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DEVELOPING BUSINESS INTELLIGENCE COMPETENCY IN HEALTH IT: PERSPECTIVES FROM HEALTH IT PROFESSIONALS

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ABSTRACT

Business intelligence (BI) is a set of methods and technologies that can provide analytical power to help the healthcare industry tackle the challenges brought by ever-growing and complex health data. To develop a successful Health Information Technology (HIT) or Health Informatics (HI) curriculum with the component of BI or health data analytics, it is critical to first identify the sets of important skills that a HIT student should possess upon graduation, especially from HIT professionals' perspective. In this paper, we reported findings from a pilot study in which we surveyed a group of HIT practitioners. The implications of the pilot study are discussed.

Keywords

Business Intelligence, Skill Sets, Health Information Technology, Health Informatics, Curriculum Design

INTRODUCTION

There is a growing interest in the healthcare industry in managing and analyzing the vast amount of health data because of the increasing adoption of Electronic Health Records (EHR) systems across healthcare organizations. From a health services perspective, BI can help reduce hospital supply costs, improve patient flow, benchmark for hospitals to assess relative performance, improve planning, lower emergency wait times, and enhance visibility into financial, operational, and clinical performance (Gartner, 2014; Henchey, 2013; Stanley Healthcare, 2014). A recent search for healthcare BI related job postings from HIMSS JobMine, LinkedIn, and Indeed showed that healthcare BI related jobs are in high demand (Zheng, Zhang, & Li, 2014).

The increasing demand prompts us to include BI education in the health IT curriculum. Zheng et al. (2014) proposed a framework to incorporate BI education in the Healthcare curriculum. The framework covers the full spectrum of a BI process, including major components of data management and integration, analysis, presentation, delivery, and domain applications which involve all of the components. However, the research was largely based on theoretical analysis and student responses. It is highly beneficial to curriculum development if we can have a clear understanding of the practical skill sets that the industry expects from students when they graduate from the program. The ultimate goal of this research is to conduct a national survey in the HIT industry to understand industry expectations and use them to support curriculum development. To achieve this goal, our first step is to (1) conduct a pilot study using a survey instrument to investigate the essential BI skills from the perspectives of health IT professionals, and (2) to identify any necessary modification for the pre-defined skill sets based on the pilot study results. How these skills can be developed for the students who are in interested in a career path in health BI will also be discussed in this paper.

This paper is organized as follows. The background is introduced in the next section. The research methodology is presented in section three, followed by the summary of the essential skills in BI from HIT professionals' perspectives from the pilot study. The last section concludes the paper with research implications and future studies.

BACKGROUND

Business Intelligence (BI) has become an important factor in the success of healthcare organizations. With shifts toward pay-for-performance from pay-for-service, many healthcare organizations plan to implement BI systems to avoid financial hits. However, the implementation pace is slowed due to skills gap (Manos, 2014). Robles (2012) has also pointed out that significant business or domain knowledge as well as effective communication skills are needed for the successful completion

of BI projects. There have been many survey studies on the skill sets in the Information Systems (IS), Information Technology (IT), and Business Intelligence (BI) fields (Aasheim, Shropshire, Li, & Kadlec, 2012; Ahmed, Capretz, & Campbell, 2012; McMurtrey, Downey, Zeltmann, & Friedman, 2008; Robles, 2012; Ryzebol, 2004) but few has studied the essential skills for BI related positions in Health IT field.

Generally skills can be categorized as hard skills, which are technical expertise and knowledge needed for a job, and soft skills which include interpersonal qualities, also known as interpersonal skills, and personal attributes that one possesses (Robles, 2012). McMurtrey et al. (2008) investigated the critical skill sets of entry-level IT professionals in four areas: IS Core Knowledge, Technical Proficiencies, Business Expertise, and Personal Attributes. Their survey results showed that IT professionals perceive both technical and non-technical skills as being important for entry-level IT jobs. They found that the most important skills for new IT professionals were soft skills, specifically the personal attributes of problem-solving, critical thinking, and team skills whereas technical skills and some skills in the area of business expertise were essential. Robles (2012) had similar findings. His study identified the top-ranked soft skills as perceived the most important by business executives: integrity, communication, courtesy, responsibility, social skills, positive attitude, professionalism, flexibility, teamwork, and work ethic.

