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Abstract

This paper presents a statistical analysis to support the notion that the Information Systems Analyst (ISA) exam can be used as a program assessment tool in addition to measuring student performance. It compares ISA exam scores earned by students in one particular Computer Information Systems program with scores earned by the same students on the Major Field Test (MFT). The paper shows that the ISA Exam appears to measure knowledge retention in the same manner as the MFT. Since the MFT is recommended as a valid program assessment tool, the ISA Exam should be similarly recommended.

Keywords: Program assessment, Information Systems Analyst (ISA), Major Field Test (MFT)

1. INTRODUCTION

The Information Systems Analyst (ISA) Exam is designed as an exit examination over the material covered by the IS2002 Model Curriculum that is jointly sponsored by the Association for Computing Machinery (ACM), Association for Information Technology Professionals (AITP), and Association for Information Systems (AIS). It is jointly administered by the Institute for Certification of Computer Professionals (ICCP) and one of ICCP's divisions, the Center for Computing Education Research (CCER). Those who hold a bachelor degree and score sufficiently highly on the ISA exam qualify to be certified as an ISA-Practitioner (50% score) or ISA-Mastery (70% score) (CCER, 2010; ICCP, 2010).

The ISA Exam is considered to be a good tool by which to assess students' learning in under-graduate CIS programs. Similarly, Educational

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Testing Service's Major Field Test (MFT) (ETS, 2010) is considered a good measurement of students' knowledge retention in specific academic disciplines. Moreover, the MFT is also considered to be a good measure of program assessment.

The issue addressed by this article is whether it is valid to use the ISA exam for program assessment in addition to student assessment. Two references were found in the literature on this topic (Carpenter, et al., 2009; Segall, et al., 2009). This article builds on the former by providing additional statistical support for the ISA exam as a program assessment tool.

2. LITERATURE REVIEW

Program assessment is a critically important activity within quality educational institutions. It measures the contribution that a program makes to students' learning, thereby insuring quality of graduates. Ultimately, though, Palomba & Banta (1999) insist the emphasis of program assessment is on programs rather than individual students. The Association to Advance Collegiate Schools of Business (AACSB) requires program assessment of its accredited programs in order to show evidence of program quality and to establish internal systems for quality improvement (AACSB, 2006).

Program assessment is done in a variety of manners using a wide range of methodologies. Those include: interviewing stakeholders in the capstone course (Payne, Whitfield & Flynn, 2002), recording multiple incidents or "occasions" throughout the program (Moberg & Walton, 2003), centering on course syllabi (Cunningham & Omaoayole, 1998), examining critical incidents throughout a program (Bycio & Allen, 2004), evaluating by student peers (Aurand & Wakefield, 2006), gathering feedback from alumni and employers (Dyke & Williams, 1996), and focusing on competencies (Roberson, et al., 2002). Strong support for multifaceted methods of program assessment exists in Young (1996), Palomba & Palomba, (1999), Mirchandani, Lynch & Hamilton (2001).

The Mirchandani, et al., multifaceted approach (2001) includes the use of the MFT exam. Others who support the use of the MFT as part of program assessment include Black & Duhon (2003), Karanthonos (1991), and Manton & English (2002). Black & Duhon (2003) go on to suggest the use of other objective tests that measure specific competencies.

The ISA Exam is one such objective test that purports to measure the specific competencies included in the IS2002 Model Curriculum (CCER, 2010). Many programs that adhere to that model curriculum do indeed use the ISA Exam as a measure of student performance in the program. That is endorsed by Kamoun & Selim (2008), Laudry, et al. (2008), and Wagner, et al. (2008).

Only two references were found that advocate the use of the ISA Exam as means of program assessment in addition to assessment of individual students. Segall, et al., (2009) explain a database approach for matching the results of the ISA exam to the learning units of the IS2002 Model Curriculum. In that sense, the ISA exam results are indeed being used to assess the program itself as well as students within the program.

Carpenter, et al. (2009) described a pre-test, post-test study using the ISA Exam for program assessment. In that 2003-2007 study, thirty-five students took the ISA exam twice, first as underclass members and second as graduating seniors. The mean ISA Exam scores for the second test were indeed statistically significantly higher than for the second test. That alone indicates that the intervening courses in that particular CIS program did add to the knowledge retention of those students. That is a positive indicator for the assessment of the program.

In the Carpenter, et al. (2009) study, fifty-one students took both the ISA exam and the MFT. The means percentile scores for those students were seen to be equal. Their conclusion is that "the ISA and MFT have equal value in terms of their usability as valid measurements for assessment purposes." (p. 358).

3. RESEARCH METHODOLOGY

The logic that flows from the Literature Review is as follows. Since MFT is widely recognized as a valid means of program assessment, if the ISA Exam does indeed demonstrate student knowledge retention in the same manner as does the MFT, then the ISA Exam should be considered in similar light as a valid program assessment tool.

