthcare: A lite	2016	rojas			0	1 (process mining)	0
204	Scholar	A systematic literature review of da	2020	salazar-reyna	E2		0	0	1
205	Scopus	The role of artificial intelligence in	2021	secinaro	E2		0	0	1
206	snowballing_2	A systematic review of the applicat	2020	stafford			1 (focus on autoimmune diseases)	1 (ML)	0
207	Scholar	A review of predictive analytics solı	2020	teng			1 (focus on sepsis)	1 (focus on predictive a., ML algos u	0
210	Scopus	Network Analysis as a Computation	2021	toor			0	1 (network analysis)	0
211	IEEE	Harnessing the Power of Machine L	2020	tsang			1 (focus on dementia)	1 (focus on ML)	0
212	ScienceDirect	Automated machine learning: Revie	2020	waring			0	1 (focus on ML)	0
213	Scholar	Are big data analytics helpful in cari	2019	waschkau			1 (focus on multimobidity)	1 (ML)	0
214	snowballing_1	Advancing Alzheimer's research: A	2017	zhang			1 (focus on Alzheimer's d.)	1 (ML)	0
216									

Figure 2. Master file in Microsoft Excel; *E*s in column *G* refer to exclusion criteria

4.2 Define the Search Terms

After selecting the databases, you need to define your search terms. Based on the initial screening of articles, you should have at least a preliminary understanding of key terms, their synonyms, and the context they appear in. Most databases allow the use of logical operators, parentheses, and wildcards, but the syntax usually differs from database to database. It is worth noting, just in case, that e.g., the search string *"information AND systems OR education"* is not equivalent to *"(information AND systems) OR education"*, the latter being more restricting (cf. Table 3 for more examples).

Defining the search terms and iterating them is a crucial step toward selecting a feasible number of primary studies for inspection. While there is no commonly agreed number of search results to aim for, we have come to experience that the total number of search results from all your selected databases should not be more than 2,000 articles if you are conducting the systematic mapping on your own. If you have co-authors who can share the workload, more articles may be selected.

4.3 Extract Metadata and the Articles

After a search has been executed, many databases allow the extraction of the search results, i.e., article metadata such as title, author names, and publication forum as Microsoft Excel files (.xlsx) or as comma-separated values (.csv), and while each database offers this feature a little differently, the feature is usually there. If it is not, the process of extracting results manually is an arduous task, but usually worth the initial time. Having article metadata in a single file makes keeping track of the total of articles easier and helps with the final reporting. We call this record the *master file* (Figure 2). Gathering all the database searches in a single Excel spreadsheet (or similar) makes it easy to remove duplicates (simply sort by the column containing the article title), see publication years (sort by publication year), and keep track of which articles are still part of the systematic map, and which are not and why. We like to color the cells that fail some criterion and use an additional column in which we type which criterion was not met.

5. Study Screening

5.1 Selection Based on Title

We like to select the articles based on three rounds of reading, i.e., selection based on title, selection based on abstract and keywords, and finally selection based on full text reading. Selection based on title is typically easiest done using a spreadsheet (or wherever you have compiled your search results). Before starting to read the titles, however, be sure to apply exclusion criteria concerning the publication years and fora, if any, to avoid unnecessary work. When you start reading the titles, most of them typically reveal that the article does not fit the scope of your mapping. This is because many databases return results in abundance, and the connection between an article and your search terms may not always be clear. Sometimes, though, a title clearly implies that the article is relevant, or that further inspection is warranted. It is not uncommon that even up to 90 percent of the articles returned by the database searches are excluded based on the reading of the title alone.

5.2 Selection Based on Abstract

Second, you start familiarizing yourself with the primary studies by reading the abstracts of articles that were either clearly or borderline relevant. At this stage, articles that were deemed clearly relevant based on the title may turn out to be outside the scope of the systematic mapping, and borderline articles may reveal themselves as relevant or irrelevant. Again, you should note which of the articles were excluded at this stage and why by explicitly referring to your criteria. A yardstick for work required at this stage can be roughly measured by considering that a typical abstract is approximately 200 words in length and reading 30 abstracts amounts to reading one full-length article of 6,000 words.

5.3 Selection Based on Full Text

Third, and depending on your criteria, this step may involve quick skimming or thorough reading of the full articles. For example, if you have defined your criteria in a way that you only include studies with empirical results, reading the methodology and results sections of the articles may be enough. In contrast, if your criteria involve strict adherence to a definition of a concept, for example, you may need to read the full texts thoroughly. Nevertheless, the number of articles at this stage is typically measured in dozens, not hundreds.

Once you are quite sure that an article fits your criteria, you may want to download or otherwise save it for easier access in the future (if you have not done so already). However, sometimes full text articles may be difficult to find or access. While many academic institutions provide access to various databases with full text articles, it is useful to know that while this way is often the easiest, in case it is not available, there are other ways. Often, a Google Scholar search reveals other sources than that of the publishers, e.g., the article can be stored as a final draft (that is, a version that was accepted for publication, but not necessarily typeset or formatted as the final publication) in the author's organization's repository. A search on arXiv can also reveal a final draft that is available without a subscription. Finally, if all else fails, authors are often more than happy to send a copy of their article against a request via ResearchGate or email. The easiest place to search for the author's email is typically on the first page of an article.

5.4 Refine Criteria

No matter how pedantic you were in defining your inclusion and exclusion criteria earlier, it is rather typical that after reading the full articles, you may need to iterate your criteria. For example, you may have narrowed your systematic mapping to cognitive load theory in educational contexts. However, after you read the articles, you begin to understand that there are many interpretations of cognitive load theory, some of which fit your initial definition and some of which do not. For the repeatability of your systematic mapping, you may need to revise your criteria and re-apply them to all the articles to see whether they still qualify for your systematic mapping. After this stage, it is typical that no articles are excluded anymore.

5.5 Snowballing

Effectively all database searches are subject to omitting key works – or alternatively, returning too many articles for a feasible title-based reading. This challenge can be mitigated by a process called *snowballing*, i.e., following either references or citations to capture relevant works more inclusively (Wohlin et al., 2022). Effectively, you read the lists of references of your selected primary studies (this is called *backward snowballing*) and include relevant works. Alternatively, or additionally, you may check which newer studies cite your selected primary studies (this is called *forward snowballing*). Among others, Google Scholar (Figure 3, right side top), Wiley Online Library (Figure 3, right side bottom), and Web of Science provide a list of works that cite a particular study. Snowballing can be done several times to better ensure that all relevant works are included in the systematic mapping, as on the right side in Figure 1.