While the required skill sets for IS/IT graduates were relatively well understood, there are few studies examine the skill sets for BI related job in HIT field. In this study we attempted to fill the gap by surveying HIT practitioners.

RESEARCH METHOD

An online questionnaire was used as the method of data gathering. Our survey instrument was built based on a survey developed by Li et al. (2014), the findings of prior skill sets research, and the BI related job opening advertisements. The questionnaire included BI job responsibilities such as understanding business requirements and translating the appropriate technical solutions to implement a BI solution to end users; ensuring high levels of BI availability through support function; designing data structures and in-depth testing; developing and generating standard and ad-hoc reporting capabilities from new and existing data sources; among others. The skills were divided into five categories: technical BI skills, general IT skills, business skills, soft skills and healthcare skills (Table 1).

Skill Category		Specific Skills
Technical BI Skills	Data Management and Integration	Data/Database administration, SQL, Scripting, Data warehouse, Data integration, ETF
	Data Query and Analysis	Data analytics, Data mining, Data modeling, OLAP (dimensional analysis, MDX)
	Presentation and UI	Data visualization, Dashboard design, Usability design, Report development
	Delivery	BI application development, Experience of one of the 4 mega BI system (Microsoft, SAP, IBM, Oracle)
General IT Skills		Information security, Mobile application/web development, Programming
General Business Skills		Business analysis, General business knowledge, Requirement engineering
Healthcare Specific Skills		Clinical processes and workflows, Clinical/healthcare knowledge, Concepts and terminology of EHR systems, HIT regulations and policies (for example, HIPAA, HITECH, and Meaningful Use rules)
Soft Skills		Ability to work in teams, Communication, Creativity, Independent learning, Problem solving

Table 1. Skills for Entry-Level BI Professional in HIT (adapted from Li et al 2014)

In this study, we confine the skill sets to an entry-level position. We are designing BI curriculum for undergraduate students. Most of our undergraduate HIT students are looking to start their HIT career upon graduation. An entry-level position is more practical for them.

As a pilot study, the survey was distributed online to five HIT organizations through authors' professional networks in May 2014. The respondents answered questions to indicate their opinions on the importance of the skills on a Likert 5-point scales (from very unimportant to very important) for an entry-level BI related job, along with their perspectives on the current and

future state of BI in HIT. At the end of each skill category, there are open-ended questions allowing the respondents to enter any skill that wasn't covered in the category. The participants also provided some basic demographic information, their positions and service time in the HIT companies to offer more insight into their opinions.

SURVEY RESULTS

Demographic Data

In this pilot study, twelve responses were collected from five HIT companies with 55% male and 45% female. More than half (55%) of the respondents are in the age group of 40-49. 64% of the respondents have been working in the IT field for more than 10 years. All of the respondents hold at least an undergraduate degree. Two people are at the director/middle management level and the rest of them are professionals without subordinates.

Most respondents work on multiple job functions. The job functions include programmer/software developer (4), business analyst (6), system analyst (1), technical support specialist (1), database administrator (2), project manager (3), manager (2), and system super user (1). More than half of the professional surveyed (55%) indicated that their current jobs are highly related to data management, analysis, or reporting. 27% are somewhat related and 18% are not related.

Perceptions on BI in HIT

The majority of the respondents are confident BI is fast growing and becoming important across healthcare organizations and HIT industry. They also point out that the future needs and opportunities of BI are promising, as shown in Table 2 and 3.

