INFORMATION SYSTEMS EDUCATION JOURNAL

In this issue:

The **Information Systems Education Journal** (ISEDJ) is a double-blind peer-reviewed academic journal published by **EDSIG**, the Education Special Interest Group of AITP, the Association of Information Technology Professionals (Chicago, Illinois). Publishing frequency is six times per year. The first year of publication is 2003.

ISEDJ is published online (http://isedjorg). Our sister publication, the Proceedings of EDSIG (http://www.edsigcon.org) features all papers, panels, workshops, and presentations from the conference.

The journal acceptance review process involves a minimum of three double-blind peer reviews, where both the reviewer is not aware of the identities of the authors and the authors are not aware of the identities of the reviewers. The initial reviews happen before the conference. At that point papers are divided into award papers (top 15%), other journal papers (top 30%), unsettled papers, and non-journal papers. The unsettled papers are subjected to a second round of blind peer review to establish whether they will be accepted to the journal or not. Those papers that are deemed of sufficient quality are accepted for publication in the ISEDJ journal. Currently the target acceptance rate for the journal is under 40%.

Information Systems Education Journal is pleased to be listed in the 1st Edition of Cabell's Directory of Publishing Opportunities in Educational Technology and Library Science, in both the electronic and printed editions. Questions should be addressed to the editor at editor@isedj.org or the publisher at publisher@isedj.org.

INFORMATION SYSTEMS EDUCATION JOURNAL

Editors

Evaluating Business Intelligence / Business Analytics Software for Use in the Information Systems Curriculum

Gary Alan Davis
davis@rmu.edu

Charles R. Woratschek
woratschek@rmu.edu

Computer and Information Systems
Robert Morris University
Moon Township, PA 15108 USA

Abstract

Business Intelligence (BI) and Business Analytics (BA) Software has been included in many Information Systems (IS) curricula. This study surveyed current and past undergraduate and graduate students to evaluate various BI/BA tools. Specifically, this study compared several software tools from two of the major software providers in the BI/BA field. The participants in the study evaluated each software tool according to three key criteria: 1) functionality, 2) ease of use, and 3) learning effectiveness. The "learning effectiveness" criterion was used to determine which BI/BA tools provided the most effective learning of BI/BA concepts in the IS classroom. The three criteria were used to develop recommendations for including specific BI/BA software tools in the IS curriculum. Based on the findings of the study, the authors recommend that colleges and universities consider the use of the IBM-Cognos suite of tools as a viable means for teaching BI/BA concepts in their Information Systems curricula. The results of the study are relevant to any college or university that currently includes (or is considering the inclusion of) Business Intelligence / Business Analytics concepts in its Information Systems curriculum.

Keywords: Business Intelligence, Business Analytics, Software Evaluation, Information Systems Curriculum

1. INTRODUCTION

Business Intelligence (BI) and Business Analytics (BA) Software has been included in many Information Systems (IS) curricula (Davis, Woratschek, & Kohun, 2005; Olsen & Bryant, 2012). The authors of this study sought to determine which BI/BA software tools are the most effective in IS curricula. To determine software effectiveness, the authors surveyed current and past undergraduate and graduate students who are attending/have attended BI/BA-related courses. Specifically, the students who were surveyed were asked to compare several software tools from two of the major software providers in the BI/BA field. In order to determine a level of "effectiveness," the participants in the study evaluated each software tool according to three key criteria: 1) functionality, 2) ease of use, and 3) learning effectiveness.   The "learning effectiveness" criterion was used to determine which BI/BA

tools provided the most effective learning of BI/BA concepts in the IS classroom. The three criteria were used to develop recommendations for including specific BI/BA software tools in the IS curriculum. The results of this study are relevant to any college or university that currently includes (or considers including) Business Intelligence / Business Analytics concepts in its Information Systems curriculum.

2. RESEARCH QUESTIONS

The current study attempted to determine the effectiveness of Business Intelligence (BI) / Business Analytics (BA) software, in regard to classroom use, by answering the following research questions:

1. Which suite of BI/BA software tools (i.e., IBM-Cognos or Microsoft) was rated by survey participants as having greater functionality?

2. Which suite of BI/BA software tools (i.e., IBM-Cognos or Microsoft) was rated by survey participants as having greater ease of use?

3. Which suite of BI/BA software tools (i.e., IBM-Cognos or Microsoft) was rated by survey participants as providing greater learning effectiveness?

4. If there are noted differences between IBM-Cognos and Microsoft BI/BA tool suites, are the differences statistically significant?

