Developments in Business Simulation and Experiential Learning, Volume 34, 2007

THE ROI OF CONNECTED PROJECTS: A PAYROLL EXAMPLE

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ABSTRACT

Projects requiring student investment can be leveraged by instructors to provide further learning opportunities such as additional assignments based upon the initial project. These additional assignments provide a means for students to obtain "returns on their initial investment." By their very nature comprehensive, end of semester projects cannot be used to provide these additional learning opportunities. This paper suggests that an alternative method is to give students an initial comprehensive project and follow that up with several smaller connected projects. Separately these projects can address certain course topics; and when viewed together, allow students to make connections between these projects. If students take advantage of these connections, it is expected that returns on investment will also occur.

This paper presents three projects that separately address a variety of concepts in an Accounting Information Systems (AIS) course. Taken together, students should begin to grasp the interactions between different AIS concepts. The core of the project is a payroll system. Project 1 requires students to build a spreadsheet-based payroll system. Project 2 requires students to evaluate their system's internal controls as well as describe, using the System Development Life Cycle, possible changes to improve the system. Finally, Project 3 requires students to revise their system to take advantage of relational database concepts. These projects allow for coverage of a variety of concepts and provide a platform for students to examine the connection between these concepts.

Evidence reported in this paper suggests that students are able to incorporate their knowledge "investments" from the initial project into subsequent projects, thus demonstrating returns on these investments. An additional method of data collection is proposed to triangulate the evidence reported in this study.

INTRODUCTION

Many instructors use some form of comprehensive end-of-semester project as a tool for students to integrate their learning and as an assessment technique to measure the students' ability to integrate a diverse set of knowledge. Because of the desire to be complete and realistic, many of these projects can be quite complex. Given the right circumstances, a comprehensive project can be broken down into several smaller projects that yield integration of knowledge and can still be used to measure the students' abilities (both to integrate diverse knowledge, and stand-alone knowledge). This paper attempts to demonstrate how an initial project can be used to cause student "investment" in the initial project, and then shows how two additional related projects allow students to obtain "returns" on that investment.

The rest of the paper is organized as follows: a definition of student "investment" and "return on investment" is proposed. Examples of student writings are then used to qualitatively demonstrate investment-causing activities and return on these investments during subsequent connected projects. Conclusions are offered on the current study. Finally, further work is proposed to examine these concepts in more detail.

STUDENT INVESTMENT AND RETURN ON INVESTMENT

For this study the concept of investment refers to stored knowledge resulting from efforts students engage in to complete a project. Many research streams describe similar scenarios, for instance, experimental psychologists (e.g., Dickinson and Balleine, 2002; Watts and Swanson, 2002) provide descriptions in motivation models where goals are achieved by behavior stemming from desires or vigilance. Studies reported in the educational outcome literature (e.g., Astin, 1999; Zhao and Kuh, 2004) use the concept of student involvement to describe how learning communities lead to favorable college experiences. Furthermore, student learning research (e.g., Geisler-Brenstein, Schmeck, and Hetherington, 1996) has focused on types of learning strategies such as: deep learning, elaborative processing, agentic learning, methodical learning, and literal memorization. Finally, teaching and learning research (e.g. Short & Weissberg-Benchell, 1989)

describe various functions (cognitive, affective and metacognitive) used in learning. These conceptions of investment lead to the first research question:

RQ1: Will activities used by students to complete a project lead to investment into their knowledge base?

The investments should eventually manifest themselves through use in future activities. The integrative learning research (e.g., Newell, 1999; and Humphreys, 2005) describe various methods (e.g., residential learning, multicultural learning, interdisciplinary study, service learning, collaborative learning, cross-cultural learning, and learning communities) to achieve the overall student objective of ordering, in their minds, the complex world. Many instructors choose to use a single comprehensive project as a mechanism to facilitate integrative learning and student return on their learning investments. An alternative to the single comprehensive project is to employ multiple smaller, connected projects. The intended benefit of using multiple smaller projects is that students and instructors can focus on specific task components, which permits: 1) a closer matching of project learning objectives to textbook materials 2) students' focusing on specific knowledge components previously gained in class, and 3) return on investments can be more readily examined and assessed. These conceptions of return on investment of learning can be summarized as research question 2:

RQ2: Will multiple connected projects used by students lead to returns on investment in their knowledge base?