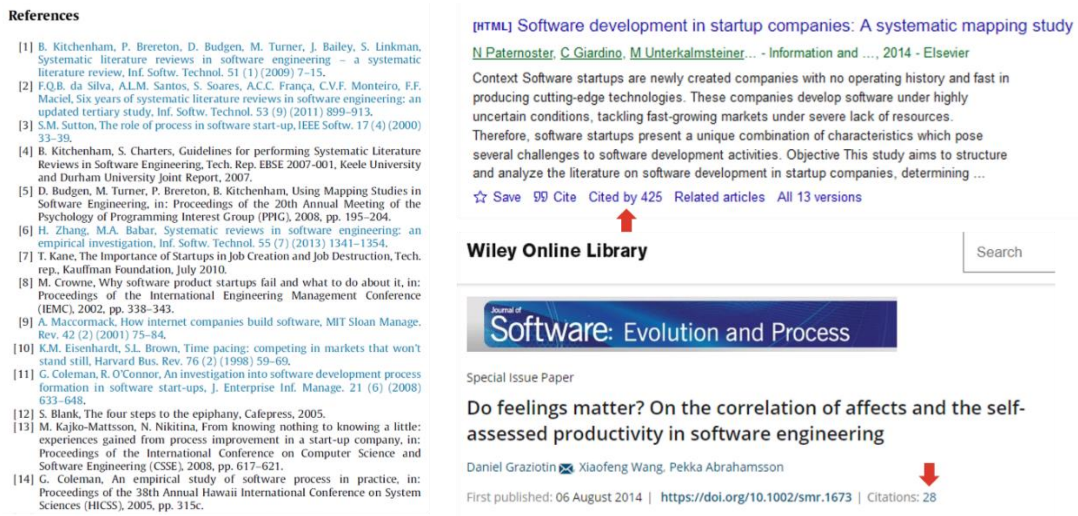


Figure 3. Backward snowballing is conducted by following the lists of references (left side from Paternoster et al., 2014), and forward snowballing by exploring studies that cite the selected primary study (see red arrows in both right-side figures)

Now that you have selected your primary studies, it is time to read them thoroughly, especially with your research questions in mind. If you chose to categorize your primary studies by, e.g., research approach and topic as discussed in Section 3.2, you should also write them down in your master file.

6. Reporting

6.1 Reporting the Systematic Map

Once you have completed your systematic mapping, it is time to compile the process and the systematic map as a research article. This is typically done in two parts. First, as the process is *systematic*, it is crucial that it is reported as explicitly as feasibly possible for repeatability. Crucial parts to report from the systematic process are the inclusion and exclusion criteria, databases selected, search terms, the number of results from each database, and the number of articles selected for inclusion in each step of the process. Refer to the examples in the previous sections for reporting each of these parts.

Second, you need to report the systematic map, i.e., the results of your systematic mapping process. What you report in your systematic map depends on your research questions, many of which are likely to be typical for a mapping study (cf. Section 3.2). Two common findings to report are publication years (cf. Figure 4) and publication fora. On the left side of Figure 4, notice how each selected primary study (identifiers inside the circles) is positioned according to the publication year. Additionally, the chart shows the publication forum for each primary study presented by the acronyms. On the right side of Figure 4, in addition to reporting the number of primary studies published each year, the stacked bar chart shows the research approaches of the primary study each year, and it is relatively easy to see from the chart that, e.g., empirical research on the subject is on a steady rise.

If you chose to map research approaches and themes, these are commonly reported in a form of a bubble chart (cf. Figure 5). A bubble chart gives a quick overview of which themes research has focused on (and perhaps neglected) and how these themes have been studied. Notice in Figure 5 that research foci and gaps are relatively easy to spot, e.g., validation research on requirements engineering studies seems to be scarce. You may also want to consider using other types of presentations or visualizations of information that may help you to explain your findings. For example, Taipalus and Seppänen (2020) found that based on their selected primary studies, the field of SQL education seems segregated into research silos, and studies in some silos seldom cite studies in other silos. To more effectively explain this, the authors constructed a citation graph (Figure 6). Finally, you may want to consider whether to include the list of your selected primary studies in your list of references, or as a separate list or appendix. This approach clearly separates the studies selected for your systematic map from the studies you have utilized in your introduction and background sections.

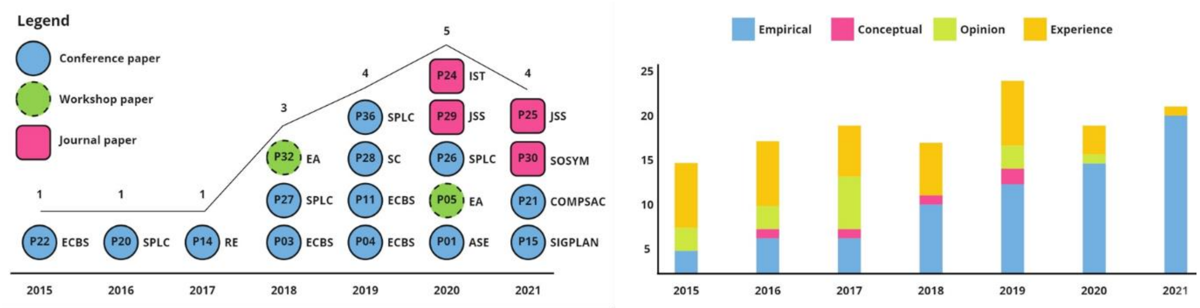


Figure 4. Examples of visualizations of publication trends by year (left side adapted from Bischoff et al., 2019, right side adapted from Isomöttönen et al., 2018)

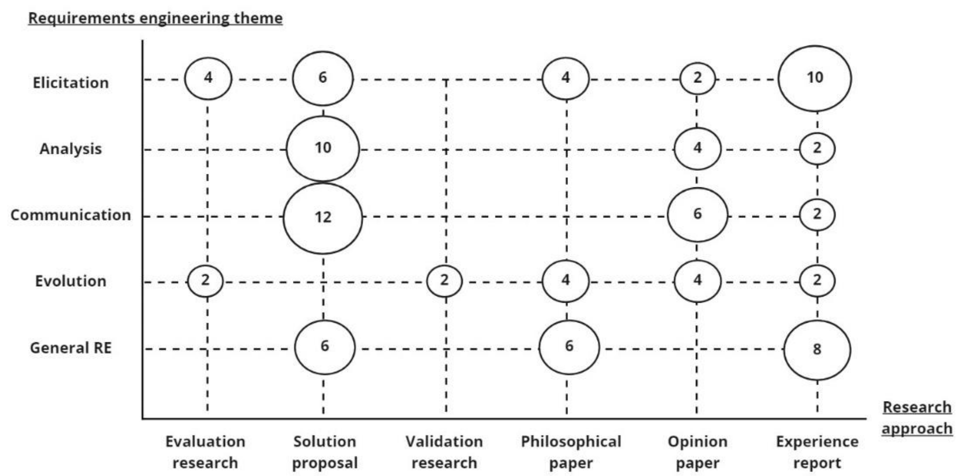


Figure 5. A typical bubble chart where the bubble size in the intersection of themes and research approaches represents the number of primary studies (adapted from Lemos et al., 2012)