3. BACKGROUND LITERATURE

The term Business Intelligence (BI) was originally coined by Richard Millar Devens in 1865. He used the term to describe how a banker profited by receiving and acting upon information about his environment before his competitors could (Devens, 1865). Collecting and acting upon information retrieved is still the basis of the definition of BI used today.

A little less than a century later, the term BI was used by IBM researcher, Hans Peter Luhn. Luhn used Webster's dictionary definition of intelligence: " . . . the ability to apprehend the interrelationships of presented facts in such a way as to guide action towards a desired goal" (Luhn, 1958, p.314).

Business Intelligence, as the term is used today, evolved from the decision support systems (DSS) that began in the 1960s and developed throughout the mid-1980s. Modern BI systems only became a reality in the 1990s with the advent of the data warehouse. Many authors assert that Modern BI is not a technology. Rather, it is described as a process of generating information from raw data by using a combination of hardware, architectures, tools, methods, and databases (Turban, Sharda, Delen, & King, 2011).

A review of the literature finds that many colleges/universities do not offer a degree in BI. A 2010 survey was conducted by the BI Congress to determine the state of BI in academia. This Congress is the work of the Teradata University Network (TUN) and the Special Interest Group on Decision Support, Knowledge and Data Management Systems (SIGDSS). Approximately 130 colleges/ universities were represented in this survey and 173 professors responded. Only three schools reported having an undergraduate degree in BI: Augusta State University, St. Joseph's University, and Stuttgart Media University (Germany).

Twelve schools reported having a graduate degree in BI: Augusta State University, University of Denver, St. Joseph's University, Stuttgart Media University (Germany), Sofia University (Bulgaria), North Carolina State University, Singapore Management University (Singapore), Texas Tech University, Loyola University Chicago, Xavier University, University of Muenster (Germany), and Universidade Portucalense (Portugal) (Wixom & Ariyachandra, 2011).

For those colleges/universities teaching BI courses, 34% indicated that having access to BI software was one of the challenges in teaching BI (Wixom, B. H. and T. Ariyachandra, 2011). Academic partnerships were used to access BI software/resources, specifically: Teradata University Network (48%) Microsoft Educational Consortium (46%), IBM Academic Alliance (28%), and Oracle Academy (14%) (Wixom & Ariyachandra, 2011).

In 2012, the BI Congress once again surveyed colleges/universities to determine the state of BI in academia. Forty-three countries and 319 professors were represented in the survey. The United States had the most respondents at 206

(66.5%). Germany came in second with 19 respondents (6.1%). Only 26% of the respondents stated that one of the challenges in teaching BI was having "access to contemporary, enterprise software" (Wixom, Ariyachandra, & Mooney, 2013). The academic partnerships used to access BI software/resources were Microsoft Educational Consortium (46%), Teradata University Network (30%), IBM Academic Alliance (28%), and Oracle Academy (12%) (Wixom, Ariyachandra, & Mooney, 2013).

Robert Morris University acquired a license for the academic use of Cognos' OLAP tool (i.e., PowerPlay) in 2003. However, that license expired and the software became unaffordable. Finding affordable BI software/resources for academic use was challenging. The solution was to join the Microsoft Educational Consortium, based out of the University of Arkansas, and use Microsoft's BI tools. The BI courses at Robert Morris University have used Microsoft's BI tools for the past three years.

The large scale software vendors such as IBM, Oracle, SAP, Teradata, and Microsoft all boast of a BI solution to business problems. However, questions arise as to the affordability and vendor support of each of these solutions for collegiate classroom use. As equally important, what are the advantages/ disadvantages, from the standpoint of student learning outcomes, in using one vendor solution over another?

4. METHODS AND PROCEDURES

Approach and Sample
This study involved the administration of a survey to current and past students who are currently taking (or have taken) Business Intelligence (BI) / Business Analytics (BA)-related courses. The survey population was obtained from student rosters of both undergraduate-level and graduate-level courses. The survey participants attended (or are currently attending) Robert Morris University, a private, medium-sized, Mid-Atlantic school. *QuestionPro Online Survey Software*, from QuestionPro, Inc. was used to administer the survey, collect results, and analyze results. All survey participants were over the age of 18, and participation in the study was completely voluntary. In addition, all survey responses were captured and stored anonymously (i.e., no personally-identifying information was solicited nor captured from the survey participants).

The *QuestionPro* online survey link was sent (via electronic mail) to 325 current and past students. The survey link was active and available from April 1, 2014 until April 30, 2014. During the 30-day period that the survey link was available, 46 respondents completed the survey and submitted their responses for analysis. The completion rate for the online survey was just over 14%.