INITIAL PROJECT DEMONSTRATING STUDENT INVESTMENT

All three projects are based upon a payroll system. Each project required various deliverables including a written description of the student experience with the project. The initial project requires students to create a spreadsheet-based payroll system based upon 60+ payroll records. Students are given three weeks to complete the project. Class time is used to describe system, spreadsheet, and payroll concepts, as well as to provide students with hands-on system building experience. During this three-week period student investment will occur in three areas: 1) system building, 2) knowledge of system strengths and weaknesses, and 3) knowledge of spreadsheet capabilities. These investments are observed in the following student quotes:

- **System building:** "the payroll spreadsheet was a much more efficient way of preparing payroll than manually doing the payroll as I had done previously. After the initial set-up of the formulas, the spreadsheet really does all of the calculating work for you."
- **Knowledge of system weaknesses:** "While I know that my payroll system was not perfect, it did provide a basis for further investigation and learning."
- **Knowledge of system strengths:** "create a reliable spreadsheet that is beneficial to the end user ... By using formulas, it reduces man hours spent entering information... many forms can be completed by retrieving information from one central spreadsheet."
- **Knowledge of spreadsheet capabilities:** "even though the main purpose of this assignment was not to learn how to use excel better, I did end up learning how to use it more effectively to my advantage."

ROI THROUGH INTERNAL CONTROL ANALYSIS AND REDESIGN

The second project consisted of students' internal control evaluation of their systems and subsequent use of system development life cycle (SDLC) concepts to aid in redesign of the controls. Specifically, students were required to identify two "strong" and two "weak" internal controls related to the payroll system built during the initial project. For the weak internal controls students were asked to follow a portion of the SDLC to identify potential activities that could strengthen the "weak" controls. Students were given two weeks to complete this task. Class time was used to discuss internal control concepts, SDLC concepts, and draft potential analyses to be turned in.

Return on student investments should manifest itself as a general "case" familiarity. Specific returns on student investment of internal control strengths and weaknesses assessment should materialize at this stage as focus on current project task. Finally, returns on system building should be demonstrated through relevance of prior project feedback, and motivation to improve on prior projects. Some examples of these returns are found in the following student quotations:

- **Familiarity with "case":** "By working with a project that we created in class, we are able to see the problems in our systems and then develop plans to correct those problems."
- **Focus on current project task:** "It allowed us to experience the ERM framework… Also…actually working with it [SDLC] for this project solidified the life cycle in my mind which I think was a very helpful way of learning it."
- **Relevance of prior project feedback:** "it is also the first time I have gone back and looked at what is right and wrong about the information system. This really opened my eyes to see how much can do done to improve a system."

- **Motivation to improve on prior project:** "Hopefully a small business will be able to use my payroll program in the future after I go back and add more detail to it."

ROI THROUGH DATABASE UPGRADE

The third related project consists of students upgrading their spreadsheet-based payroll system to a database system. Specifically, students were required to build a database that could house their payroll data, import (cut & paste) their data from their spreadsheet-based payroll system, and make certain queries of the database. The students were given two weeks to complete this project. Class time was used to discuss database concepts such as flat files, relational database systems, and query by example (QBE) interfaces and structured query language (SQL). Class time was also used by students to perform hands on work with Microsoft Access and a SQL interface.

Return on student investment will be observed through "data" familiarity. Specific return on student investment of system building will be demonstrated through a focus on database structures and relationships. Furthermore, spreadsheet concepts will be reinforced through the comparison of database systems with spreadsheet systems. The following student quotations exemplify these returns:

- **Data familiarity:** "This project required fewer assumptions than projects in the past. This is because many of the assumptions were already made in the first payroll project database. These assumptions were assumed to be correct and the data was simply taken from that database."

- **Focus on database structure and relationships:** "This database assignment was both easier and harder for me than the previous assignments. It was easier because I did not have to perform any calculations or think about financial or managerial accounting statements. It was more difficult, though, because I had never worked with a database system before and had to learn the details of the system."

- **Comparison with spreadsheet system:** "The database was much easier to query and extract data than a program such as Excel. …This was visible even with the small amount of data that we were working with. It is very easy to see, then, that databases would be an enormous help to large companies with more data."

OTHER RETURNS ON INVESTMENT

The students' responses contained other examples of returns on investment that are not specifically addressed by this paper. These include textbooks, other classes, self-directed learning, and work experiences. The following excerpts are additional examples of return on investments:

- **Textbook:** "It fully incorporates the information that was presented in the textbook and gives a real world example of how the process [SDLC] can be used."