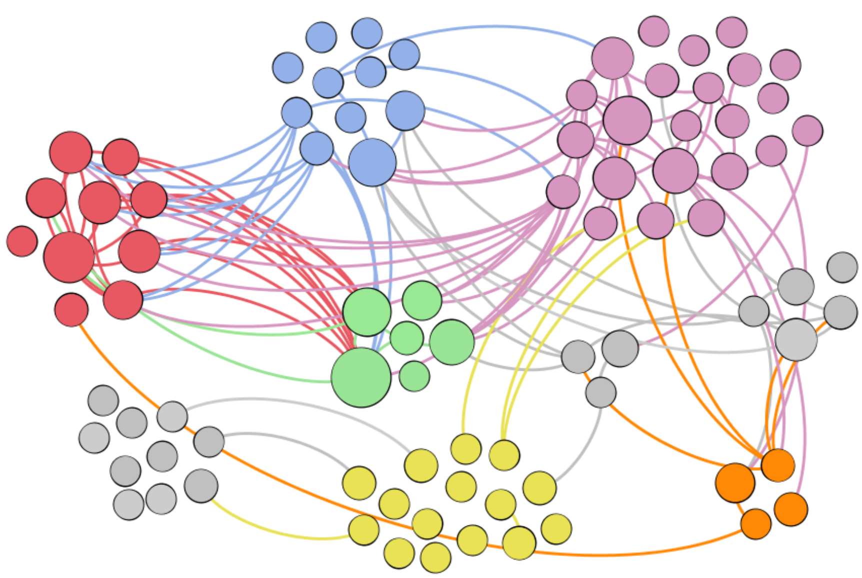


Figure 6. A citation graph showing citations among primary studies to highlight the segmentation of the research field (adapted from Taipalus & Seppänen, 2020)

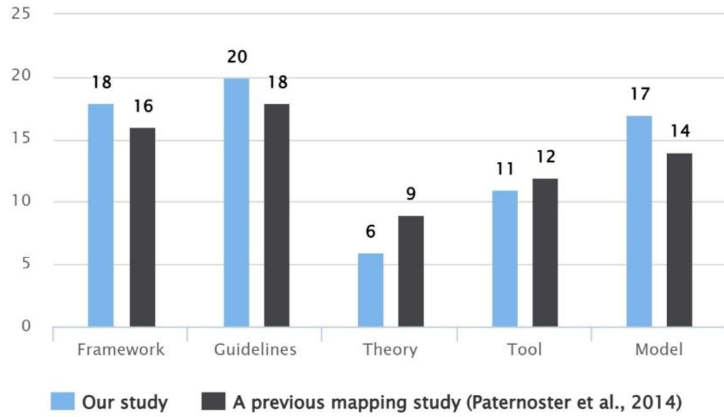


Figure 7. A bar chart comparing the number of primary studies in each theme to the results of another systematic mapping study (adapted from Berg et al., 2018)

6.2 Formulating a Synthesis and Discussing the Implications

After conducting the systematic mapping study, you are likely one of the few researchers who know your exact topic to this degree. Along with your relatively objective systematic map, your more subjective input on the state of research, industry, and education concerning the topic is the most interesting part of your research. Do not leave the discussion on the practical implications of your systematic map to the level of "*the systematic map provides an increased level of understanding concerning the topic*". Rather, compile and interpret your findings, and provide concrete suggestions on to how these insights can be utilized by other researchers, industry, and educators. Is research concerning the topic increasing or declining over the years? Why? What does this trend imply and how should we react? Did you notice research gaps or focus points? Where? Are these insights important and for whom? Compare your results to other similar or tangential systematic maps and literature reviews, if applicable. What can you infer from such comparisons? This is the part of your research where you can show your expertise (or lack thereof) accumulated during the mapping process.

6.3 Reporting Threats to Validity

Kitchenham et al. (2010) emphasize rigor in conducting the systematic mapping study for the results to be a valid baseline for other researchers. Effectively all research is subject to several threats to validity, i.e., factors that can have unexpected and unwarranted effects on the results. By following systematic mapping guidelines and reporting all steps explicitly and transparently, you can mitigate many of the acknowledged threats to validity concerning systematic mapping studies. For example, snowballing is conducted to further ensure that you have not missed relevant primary studies due to ill-phrased search terms or database selections.

If you conducted the mapping study as the sole author, your main threat to validity is probably the fact that the primary study selection and categorization (by research approach, theme, etc.) is based solely on your subjective interpretation. If you conducted the mapping study as a bachelor's or a master's thesis, which is typically a single-author work, there is usually not much you can do to mitigate this threat. Based on conventions in your institution, you may ask if you can use the help of another student or your thesis supervisor to validate a part of your work. Commonly used metrics for measuring agreement between researchers selecting and classifying primary studies are Fleiss' (1981) or Cohen's (1960) Kappa. If there are other systematic mapping studies with similar subject areas and research questions, consider comparing their results with yours, as presented in Figure 7. Nevertheless, reporting any threat to validity, even in the case you did not or could not mitigate it, shows that you understand the potential pitfalls in the research method, and in your application of it.

6.4 Further Reporting for Transparency

Instead of simply reporting the numbers of primary studies by research approach, you might be asked to explicitly show which particular primary studies you have categorized to which research approach. You might be required to report which potential primary studies you excluded and why. A reviewer or a supervisor may request that you list all the research articles returned by your database searches, not only the number of results from each database. With these considerations in mind, keeping your systematic mapping process explicitly reported throughout all the steps in the process will help you if more transparent reporting is required. Even if it is not, you can include your master file in your research as a supplementary appendix from the very beginning.

7. Discussion

7.1 Incentives for Using a Systematic Mapping Study

Compared to other research methods, a systematic mapping study is a relatively accessible and agile way of experiencing the underlying mechanisms of the scientific method. Starting with data collection, a systematic mapping study is as effortless as other secondary research methods such as systematic literature reviews. The method is also applicable to various fields of science such as education, medicine, art, and business (Vanhala et al., 2022). If the researcher has access to relevant scientific databases, the data collection process can begin relatively effortlessly. Furthermore, a systematic mapping study is not subject to data collection problems arising from the uncertainty of finding study participants, sometimes long waiting times of acquiring enough data, or the risk of selecting a participant sample that does not represent the population. While such considerations are relatively common in scientific research, they arguably take from the process of learning the application of a scientific method or halt the process completely. Furthermore, the primary study selection process may be iterated with relative ease, and without committing to a decision in the early phases of the research.