The null hypothesis is that students who took just the ISA Exam performed statistically equally (using percentile scores) as those students who took both the ISA Exam and the MFT. Failure to reject the null hypothesis would indicate that the ISA measures student retention of knowledge

from the CIS courses in the same manner as does the MFT for business courses. Thus, hypothesis 1 (H_1) is:

$$H_0: \mu_{ISA\ \&\ MFT} = \mu_{ISA}$$

$$H_A: \mu_{ISA\ \&\ MFT} \neq \mu_{ISA}$$

This study includes one hundred and three students in a computer information systems program in a western state college who took the ISA Exam between 2003 and 2010. Thirty-one of those students took only the ISA Exam. Seventy-two of the students took both the ISA Exam and the MFT.

Next, the researchers must measure whether the ISA percentile scores of the two groups of students can be considered statistically equal. This would indicate whether there is some anomaly in one group or the other. Only then can the ISA and MFT percentile scores of those who took both exams be compared to each other. Thus, hypothesis 2 (H_2) is:

$$H_0: \mu_{ISA} = \mu_{MFT}$$

$$H_A: \mu_{ISA} \neq \mu_{MFT}$$

Other interesting aspects were also explored. Specifically tests were run to determine what portion of the variability in the ISA Exam scores are explained by the MFT scores, and whether the students' graduating grade point average (GPA) explains any of the variability in ISA Exam scores was also considered.

Data for the study were taken from reports provided to the college by the Educational Testing Service (ETS) for the MFT exam and by Center for Computing Education Research (CCER) for the ISA exam. Data were analyzed using Microsoft Excel 2007 and SPSS 15.0 for Windows. A 95% confidence level was used for all tests and reported results.

4. FINDINGS

Table 1

F Test for Differences in Two Variances	
F Test Statistic	1.0798441
Two-Tail Test	
Lower Critical Value	0.5214404
Upper Critical Value	1.776174
p-Value	0.7709159

To test whether the two groups of students (the thirty-one who took only the ISA Exam versus the seventy-two who took both the ISA Exam and the MFT) are statistically equal, an F-Test was run to determine whether the variances in the scores are statistically equal. Table 1 illustrates that the variances are statistically equal, so the researchers then ran a two-sample t-test that assumes statistically equal variances. Table 2 illustrates that mean ISA exams of the two groups are statistically equal. Findings of Tables 1 and 2 combined indicate that there is no anomaly in the two groups, so that the ISA Exam scores can be considered to be valid for those who took both the ISA Exam and the MFT, supporting the null hypothesis for H_1. This enables the researchers to continue with further comparison of the ISA Exam percentile scores to the MFT percentile scores of that group of seventy-two CIS students.

Table 2

t-Test: Two-Sample Assuming Equal Variances		
	ISA	*ISA & MFT*
Mean	60	58.25
Variance	733.13333	678.725352
Observations	31	72
Pooled Variance	694.88614	
Hypothesized Mean Difference	0	
Df	101	
t Stat	0.3090365	
P(T<=t) one-tail	0.3789652	
t Critical one-tail	1.6600806	
P(T<=t) two-tail	0.7579304	
t Critical two-tail	1.9837309	

Table 3

F Test for Differences in Two Variances	
F Test Statistic	1.057621
Two-Tail Test	
Lower Critical Value	0.625649
Upper Critical Value	1.59834
p-Value	0.81407

Moving on to a comparison of the ISA Exam percentile scores and the MFT percentile scores of the seventy-two students who completed both

exams, the researchers first conducted an F-test to determine if the variances are statistically equal. The results indicate that they are statistically equal as shown in Table 3.

Equality of variances leads to the two-sample t-test that assumes equal variances for the null hypothesis that ISA Exam percentile scores and MFT percentile scores are statistically equal for the same set of students. The results indicate that the percentile scores are indeed statistically equal. The results of the t-test are given in Table 4.

Table 4

t-Test: Two-Sample Assuming Equal Variances		
	ISA	*MFT*
Mean	58.25	61.84722222
Variance	678.725352	717.7650626
Observations	72	72
Pooled Variance	698.245207	
Hypothesized Mean Difference	0	
Df	142	
t Stat	-0.81679776	
P(T<=t) one-tail	0.20770612	
t Critical one-tail	1.65565517	
P(T<=t) two-tail	0.41541223	
t Critical two-tail	1.97681096	

These results indicate that the ISA exam can be utilized as an assessment instrument, as the student group who took both exams placed in the same percentile for both exams, and has been verified over time. This indicates that the students' retained knowledge is being measured in a parallel manner between disciplines. This is not surprising, as both tests are nationally normed, and the ISA Exam is built around the IS2002 curriculum model, which standardizes the coursework and the knowledge base of the curriculum.