- **Other classes:** "Other [accounting] classes often have discussions about the proper recording processes when dealing with payroll… it coincides with discussions relating operations management as well as finance."

- **Self-directed learning:** "The computations of … taxes proved to be a bit of a challenge for me, but it also caused me to do some research on the IRS website which I probably would not have done otherwise."

- **Work experiences:** "I naively took for granted the work that goes into creating a payroll system. The payroll system that I have had experience with was only for two people, and the tax calculations were done manually with tax tables. I was unaware of the many complexities that can go into the computerized system."

SUMMARY

The purpose of this paper is to examine student investment in an initial project as well as returns on those investments through subsequent projects. A definition of student investment and return on investment was proposed. An initial project was used to demonstrate where student investment should occur. Two additional projects were given to students to demonstrate returns on this investment occurring with the initial project. In general, student investment in the initial project does appear to provide returns on investment with future projects. Specifically, an investment with an initial system spreadsheet based project can bring returns with internal control, and SDLC concepts, as well as database upgrade project.

Although the student responses provide richness to evidence of investments and returns on the investments that is lacking in any statistical analyses, they can also be perceived to be a limitation to this paper. Excerpts may be misinterpreted, and it is clear that statistical computations can not be performed, nor can a preponderance of evidence be used to clearly demonstrate the arguments of this paper.

Although student responses indicate that returns on investment occur, it is unclear if similar returns could have been obtained using a single comprehensive project. While multiple projects allow the instructor to provide feedback and guidance for future projects, a single project (if returned to the student) could provide the same benefit. The effectiveness of multiple projects versus a single comprehensive project cannot be examined with the current data set.

FUTURE WORK

In order to triangulate the qualitative evidence offered in this paper, a survey instrument is being designed and will be administered after students complete each of the three projects during the fall semester. Although a controlled experimental setting would allow for the strongest results, the nature of the task and conditions in which to employ such an experiment are complex, therefore quasi-experimental approach is likely to be employed. Questions contained in the surveys will focus on perceptions related to performance of multiple projects versus a single comprehensive project. A five-point Likert-type scale will be used to determine student perceptions of areas they invested in the initial project as well as areas receiving a return on this investment. The scale will consist of end points of strongly agree and strongly disagree with the term neutral as the center point. The categories to be analyzed are yet to be determined, but will likely mirror the categories identified by the student responses. The investigators expect each survey will consist of 20 questions, and should not require more than 10 minutes to complete. The data analyses will consist of determining the significance of mean differences from a neutral position. A significant difference would indicate that the projects did in fact cause students to respond in a non-neutral manner to the survey.

REFERENCES

Astin, A. W. (1999). Student involvement: A developmental theory for higher education. Journal of College Student Development, 40, 518-529.

Dickinson, A., and Balleine, B. (2002). The Role of Learning in the Operation of Motivational Systems. In H. Pashler (Series Ed.) & R. Gallistel (Vol. Ed.), *Stevens' handbook of experimental psychology: Vol. 3. Learning, Motivation, and Emotion,* (3rd ed). (pp. 497-533). New York: John Wiley & Sons, Inc.

Geisler-Brenstein, E., Schmeck, R. R., and Hetherington, J. (1996). An individual difference perspective on student diversity. Higher Education, 31, 73–96.

Humphreys, D. (2005). Why integrative learning? Why now? Peer Review, 7, 30-31.

Newell, W. H. (1999). The promise of integrative learning. About Campus, 4, 17-23.

Short, E. J., and Weissberg-Benchell, J. A. (1989). The triple alliance for learning: Cognition, metacognition, and motivation. In C.B. McCormick, G.E. Miller, and M. Pressley (Eds.), *Cognitive strategy research: From basic research to educational applications* , (pp. 33-63). New York: Springer-Verlag.

Watts, A. G., and Swanson, L. W. (2002). Anatomy of Motivation. In H. Pashler (Series Ed.) & R. Gallistel (Vol. Ed.), *Stevens' handbook of experimental psychology: Vol. 3. Learning, Motivation, and Emotion,* (3rd ed). (pp. 563-631). New York: John Wiley & Sons, Inc.

Zhao, C.M., and Kuh, G. D. (2004). Adding value: Learning communities and student engagement. Research in Higher Education, 45, 115-138.