Survey Instrument
The survey instrument consisted of a total of 27 questions; 25 of the questions were closed-ended, and two of the questions were open-ended. The survey asked the participants to provide ratings for BI/BA software tools sold by IBM-Cognos and by Microsoft. These two software tools were chosen because of their use in Robert Morris University's BI courses, past or present. Questions one through nine asked participants to rate various BI/BA software tools provided by IBM-Cognos (i.e., Data Manager, Transformer, Analysis Studio, and Report Studio). Question 10 asked participants to give an *overall* rating to the *suite* of BI/BA tools sold by IBM-Cognos. Questions 11 through 19 asked participants to rate various BI/BA software tools provided by Microsoft (i.e., Integration Services, Analysis Services, Excel, and Reporting Services). Question 20 asked participants to give an *overall* rating to the *suite* of BI/BA tools sold by Microsoft. In all of the questions that solicited a rating, participants were asked to rate the tools according to *functionality*, *ease of use*, and *learning effectiveness*. For each of the aforementioned criterion, participants were asked to provide a rating of (1) Poor, (2) Average, (3) Good, or (4) Excellent. The four-point rating system was used in the survey in order to require a "forced-choice" from the participants and, therefore, avoid "central tendency" bias.

In addition to the questions that solicited a rating, the survey also contained several demographic questions. The demographic questions asked participants to indicate their degree (i.e., either earned or in-progress), their sex, whether or not they are currently working in BI/BA, and (if "yes") what BI/BA tool(s) they currently use in their job.

Toward the end of the survey, participants were asked what they felt would be the next "hot topics" in the field of BI/BA. At the very end of the survey, participants were asked to list the

BI/BA topics that they feel should be included in Information Systems curricula.

Once collected, all survey results were analyzed using SPSS (Statistical Package for the Social Sciences). Descriptive statistics were generated in SPSS to calculate the participants' mean rating scores, as related to software functionality, ease of use, and learning effectiveness. In addition, the *Independent Samples T-Test* was used to determine if any noted differences in mean rating scores between the two software vendors were statistically significant.

5. RESULTS

Functionality
To address the first research question (which Business Intelligence/Business Analytics tool suite was rated by participants as having greater functionality?), the survey contained questions that asked participants to compare the functionality of IBM-Cognos BI /BA tools with the functionality of Microsoft BI/BA tools. The functionality was categorized by ETL (Extract, Transform, and Load) functionality, OLAP (On-line Analytical Processing) functionality, and Reporting/BPM (Business Performance Management) functionality. Overall, the survey participants rated the functionality of IBM-Cognos BI/BA tools as being greater ($\bar{x}$ = 3.12) than the Microsoft BI/BA tools ($\bar{x}$ = 2.90).

The Independent Samples T-Test was used to determine whether or not the difference in functionality was statistically significant. Although the IBM-Cognos tools were rated as having greater functionality than the Microsoft tools, the difference in means was not statistically significant at the .05 level (t = 1.013, p = .316). The results from the responses regarding functionality are summarized in *Appendix A - Table 1: Independent Samples T-Test for BI/BA Functionality.*

Ease of Use
To address the second research question (which BI/BA tool suite was rated by participants as having greater usability?), the survey contained questions that asked participants to compare the usability of IBM-Cognos BI /BA tools with the usability of Microsoft BI/BA tools. In a similar manner as functionality, usability was again categorized according to the usability of ETL tools, OLAP tools, and Reporting/BPM tools. Overall, the survey participants rated the usability of IBM-Cognos BI/BA tools as being greater ($\bar{x}$ = 3.00) than that of Microsoft BI/BA tools ($\bar{x}$ = 2.62).

The Independent Samples T-Test was used to determine whether or not the difference in usability was statistically significant. The IBM-Cognos tools were rated as having greater usability than the Microsoft tools; however, the difference in means was not statistically significant at the .05 level (t = 1.653, p = .105). The results from the responses regarding usability are summarized in *Appendix A - Table 2: Independent Samples T-Test for Ease of Use.*

Learning Effectiveness
To address the third research question (which BI/BA tool suite was rated by participants as having greater learning effectiveness?), the survey contained questions that asked participants to compare the learning effectiveness of IBM-Cognos BI /BA tools with the learning effectiveness of Microsoft BI/BA tools. As with the prior criteria, learning effectiveness was categorized according to the learning effectiveness of ETL tools, OLAP tools, and Reporting/BPM tools. Once again, the survey participants rated the IBM-Cognos tools higher than Microsoft. Overall, the participants rated the learning effectiveness of IBM-Cognos BI/BA tools as being greater ($\bar{x}$ = 3.18) than the Microsoft BI/BA tools ($\bar{x}$ = 2.86).