Please indicate your opinion on the following statements	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	I don't know
The demand for BI skills in HIT is expected to increase	0	0	0	2	8	1
BI is fast growing and important field in HIT	0	0	0	3	7	1
I'm interested in learning more about BI	0	0	1	3	7	0

Table 2. Perspectives on BI

Please indicate your opinion on the following statements regarding the future needs and opportunity of BI	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	I don't know
The availability of BI job opportunities at my organization will increase in the future	1	0	1	5	2	2
My organization's needs for BI skills will increase in the future	0	0	0	5	5	1
The HIT internship and co-op opportunities at my organization will increase in the future	0	1	2	0	3	3

Table 3. Perspectives on Future Needs and Opportunities of BI

Skills Required by a BI-Related Entry-Level Position in HIT

The respondents' opinions on the skills of a BI-related entry-level position are shown in Table 4, in which skills are ranked by mean value of their importance. In the survey instrument, the skills are listed alphabetically to avoid the potential bias of the order of the skill items.

The results showed the top ten desired skills are:

1. Problem solving
2. Business analysis; Data analytics (tie)
3. Communication skills
4. Ability to work in teams
5. Data visualization and dashboard
6. Research methods; SQL and query (tie)

7. Data integration; Independent learning (tie)

In this top 10 list, the soft skills (problem solving, communication skills, ability to work in teams, and independent learning) rank higher than technical skills. The BI-related technical skills are desired (data analytics, data visualization and dashboard, SQL and query, and data integration). The general skills (business analysis, research methods) are also needed for the BI-related entry-level jobs in the HIT industry. This is consistent with many prior studies on the soft skills or interpersonal skills that IT professional should possess (Aasheim et al., 2012; Ahmed et al., 2012; McMurtrey et al., 2008; Robles, 2012; Ryzebol, 2004).

Skills for a BI-Related Entry-Level Position in HIT.	Not Important	Not Very Important	Neutral	Somewhat Important	Very Important	Mean
Problem solving	0	0	0	2	8	4.8
Business analysis	0	0	0	3	7	4.7
Data analytics	0	0	0	3	7	4.7
Communication skills	0	0	1	3	7	4.55
Ability to work in teams	0	1	0	2	7	4.5
Data visualization and dashboard	0	0	1	4	5	4.4
Research methods	0	0	2	2	5	4.33
SQL and query	0	1	1	1	6	4.33
Data integration	0	0	2	3	5	4.3
Independent learning	0	0	1	5	4	4.3
General business knowledge	0	0	1	6	4	4.27
OLAP (dimension analysis)	0	1	1	2	5	4.22
BI application development	0	1	1	3	5	4.2
Clinical/healthcare knowledge	0	0	1	6	3	4.2
Creativity	0	0	2	4	4	4.2
Experience of one of the 4 mega BI system (Microsoft, SAP, IBM, Oracle)	0	0	3	2	5	4.2
Usability design	0	0	1	6	3	4.2
Concepts and terminology of EHR systems	0	0	3	3	5	4.18
Clinical processes and workflows	0	0	3	4	4	4.09
Data modeling	0	0	4	2	4	4
HIT regulations and policies (e.g., HIPAA, HITCH, and MU rules)	0	0	4	4	3	3.91
Information security	0	1	1	6	2	3.9
Data mining	0	1	4	1	4	3.8
Programming	0	2	2	2	4	3.8
Requirement engineering	0	1	2	5	2	3.8
Data/Database administration	0	1	4	1	3	3.67
Mobile application/web development	0	3	3	1	3	3.4

Table 4. Perspectives on the Skills Required by a BI-Related Entry-Level Position in HIT

Experiences an Entry-Level BI-HIT Job Candidate Should Possess

To help students have a better learning experience, we also asked the HIT professionals what experiences are important to obtain the identified desired skills. The findings are summarized in Table 5. It showed that the HIT course work and course projects are the most important experiences that the HIT industry values. The formal degree programs can be a way to provide the needed course work and projects. Reflected from the job description we had found on HIMSS Jobmine, LinkedIn, and a few job searching websites, the HIT industry relies a lot on the job experience related to healthcare or healthcare IT. The pilot survey findings supported this view.