In the analysis phase, a systematic mapping study does not necessarily require methodological expertise besides applying the systematic mapping process. Should the researcher choose so, however, both qualitative and quantitative methods may be applied to the selected primary studies. Generally, however, the process of applying the systematic mapping process is more about understanding the subject matter, rather than applying a method. Guidelines for reporting a systematic mapping study such as those of Petersen et al. (2008, 2015) and Kitchenham (2004) also discuss and recommend that the researchers consider and report different threats to validity. These considerations are suitable for the teaching of the scientific method through a systematic mapping study, as the effects of mitigating threats to validity are rapidly reflected upon the selection or categorization of the primary studies.

7.2 Limitations of a Systematic Mapping Study

While a systematic mapping study can be suitable for applying the scientific method in practice, the method emphasizes the accumulation of knowledge on the subject matter over developing skills important for a researcher in general. As the data collection process is merely concerned with primary studies and not participant-generated data, applying the method does not yield the researcher the experience of working with anomalous or missing data, or with unexpected values therein. Furthermore, as the systematic mapping process does not require the researcher to commit to an approach early on, this agile approach may not teach the importance of planning the research as deeply as a failed experiment with weeks or months of planning.

In the analysis phase, the researcher may not be subjected to research methods other than the systematic mapping process. While this is true with other research methods as well (i.e., a study with a regression analysis only applies regression analysis), it might be seen as a weakness because new knowledge yielded by a systematic mapping study is largely limited to what can be synthesized, abstracted, or inferred from the primary studies. In this regard, the research avenues are limited to those of prior studies. All in all, the systematic mapping study is a fast and relatively risk-free approach to learning many of the principles of the scientific method. While a systematic mapping study is unlikely to be hindered by data collecting or analysis-related issues, from a pedagogical point of view, it is important to understand the limitations as well.

8. Conclusion

Systematic mapping studies are often warranted in order to form and report a high-level overview of research directions, gaps, and trends regarding a particular scientific topic. In this study, we presented accessible systematic mapping study guidelines and examples targeted specifically for novices and information systems research. Additionally, we presented arguments for utilizing systematic mapping studies in teaching the principles behind the scientific method and discussed the limitations of using a systematic mapping study. These guidelines may be utilized by both educators teaching the process of systematic mapping study in information systems research, as well as by learners in applying the method in practice.

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IS Career Day in a Class: Raising College Student Awareness and Interest in Information Systems

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Abstract

Organizations are constantly seeking college graduates with IT and digital skills. This shortage of IT talent is cited as a barrier to implementing emerging technologies at many organizations. Nevertheless, when asked why they are taking an Introduction to IS class, students respond with, "this class is required." This paper describes how a career day, job fair, and day-in-the-life were combined to create an IS Career Day in a Class. During this session, college students engage with IT hiring managers, IT recruiters, recent information systems alums, and current students with internships to understand the academic and career pathways available through the information systems program. This paper also addresses stereotypes around diversity and coding. Quantitative and qualitative data were collected to understand student interest in IS and to provide feedback about the event.

Keywords: IS career path, IS academic path, IT employability

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1. Introduction

The need for information technology (IT) workers has grown throughout the COVID-19 pandemic of 2020 and 2021. In fact, 79% of CEOs surveyed expressed concern about the lack of talent for technology-related roles (English, 2021). Similarly, Gartner (2021) notes that 64% of IT executives see the talent shortage as the most significant barrier to adopting emerging technologies, up from just 4% in 2020. The need for skilled college graduates creates industry pressure on our program to increase job shadows, internships, and graduates with digital and technical skills. Like many business programs, those offered by our university require undergraduate students to take an introductory course in Information Systems. When asked why they are taking the class, most students reply, "because it is required" or "I don't know, my advisor said I needed to." Many college students do not understand what an information systems (IS) focus means nor how a focus in IS can impact their career options.

While instructors hope that the structure of our course and class activities will naturally draw students into our IS discipline, this is not always the case. Li et al. (2014) illustrated that the impact of unique promotional events increases positive perceptions of the Information Systems program, and students are more likely to select an Information Systems program. Similarly, guest speakers and panels allow students to learn about careers, hear what professionals enjoy about their work, required skills, confidence in career choice, and salary and promotion opportunities (Metrejean et al., 2002; Walker et al., 2022). Finally, career days can assist students in exploring career options and assessing how they will fit in the IT industry (Lee et al., 2020).

We created an IS Career Day in a Class event to address this problem. Students engage with hiring IT managers, human resource recruiters, and recent IS alums during the session. This unique in-class event combines elements of a career day, job shadow, and panel presentation to expose students to our IS discipline and show them both academic and career paths within IT. To accomplish this, we showcase specific industry needs, opportunities, and jobs (including salary) within the information technology departments of companies across the region. Similarly, the IS Career Day in a Class highlights that companies seek graduates with digital and technical skills, regardless of the specific job. Students hear about various roles and an IT employee's "day in the life." By focusing on the social and technical aspects, students gain an insight into the role and what they could expect as an employee. Panelists also share information regarding their companies and industries. Students are often unaware of many local and regional companies or their products and services. Students learn why their peers pursued IS-related majors, minors, or certificates. They hear about the jobs that these recent graduates accepted upon graduation. Students can ask panelists questions throughout the event. The IS Career Day in a Class also has a breakout period where students can interact with each panelist in a smaller group.

Several relevant theories guided the development of the IS Career Day in a Class. First, through the IS Career Day in Class interactions, students experience socialization with IS careers, including the nature of the work, insight into the working environment, and what to expect from a career in IS (O'Brien, 2018; Olsen, 2021). By speaking with professionals in the IS field, students can explore various careers and learn more about what they want to do in the future while feeling more confident and comfortable. Similarly, this event builds academic and career self-efficacy within students. Students learn more about potential academic and career pathways, hear from peers and professionals, learn skills and roles, and ultimately feel better about managing their academic and professional careers (Bandura, 1986; Kitchen et al., 2021; Kossek et al., 1998). Next, we recognize the importance of engaging IT speakers with ethnic and gender diversity to engage all students in pursuing IS courses and careers (Deng et al., 2022). Finally, the event attempts to shatter many students' computer science stereotypes. These Stereotypes of IT professionals include technology-oriented obsession, innate genius, social awkwardness, unattractive physical appearance, and masculinity (Vera, 2021).

An understanding of self-efficacy also guides the approach to the IS Career Day in a Class. According to Bandura (1986, 1997), students' beliefs in their ability serve as a powerful motivator to act and provide persistence and coping mechanism when setbacks occur. Further, Bandura (1986, 1997) proposed four sources of self-efficacy, including mastery experiences, vicarious experiences, verbal persuasion, and physiological arousal, with mastery experiences postulated as the most potent source. Our students in this introductory course have minimal to no mastery experience. Given this lack of mastery experience, we built the event to showcase vicarious experiences and verbal persuasion as the primary motivator for enhancing student self-efficacy beliefs (Tschannen-Moran & Hoy, 2006).