The Independent Samples T-Test was used to determine whether or not the difference in learning effectiveness was statistically significant. The IBM-Cognos tools were also rated as having greater learning effectiveness than the Microsoft tools; however, the difference in means was not statistically significant at the .05 level (t = 1.711, p = .094). The results from the responses regarding usability are summarized in *Appendix A - Table 2: Independent Samples T-Test for Learning Effectiveness.*

T-Test for Statistical Significance
As discussed in the **METHODS AND PROCEDURES** section, the Independent Samples T-Test was used to detect statistical significance in any noted difference in survey results between the two vendors. None of the criteria tested (i.e., functionality, ease of use, nor learning effectiveness) differed between the

two software vendors in a statistically significant way. Out of all three criteria tested, the learning effectiveness criterion *came closest* to a statistically significant difference. However, as discussed above, the difference in means between IBM-Cognos BI/BA tools and Microsoft BI/BA tools for learning effectiveness was not statistically significant at the .05 threshold ($t = 1.711$, $p = .094$).

6. CONCLUSIONS

This research surveyed current and past undergraduate and graduate students to answer the following questions regarding IBM-Cognos and Microsoft BI/BA (Business Intelligence / Business Analytics) software tools: 1) Which suite of software tools was rated by survey participants as having greater functionality?, 2) Which suite of software tools was rated by survey participants as having greater ease of use?, 3) Which suite of software tools was rated by survey participants as providing greater learning effectiveness?, and 4) Are any noted differences in participant ratings between the two software vendors statistically significant?

As discussed in the **RESULTS** section, the IBM-Cognos tools were rated higher than Microsoft tools by survey participants in all three categories: 1) functionality, 2) ease of use, and 3) learning effectiveness. However, *none* of the differences were statistically significant at the .05 level. Despite the lack of statistical significance, these results seem to indicate that, when compared to Microsoft, the IBM-Cognos BI/BA suite of tools offer greater functionality for performing BI/BA tasks, and greater ease of use for the end user. These results also seem to indicate that the IBM-Cognos tools provide more effective learning of BI/BA concepts (when used in the classroom) than the Microsoft toolset.

The above findings are interesting when viewed in the context of responses received from other survey questions. For example, more survey participants (61%) reported as having used the Microsoft BI/BA toolset than the IBM-Cognos toolset (39%). This pattern of software use is not surprising, given that Robert Morris University has been using the Microsoft BI/BA toolset since 2011. In other words, it is expected that current and past students of the University would have had exposure to the Microsoft toolset, as part of their BI/BA classes.

The findings, regarding the use of BI/BA software in academia, are also consistent with the aforementioned findings by the BI Congress. As discussed previously, a 2010 survey by the BI Congress found that 46% of schools surveyed utilize the Microsoft Educational Consortium to provide BI/BA software to students. In the 2010 survey, the percentage of schools utilizing the Microsoft Educational Consortium was significantly higher than the percentage of schools utilizing the IBM Academic Alliance (28%) (Wixom & Ariyachandra, 2011).

However, when the current study asked which suite of tools was used in the workplace (by participants who currently work in the BI/BA field), IBM-Cognos was reported as the tool of choice for 21% of the participants' employers. The Microsoft BI/BA toolset, however, was reported as being used by only 13% of employers. It is also interesting to note that Oracle BI/BA tools were also reported as being used by 21% of employers. The other major BI/BA software vendors used by participants' employers included SAP-Business Objects (13%), and Informatica (15%). Oracle, SAP-Business Objects, and Informatica software tools were *not* rated by participants in the current study. The remaining 17% of employers in question were either represented by the category "Other" (i.e., we use a BI/BA tool that was not listed on the survey) or by "My organization does not use BI/BA software tools."

Recommendations
Based on the findings from the current research, colleges and universities should consider the use of the IBM-Cognos suite of tools as a viable means to for teaching BI/BA concepts in their Information Systems curricula. However, these findings, and the resulting recommendations, are contrary to the reported market shares of leading BI/BA software suites. In North America, the top three BI/BA vendors, in terms of 2013 market share, were Microsoft (43%), Oracle (30%), and SAP-Business Objects (28%) (Henschen, 2014). In terms of 2013 *worldwide* market share, the top three BI/BA vendors were SAP-Business Objects (21%), Oracle (14%), and IBM-Cognos (13%) (Columbus, 2013).