As a further exploration and verification of this relationship, a scatter plot of the ISA scores versus the MFT scores is given in Figure 1 in the Appendix. This figure illustrates a positive trend in exam performance by students. The slope indicates that for every percentage point increase in the MFT Exam score, a 0.81 percentage point increase in the ISA Exam score is attained. A correlation coefficient of r = 0.8235 confirms this, and a coefficient of determination of R^2 = 0.6782 tells one that 67.82% of the ISA performance can be described by the MFT performance.

Other factors that could drive this relationship could be:

- students' graduating GPA
- CIS coursework GPA
- the students' employment status
- the students' marital/family status
- students' test-taking ability
- course repeat for improved GPA
- multiple majors being pursued

These variables could increase the R^2 value in a multiple linear regression model, and contribute to the explanatory nature of the model.

The only one of the above data to which the researches had access was overall GPA. A graph of the GPA versus ISA percentile is given as Figure 2 in the Appendix. The results are to be expected in that a higher GPA indicated a higher ISA percentile. Reading the regression statistics one can conclude that for every point increase in the students' GPA, a 35 percentile point increase in the ISA Exam score was accomplished.

Addition of the graduating GPA to the regression model yields:

$$y = -32.52 + 0.68\,x_1 + 13.75\,x_2$$

where

$$y = ISA\ percentile$$

$$x_1 = MFT\ percentile$$

$$x_2 = Graduating\ GPA$$

$$and\ R^2 = 0.72$$

This multiple regression model now determines 72% of the variation in the ISA exam percentile as a function of the MFT percentile and the students' graduating GPA. The remaining 28% could be due to the factors listed above, or other factors yet to be determined. The slight addition to the R^2 value is most likely a result of GPA measuring knowledge as it is acquired, while the MFT and ISA exams measure knowledge as it is retained.

5. CONCLUSIONS, LIMITATIONS, AND RECOMMENDATIONS

This study demonstrates that the ISA Exam indicates students' knowledge retention in the

same sense that the MFT does. Therefore, in addition to being a means of assessing student performance, the ISA Exam can be used as a program assessment tool in the same sense the MFT is used.

A limitation of this study lies in the number of students involved. While the sample size is sufficient to justify these statistical tests and conclusions, it is not large enough to draw conclusions about all programs.

Another potential limiting factor is the nature of the college in which this study was conducted and of the students at that institution. While, no anomaly in the college or students is perceived, yet the students annually score higher as a group than the average score for all who have taken the ISA Exam each year.

A third limiting factor relates to the use of MFT overall scores. This study might have yielded different results if data were used for an information systems subset of questions of the MFA. However, such data were not available at the subject institution.

If similar data exist at other institutions, this research can be easily replicated. If similar results are produced by those replications, the limitations of this particular study are overcome. The authors encourage the Center for Computing Education Research (CCER) to sponsor such research efforts.

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7. APPENDIX

Figure 1

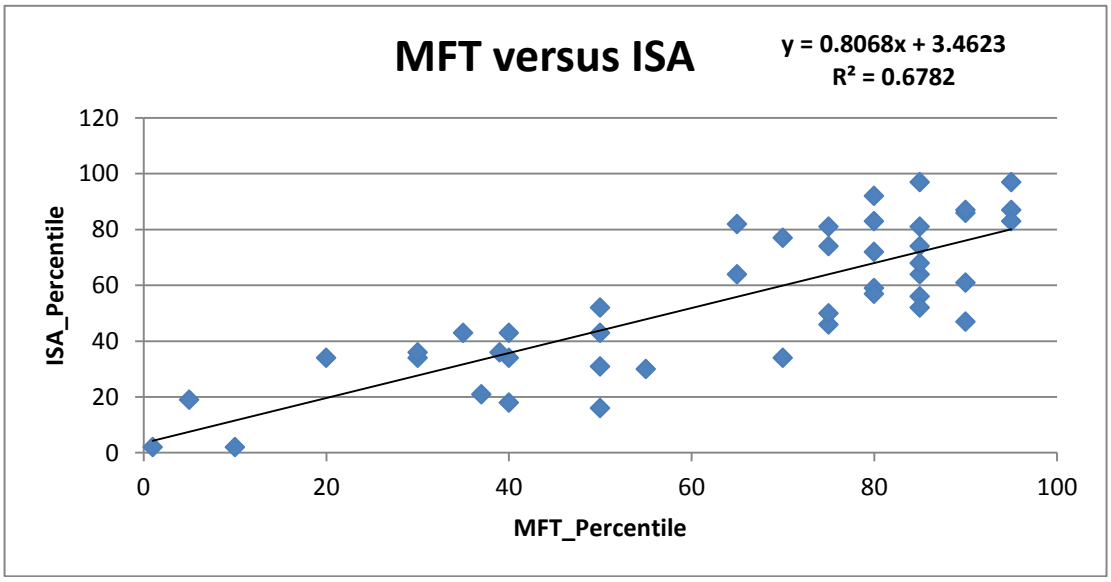

Figure 2