Students found the IS Career Day in a Class to be a valuable experience (82.9%). Similarly, 43.8% of students surveyed after the event indicated they would be interested in pursuing an IS-related career, up from 19.8% before the event. In addition, this study captured qualitative data around activities to start, stop, and continue related to the IS Career Day in a Class. For example, students indicated that IS Career options and opportunities, a roundtable with panelists, and small group breakouts should continue. Conversely, when asked what to stop, nearly 73% offered no response or indicated "nothing" or "good job." Most other comments were suggestions to improve the event.

This paper will proceed as follows. Part two provides an overview of the IS Career Day in a Class goals. Next, we address the actual execution of the event. Part four will offer implementation suggestions. Part five discusses participants' perception of the event and their interest in pursuing an IS academic path (IS major, minor, or certificate). Finally, part six will offer a discussion and conclusion.

2. IS Career Day in a Class Goals

Several goals were established to set guidelines and expectations for students, professors, and panelists as they prepared, presented, and attended the sessions.

2.1 Consider the value of technology and digital skills

First, the IS Career Day in a Class highlights the technology, digital skills, and opportunities hiring organizations have for all students they hire. Information Technology does not start and stop in the IT department. All employees must have technical and digital knowledge and skills (Munoz, 2021). This event helps the students understand that they should embrace these skills. This mindset opens the door to considering career and academic paths. Moreover, having worked and learned through the COVID-19 pandemic, most students saw the value of technology in support of their work and learning from remote locations (Dhunjishah, 2021).

2.2 Understand a Day-in-the-Life of an IT Employee

Participants in this event are encouraged to talk about the daily activities performed by many IT employees. The key stereotype is that IT employees code all day. One paper titled "I Don't Code All Day": Fitting in Computer Science When the Stereotypes Don't Fit (Lewis et al., 2016) explicitly targets this notion. In addressing the stereotype around "coding all day," IS Career Day in a Class, panelists showcase their day-in-the-life tasks. For many in the IT field, these tasks include face-to-face and virtual meetings with business users, meetings with different IT employees, translating business requirements into IT deliverables, documenting requirements, and completing reports and status updates. Some IT employees have periods of coding, database development, networking activities, and the more technical nuts and bolts of running an IT department supporting the business. It is essential that students hear a wide range of social-technical perspectives and related daily activities from the panelists. These career stories will better equip the students to see themselves performing various IT-related tasks. We must help students overcome the misconceptions around coding all day. This day-in-the-life understanding helps students grow their career self-efficacy and become open to considering both IS-related career paths and academic paths.

2.3 Explore the Numerous Information Systems-Related Career Paths

Similarly, as students are exposed to the value of technology and digital skills and understand the day-in-the-life of an IT employee, the discussion moves to the various career paths for information systems students and those students who complete IS-related minors and IS-related certificates. Our panelists highlight the quality, quantity, and starting wages associated with internships throughout the session. The discussion will highlight the number of open jobs for graduates. Students are often surprised that every company they hear about and physically drive-by daily has an IT department, often with our alums working there. Finally, we discuss the average starting salary for information system students. Within the College of Business, information systems represent the highest-paid major.

2.4 See that Diversity in Information Systems is Valued

Lack of diversity represents another common challenge in recruiting students into the information technology field. Students commonly report that their computer science stereotypes include being male, singularly focused, asocial, and competitive (Lewis et al., 2016). As we build panels, we carefully consider gender and other diversity so we can represent and showcase to students that racial and gender diversity is valued in the workplace. Similarly, we include aspects of Rowland & Notebook (2018) CLASS Anchor Model, including life system (work-life balance), security (career opportunities and financial security), and service (they see female IS leaders on the panel).

2.5 Explore Information Systems-Related Academic Paths

Once the importance of having technical and digital skills is established, we explore the day-in-the-life of IT professionals so that students can see an IS-related career path. We then turn our attention to the academic pathways supporting this new insight. We explore the information system major, cover the information systems-related minors, and cover the potential for marketing, management, HR, supply chain, finance, and accounting students to earn an IS-related certificate.

2.6 Consider an IS Job Shadow

Finally, we ask students to express an interest in completing a job shadow if they are still determining the next steps in their academic planning and career selection. Our department works with several local organizations to support job shadows. The job shadow program is not specifically part of the Career Day in a Class but a separate initiative our department supports.

3. IS Career Day in a Class

This section will describe the IS Career Day in a Class, including the pre-event tasks, day of event flow, an agenda, and the post-event. This activity covers one class session.

3.1 Pre-Event Activities

Several pre-event activities are required to ensure a successful IS Career Day in a Class. Securing panelists is the most time-consuming and time-sensitive activity. For each event, we try to have 3-5 panelists, including the following:

- Recent alums with an IS-related major, minor, or certificate (1 or 2 panelists)
- Technical Human Resource Recruiter (no more than one panelist)
- Current student in IS-related internship (no more than one panelist)
- Hiring IT Manager (1 or 2 panelists)

These potential speakers can be identified through professional connections, college career fairs, industry events in the region, connections from colleagues, and even the use of LinkedIn for cold-call introductions. As part of securing panelists, we communicate expectations about the event. These panelist-related expectations include logistical information (where, when, parking, etc.), the event's goals, and the agenda and flow of the event. Similarly, we communicate information about the event to students via the course learning management system (LMS) announcements and in-class discussions highlighting the event to ensure our students are aware, excited, and prepared for the event.

3.2 Day of Event Activities and Agenda

Ensure that panelists have parking information as well as classroom location. We provide chairs placed in the front of the class. The event follows the agenda, which has been shared with the panelists before the event. Our college offers this course in either a 60-minute version or 90-minute version. I have included approximate time allocation for both versions. The full schedule includes the following components:

3.2.1 Introductions (10 minutes | 10 minutes)

The faculty moderator will ask each panelist to introduce themselves and provide their name, role, company, education, and a short elevator pitch. Ensure panelists describe what their company does as many students are unfamiliar with the organization.

3.2.2 Why are you in Information Systems? (10 minutes | 15 minutes)

Have each panelist describe how they got into IT and what interested them in pursuing an IS-related program. Alternatively, they can explain how they ended up working in the IS field if they do not have an IS-related education.

3.2.3 Describe a "day in the life" of an IT employee (10 minutes | 15 minutes)

Encourage each panelist to share the "day in the life" of an IT employee. Additional follow-up questions or prompts include:

- How are you making a difference for your organization?
- Don't you write code all day? (Here, we try to show the breadth of job and daily activities and the fact that IT employees are often meeting and talking to others in the organization)
- Give an example of a recent project. Talk about the who, what, where, why, etc.