Experiences an entry-level BI-HIT job candidate should have	Not Important	Not Very Important	Neutral	Somewhat Important	Very Important	Mean
Course work in HIT	0	0	0	2	8	4.8
Course (including capstone) projects	0	0	0	3	7	4.7
Degree programs related to HIT	0	0	1	3	6	4.5
Job experience related to healthcare or health IT	0	0	1	4	5	4.4
HIT internship and healthcare or HIT related job experience	0	2	0	4	4	4
IT internship and IT job experience	0	1	0	7	2	4
Workshops/training on HIT	0	1	1	6	2	3.9
HIT certifications (e.g., RHIT, RHIA, CompTIA, CHDA, CHTS, CPHIMS)	0	1	2	5	2	3.8
General IT certifications	0	2	2	3	3	3.7

Table 5. Perspectives on the Experiences a BI-HIT Entry-Level Candidate Should Possess

Since the HIT related job experience is very important to the employers, we asked them, at the end of the survey, whether their organizations currently have any HIT internship and/or co-op programs available for HIT students. Only one "Yes" with the rest of responses as either "No" (45%) or "I don't know" (45%). Internships are a great way to expose students to a company's culture and real world work environment. However, despite that the HIT industry needs experienced workforce, there are not many internship opportunities in the HIT organizations for the students to gain experiences. Fortunately the industry and the HIT organizations, such as HIMSS (Healthcare Information and Management Systems Society), have become aware of the situation and started to bring the HIT employers and the students together. In the annual HIT Leadership Summit taken place in Atlanta, GA on November 20, 2014 (Simmons, 2014), an internship forum was set up as a new addition to the summit. The forum featured a panel discussion with industry leaders, employers and former interns, followed by an internship fair to directly connect companies with students from colleges and universities across the metro Atlanta region. On the other hand, as educators in higher education, we also need to find out ways to work with industry practitioners and create more hands-on opportunities as a course component for our students.

DISCUSSION AND CONCLUSION

In this paper, we conducted a pilot study to survey the important skill sets for a BI-related entry-level position in HIT field. The survey results showed that the majority of the respondents recognized the needs for BI and data analytics skills in the HIT field. Among all the listed specific skills, soft skills rank on the top (problem solving, communication skills, ability to work in teams, and independent learning). Additionally, the BI-related technical skills are desired (data analytics, data visualization and dashboard, SQL and query, and data integration) and the general skills (business analysis, research methods) are also needed for the BI-related entry-level jobs in the HIT industry.

The initial findings not only help design BI content in HIT courses, but may also improve the general HIT curriculum. We need to emphasize more on teamwork, communication skills, and research skills in addition to technical skills when designing the course projects throughout the curriculum. One interesting finding is that the respondents indicated HIT coursework or holding a degree was more important for a BI-related entry-level job in the HIT field despite that work experience in the field is usually desirable for hiring for HIT-related jobs. This is great news for fresh graduates who have no job experience although HIT internship or healthcare related experience is appreciated. Educators need to reach out and work closely with the industry to design projects to solve real-world problems, and better yet, create more internship opportunity for the students.

It is important to point out that this is an exploratory pilot study and we received only 12 survey responses. Our findings do not carry significant statistical power, and may or may not represent the common view of expected skills. The purpose of the pilot study is to validate our instrument and make the skill list as complete as possible. Respondents had no major issues about the survey questions. The skill sets listed in the survey also seemed to be complete since only one skill (multidimensional expressions) was added by one respondent. We will continue to evaluate the survey questions and finalize the survey instrument.

In the future, we plan to distribute the survey to a larger audience such as the various HIT related groups in LinkedIn. We expect that we will have more participants to make our research findings more significant. Prior research (McMurtrey et al., 2008) found the effects of age, gender, years in IT field, and management level on the evaluation of the skills expected for entry-level IT professionals. The future study could also explore more on these factors when respondent numbers are larger.

Another direction of the future research is to apply what we have learned in this study to the curriculum design and measure its success through student and employer feedback.

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