The recommendations from the current study also seem to conflict with the current use of academic partnerships by colleges and universities. As discussed previously, the most prevalent academic partnerships leveraged by

colleges and universities are Microsoft Educational Consortium (46%), Teradata University Network (30%), IBM Academic Alliance (28%), and Oracle Academy (12%) (Wixom, Ariyachandra, & Mooney, 2013).

Future Research
Even though the IBM-Cognos suite of BI/BA tools received the highest rating in all three question categories, the sample size of the current study was quite limited ($n = 46$). Future research could solicit responses from a larger sample, both in terms of number of participants and in geographical area. Participant ratings for additional BI/BA software vendors (e.g., Oracle, SAP-Business Objects, Teradata, Informatica, et al.) might also be requested. Finally, the current research focused on *suites* of BI/BA tools. Future research could solicit and analyze participant ratings for suites of tools, as well as *individual* types of tools, such as ETL, OLAP, Reporting, and BPM.

7. REFERENCES

Borkovich, D. J., Noah, P. (2014). Big data in the information age: exploring the intellectual foundation of communication theory. *Information Systems Education Journal*, 12(1) pp. 15-26.

Columbus, L. (2014). 2013 Business intelligence and analytics market share update: SAP continues market leadership. Retrieved June 17, 2014 from http://www.forbes.com/sites/ louiscolumbus/2014/04/29/2013-business-intelligence-and-analytics-market-share-update-sap-continues-market-leadership.

Davis, G. A., Woratschek, C. R., & Kohun, F. G. (2005). Curriculum development: Developing a graduate degree program in Competitive Intelligence. *Issues in Information Systems Journal*, 6(1), 318-324.

Devens, R. M. (1865). Cyclopaedia of commercial and business anecdotes; comprising interesting reminiscences and facts, remarkable traits and humors of merchants, traders, bankers, etc. in all ages and countries, p. 210. Retrieved 11 June 2014 from D. Appleton and company.

Halevi, G., Moed, H. (2012). The evolution of big data as a research and scientific topic. *Research Trends*, Issue 30, September 2012.

Henschen, D. (2014). 2014 BI outlook: who's hot, who's not. *InformationWeek*. Retrieved 6/17/2014 from http://www.informationweek.com/softwar e/information-management/ 2014-bi-outlook-whos-hot-whos-not/d/d-id/1113002.

Luhn, H.P. (1958). A business intelligence system. *IBM Journal* 2(4): 314. doi:10.1147/rd.24.0314.

Olsen, D. H., & Bryant, P. (2012). Business intelligence and information systems: enhancing student knowledge in database courses. *The Review of Business Information Systems* (Online), 16(1), 1.

Sharda, R., Delen, D., & Turban, E. (2014). *Business intelligence: a managerial perspective on analytics–3rd edition*. Saddle River, NJ: Pearson-Prentice Hall.

Turban, E., Sharda, R., Delen, D., & King, D. (2011). *Business intelligence: a managerial approach – 2nd edition.* Saddle River, NJ: Pearson-Prentice Hall.

Wixom, B. H. & T Arivachandra (2011). State of business intelligence in academic 2010. BI congress 2, Retrieved June 14, 2014 from http://www2.cmmerce.virginia.edu/bic3/ 2010-State-of-BI-Report.pdf

Wixom, B. H. & T Arivachandra and J. Mooney (2013). State of business intelligence in academia, BI congress 3. Retrieved June 14, 2014 from http://www2.commerce.virginia.edu/bic3 / content/2012-State-of-BI-Report.pdf.

APPENDIX A – T-TEST RESULTS

Table 1: Independent Samples T-Test Results
Independent Samples T-Test Results for BI/BA Functionality

	Mean	Std. Dev.	t-test	df	Sig.
IBM-Cognos Suite of BI/BA Software	3.12	.781	1.013	44	.316
Microsoft Suite of BI/BA Software	2.90	.673			

Table 2: Independent Samples T-Test Results
Independent Samples T-Test Results for Ease of Use

	Mean	Std. Dev.	t-test	df	Sig.
IBM-Cognos Suite of BI/BA Software	3.00	.707	1.653	44	.105
Microsoft Suite of BI/BA Software	2.62	.775			

Table 3: Independent Samples T-Test Results
Independent Samples T-Test Results for Learning Effectiveness

	Mean	Std. Dev.	t-test	df	Sig.
IBM-Cognos Suite of BI/BA Software	3.18	.636	1.711	44	.094
Microsoft Suite of BI/BA Software	2.86	.581			