3.2.4 IS Major, Minor, or Certificate Options (not included | 10 minutes)

The faculty member provides a handout on IS Major, Minor, and IS-related Certificates and notes the specific classes offered the following semester that students are eligible to enroll in.

3.2.5 Internships & Job Shadows (10 minutes | 15 minutes)

Faculty ask panelists about their internship experience or a recent intern they worked with at their company. The event should showcase IT-related internships available for students. The facilitator also indicates that job shadows are available for students interested in learning more before committing or making a final decision.

3.2.6 Small Group Breakout (10 minutes | 15 minutes)

Faculty will divide the class into small groups (divide the number of students/panelists). Assign one panelist to each group of students and rotate every couple of minutes. These smaller groups often generate discussion and questions from students, especially introverts or students who lack confidence.

3.2.7 Next Steps (5 minutes | 5 minutes)

Faculty should note several items:

- The role of this introductory course is to provide an overview of IS for all business and other interested students.
- Talk to an academic advisor to learn more or add a major, minor, or certificate.
- Share the location of the Job Shadow interest form (place in an LMS announcement).
- Consider a double major or minor if initially interested in a non-IS major.

3.2.8 Survey & Closing Comments (5 minutes | 5 minutes)

Ask students to complete the survey while panelists make any closing comments.

3.3 Post-Event Activities

There are several post-event activities. First, we send a thank you email to each panelist and include any follow-up from the event. Second, there are a few post-event activities with students. These include a follow-up post in the LMS with detailed contact information for each panelist and a link to their LinkedIn profile. We also provide a link to a job shadow form for students interested in exploring a job shadow. Finally, we again encourage questions and discussion while welcoming students to join our discipline and becoming IT professionals.

5. Implementation Suggestions

Several suggestions are offered to ensure a high-quality event for panelists and student participants.

5.1 Prepare Students for Event

Students should not be surprised when they walk into the classroom and find a panel of speakers. Pre-communication represents an excellent opportunity to make students aware of the event, get them excited, and share preliminary information about the panelists and its outcomes. We post an announcement in our LMS introducing both the goals and panelists. Hype it up. Make it sound fun.

5.2 Prepare Panelists for Event

Ensure the agenda and question guide are shared with the panelists. They should understand that they are part of a panel and the overall goals for the event. Ask that they prepare responses and think about examples from their day-to-day work. Students are interested in hearing about the organization the panelists work for and especially about a typical day. We recommend having only one technical recruiter as the students prefer to hear from hiring managers and recent alums. Students value having at least one panelist closer in age (recent graduate or current students in internship) as they find these panelists relatable.

5.3 Logistics

We have noted several necessary event logistics. First, it is essential to manage time carefully. For example, introductions can become very long-winded. Panelists are asked to have a brief elevator pitch while simultaneously encouraged to explain their organizations, as students may not know local companies in the region. Second, we also want to ensure we leave time for the small group Q&A panel during the session. Rotating the different panelists through small groups generates the most interaction and questions from students and allows a real one-on-one experience. Similarly, in the spirit of changing modes of teaching, having a short presentation where the instructor talks about the different IS-related programs and related IS courses allows for a change of mode and reengages students. Alternatively, this presentation could be completed outside of the actual IS Career Day in a Class. We have a one-hour and an hour and a half class. The one-hour classes are structured to minimize the introductions (placed in a pre-class announcement in the LMS). Similarly, coverage of the specific IS programs can be removed from the session and covered briefly in a follow-up class or as an announcement in the LMS.

5.4 Panel Diversity

Attempt to have diversity in the panelists. In securing nearly 25 panelists for the six sessions offered across different days and times, we cannot always control who can attend which session. Recently, we had two sessions that only had male panelists, and several students noted this on the survey.

5.5 Panel Moderation

While moderating the panel, it is recommended that you alternate the order for responses. Encourage students to ask follow-up questions. Don't hold all questions until the end—the more engaging and interactive the session, the better. Focus on jobs, salaries, internships, and skills students can work on and take for college courses. Finally, we have found that avoiding any IT theory-based comments results in more engaged students. Additional suggestions can be identified from the Start, Stop, and Continue comments listed in section 4 evidence and student feedback.

5.6 Timing

We offer this event one week before many students register for the following semester. We hope to encourage students that are excited or intrigued or want to explore the next step to register for additional information systems classes the following semester.

6. Evidence and Student Feedback

During the last few minutes of class, students were asked to complete an anonymous survey to allow us to understand the impact of the IS Career Day in a Class as well as their intentions relating to academic and career pathways. Finally, we gather basic feedback to improve the session through a series of Start, Stop, and Continue questions.

6.2 Was attending IS Career Day in a Class Valuable?

Students were asked if attending the IS Career Day in a Class was valuable. Nearly 83% of students indicated it was valuable or highly valuable, compared to only 6.6% who indicated the event was not valuable or highly not valuable. See Figure 1 for details.

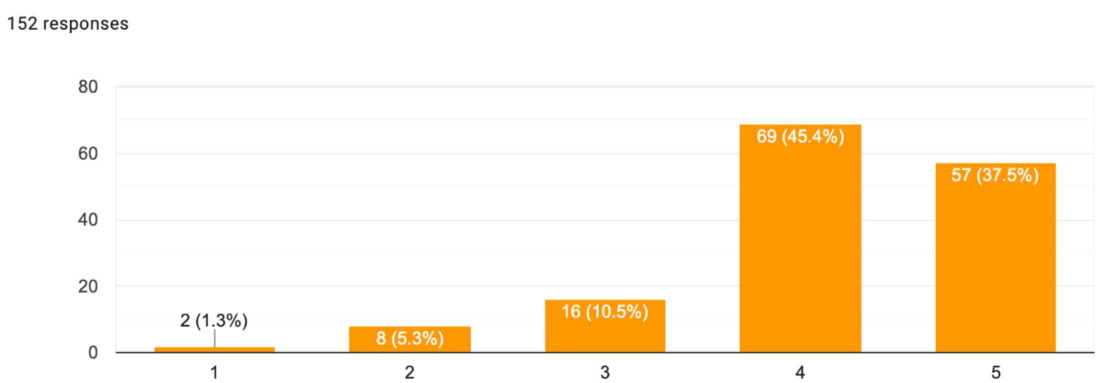

Figure 1. Was attending IS Career Day in a Class Valuable
(1 being highly not valuable and 5 being highly valuable)

6.3 Interest in Pursuing IT Career Before and After IS Career Day in a Class?

Students were asked two similar questions about their interest in pursuing an IT career. The first question asked about their interest in an IT career before the IS Career Day in a Class. As Figure 2 shows, 65.1% of students were not interested or highly not interested in pursuing an IT career. Conversely, only 19.8% of students indicated they were interested or highly interested in pursuing an IT career.

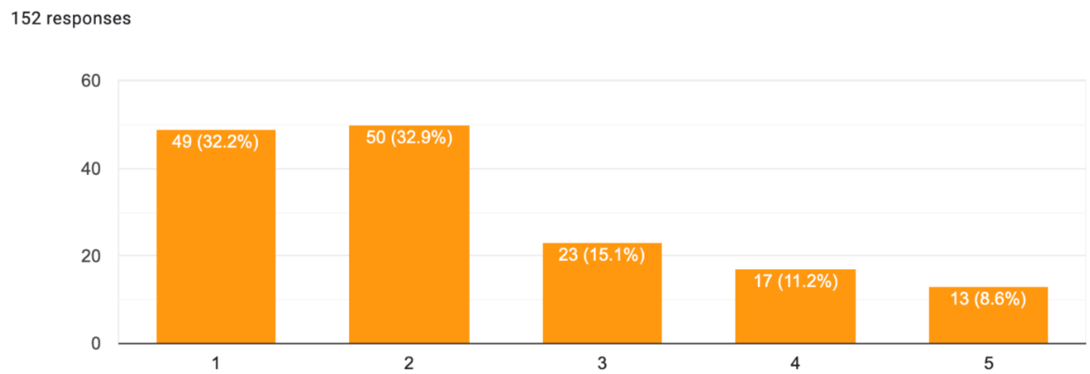

Figure 2. Interest in pursuing IT Career BEFORE attending IS Career Day in a Class
(1 being highly not interested at all and 5 being highly interested)

When asked about their interest after attending the IS Career Day in a Class, 43.8% indicated they were interested or highly interested, while 23.4% of students were not interested or highly not interested in pursuing an IT career. See Figure 3 for interest in pursuing IT career after the event.

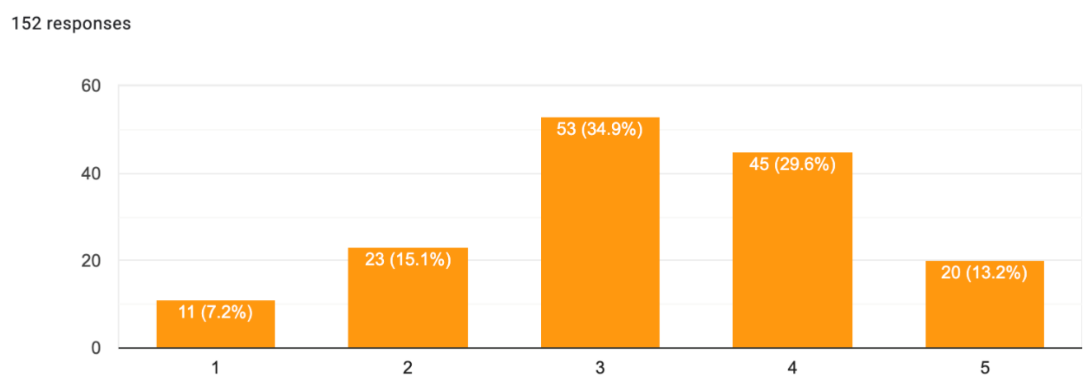

Figure 3. Interest in pursuing IT Career AFTER attending IS Career Day in a Class
(1 being not interested at all and 5 being highly interested)

There was a significant increase in interest in pursuing an IT career after attending the IS Career Day in a Class (M=3.26, SD=1.096) than before attending the IS Career Day in a Class (M=2.31, SD=1.267); t(151)= -13.048, p=0.001.

6.4 Specific Interest Moving Forward

Students were asked about their specific interest in pursuing a major, minor, or certificate. Nearly 60% of students express interest in pursuing a major (19%), minor (21%), or certificate (20%). See figure 4 for details. Not surprisingly, 40.8% of the students expressed no interest. This is a survey course that is required of all College of Business students. Some of these students have already selected and worked toward a non-IS major prior to taking this course.

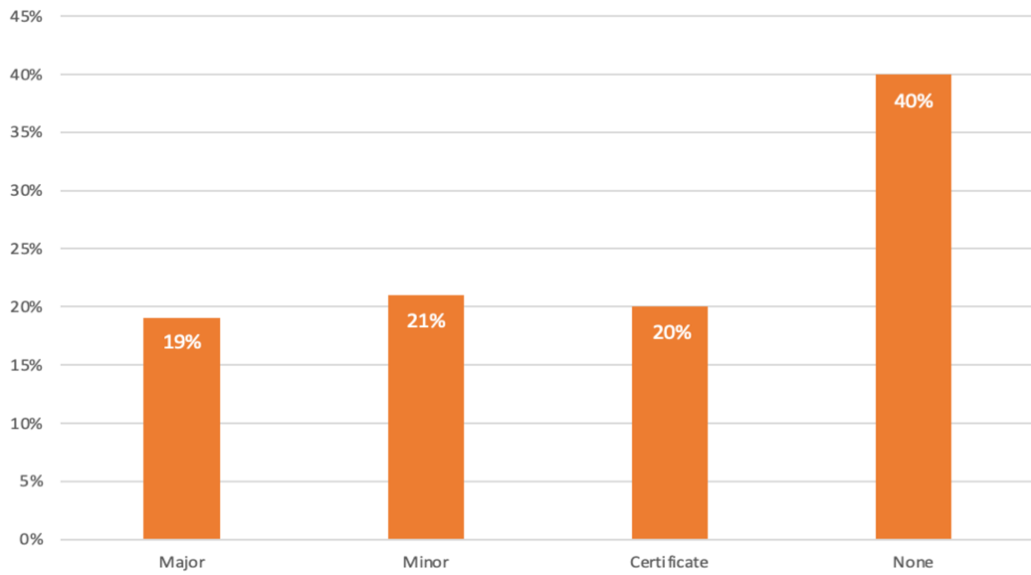

Figure 4. Because of IS Career Day in a Class, Interest in pursuing Major, Minor, or Certificate

6.5 Session Feedback: What are things we should START doing?

The students were asked, "What are things we should START doing during the IS Career Day in a Class? (Please start doing these... they would be helpful to me)". The 153 comments were categorized. Answers that were NA or blank accounted for 19% (23). Twenty-nine responses related to "good job" (10.5%). Table 1 highlights the top 5 categories and selected comments for each category.

Category	Comments
In-Class Logistics (19, 12.4%)	• Small group interactions (6) to allow for discussion and questions. • Use PowerPoint to guide the session so it appears to have more structure (3). • Ensure speakers are visible to everyone in class (2). • Show speakers names, role, and company on whiteboard or in a presentation. • Have all speakers provide an introduction and explain what their company produces or sells. Not all students are familiar with the companies that are presented.
Engage Class (15, 9.8%)	• Have the guest speakers show a small presentation on what their job is like. • More PowerPoints to engage us more. • Allow students to ask questions (I think we were but ran out of time). • Maybe have students ask questions before hand through email or group discussion on canvas which then the professor can ask the speakers. • Try to interact with the class more. • Maybe more activities to keep students' attention. • Have Kahoots set up so that it's more interactive. • Honestly, maybe we can try doing a mock interview on the spot or something along those lines! • More class activities and demos.
Day in the Life (14, 9.2%)	• Possibly a type of hands-on activity, or maybe one of the professionals could do some type of demonstration to better show the things they do during the day. Some of the things the people said sounded really interesting, but for some people it might be better to actually see what's going on. • I think just talk more about what they actually do on a day-to-day basis for their jobs would help us learn more about what jobs look like. • Talk more about the day to day, struggles of their jobs, things they like etc. • Talk more about the daily life and what problems come across in a normal workday. Give more examples so I can see if I would want to go into that field.

	• Possibly have the guests show examples of the work they create
Bridge IS to Business / Career (13, 8.5%)	• Start talking more about how info systems would specially help you get into all aspects of business. • Emphasize the importance of info systems in each college of business major right away to get the students paying more attention. • Talking more about how other majors can use the certificate. • I think it would be good to talk about valuable skills and coursework that was really influential. • Talk more in depth about the types of job responsibilities that people have to get a better understanding.
Panelist Composition (13, 8.5%)	• Bring in a greater variety of business professionals from different IT areas (maybe like 5-6 people instead of just 3). • Bringing in an intern to describe their personnel experience in the IS field. • I think it would be beneficial to have more people that are more in the field instead of recruiters. • Have a wider range of people. • More guest speakers fresh out of college closer to our age. • A female actually working in the industry and not just all men.

Table 1. Categories and Comments Relating to "Start"

Other categories included academic pathways (6, 3.9%), hiring and continuing education (6, 3.9%), internship related (6, 3.9%), panelist – topics (5, 3.3%), and student preparation before the event (10, 6.5%). One student indicated that the event was not helpful under this "start" category.

6.6 Session Feedback: What are things we should STOP doing?

The students were asked, "What are things we should STOP doing during the IS Career Day in a Class? (SUBTRACT from the session)". Answers that were NA or blank accounted for 52.3% (80 responses). Thirty responses related to "good job" (19.6%). Eight students indicated that they would like more interaction with panelists in small groups, while 3 students indicated they wanted less interaction with panelists in small groups. Four students commented on the presentation, indicating that the presentation should be either moved to a different session or modified to be more engaging and less repetitive than topics already covered by presenters. The remaining 28 responses did not group into categories and represented one-off suggestions or highlighted subtle differences between the six sessions that were held. Table 2 highlights the top 2 categories and selected comments for each category.

Category	Comments
NA or Blank (80, 52.3%)	• NA • (blank)
Good Job (30, 19.6%)	• Good job • Don't change anything

Table 2. Categories and Comments Relating to "Stop"

6.7 Session Feedback: What are things we should CONTINUE doing?

The students were asked, "What are things we should CONTINUE doing during the IS Career Day in a Class? (These things were very helpful to me. Keep doing them)." The 153 comments were categorized by themes. Answers that were NA or blank accounted for 8.6% (13 responses). Table 3 showcases key categories and select comments for each of these categories.

Category	Comments
Panelists - Career Options and Opportunities (63, 41.4%)	• Bring in multiple different companies/professionals at all levels so we can see how a career progresses and the different opportunities available. • I really like hearing about the professionals' personal academic path and how they got in to the job that they are in now.

	• I liked hearing from alumni to learn about their experiences and recommendations. • I think they did really good, talking about what and how they got to where they are today. It was helpful to know kind of what they have gone through. And it was a big help.
Good Job (22, 14.5%)	• Keep doing the career day in class! Absolutely love this and wish every class had something similar! • Keep what you guys have now, it was well put together.
Small group and rotating panelists (21, 13.8%)	• Having small groups and rotating to have more in depth discussion. • Keep having the panel and conversations amongst students in groups! • Continue going off in smaller groups, it gives more opportunities to ask questions.
Roundtable Format (11, 7.2%)	• The guided questions were very helpful in making sure we get useful information from the guests. • I liked the prepared questions. • Keep asking unique, thought-provoking questions.
Slideshow Presentation showing statistics (7, 4.6%)	• It's good that job placement was highlighted through the fields because the statistics given were really encouraging. • I liked the slideshow showing the statistics and what is needed to pursue certificates, minors, or majors within IS. It was nice to have a visual.
Difference between IS and CS (4, 2.6%)	• Continue: Talking about internships, having a wide variety of companies and professionals come in, emphasizing the difference between IS and computer science.
Other Comments	• Continue bringing in men and women - I always think of IT being a male job and it was nice seeing women in the field. • Continue showing students the salary break-down. • Keep it entertaining and interesting.

Table 3. Categories and Comments Relating to "Continue"

7. Discussion & Conclusion

This teaching tip presents an intentional approach to recruiting students into the IS discipline. Until we instituted the IS Career Day in a Class session, we assumed that students shared our interest in the Information Systems discipline. The lectures and hands-on activities were inspiring, we hoped. Interest in a career relating to IT was piqued, we told ourselves. The IS Career Day in a Class intervention directly appeals to students by exploring internships, careers, and academic pathways in a single setting. This event builds on all the great work we do in the classroom during each lecture and lab activity. The goal is not to "convert" all the students to the information systems major. Instead, this event showcases the depth and breadth of technology across an organization. It allows students to see that technology will play an integral role in their careers regardless of their career paths. Through this vicarious experience and verbal persuasion, we hope to boost student self-efficacy beliefs around their consideration of an information systems-related academic and career path. Our findings suggest that additional research into the value of vicarious experience and verbal persuasion on students' self-efficacy in the absence of mastery experiences is warranted. Finally, the IS Career Day in a Class showcases the majors, minors, and certificates available to students as they think about their future academic and professional selves. Our evidence suggests this experience engaged students and increased student interest in pursuing an IS academic path.

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John Michael Muraski is an assistant professor of information systems in the University of Wisconsin – Oshkosh College of Business. After 20 years of working and consulting in industry, he transitioned into higher education and earned his DBA at the University of Wisconsin – Whitewater. Over the last 12 years, he has taught at both the undergraduate and graduate levels and led the development of several new programs, including the ERP and Business Analysis programs at UW Oshkosh. Dr. Muraski researches two main areas: (a) new technology characteristics that enhance infusion between software and an employee in an organizational context and (b) challenges and opportunities relating to high school and college student reluctance to explore technology-related educational pathways.