EXPERIENTIAL LEARNING FOR THE "FUTURE" SYSTEMS ANALYSTS: EFFECTIVE USE OF ROLE-PLAY IN THE CLASSROOM

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ABSTRACT

Rapid advancements in information and communication technologies in recent years, coupled with the ubiquity of information systems in today's society, have led to a continuing increase in the demand for systems analysts in organizations. A review of both academics and practitioners suggest that a majority of IS students are likely to take up systems analysis-related roles upon graduation. At the same time, it has also been acknowledged that a majority of the systems analysts fail to perform successfully in today's often complex and dynamic systems development project environments, prompting IS researchers and educators to pay special attention to their education and training. One suggested method has been to focus on "experiential learning" of the students. In this manuscript, which represents a research in progress, we describe three different experiential learning techniques (involving role-playing and collaborative learning) that were implemented to impart systems analysis and design education to IS undergraduates in a large northwestern US university. The comparison of the advantages/disadvantages of the three techniques is provided, and plans for a more empirically grounded assessment of the effectiveness of the three techniques, and the identification of the "best" technique is also discussed.

Keywords: SA&D, MIS Teaching, Group Projects, systems analysts, role-play

I. INTRODUCTION

In the last few years, along with "rapid advancements in information and communication technologies (ICTs)," there has been significant changes in the demands for (and the expectations from) IS professionals [Chao and Shih, 2005, pg 1]. A review of the current top IS/IT jobs have indicated that business analyst jobs have the second largest demand, with end-user support jobs having the most demand [Chao and Shih, 2005, pg 7]. Chao and Shih's study (2005) also found that within the broad category of "business analyst jobs," the second most in demand is that for systems analyst jobs. Further, reports published by the *Bureau of Labour Statistics* (2003) note that computer software engineer, computer systems analyst are occupations that are considered to be among the fastest growing for the period 2004-2003. In fact, the job of a software engineer and IT analyst has been ranked as the best jobs in US in terms of factors such as growth, pay, and stress level, with projected growths of 46% and 36% over the next ten years [Kalwarski et al, 2006]. Such projected growth patterns emphasize the importance of the system analysis and design skills and the importance of their effective instruction.

While the demand for systems analysts seems to be on the rise, it has also been acknowledged that systems analysts often fail to "elicit requirements effectively" [Pitts and Browne, 2007], which ultimately has a negative cascading effect on the overall success of an information systems development project. A myriad of issues such as the inability to structure the problem, insufficient domain knowledge, lack of strong problem-solving skills, cognitive limitations, among others, have been attributed as the causes due to which systems analysts fail. Considering that a majority of IS graduates would be taking up the role of analysts in organizations, researchers have suggested that IS educators pay special attention to the training and education of the future systems analysts [Heiker, 1974, Chen, 1985]. While there has been substantial effort within the IS community to design a curriculum that would appropriately train IS students for such roles [Gorgone et al, 2003], it has been observed that

many of the existing course structures fail to provide students with the “practical experiences they need” in order to be successful as systems analysts in complex information systems development projects [Heim, et al 2005, p. 429], resulting in them being unprepared to deal with the “complex, dynamic, and unstructured situations they will face when they enter the workforce” [Heim et al. 2005, p. 429].

While a university course on systems analysis and design exposes students to the key concepts, methodologies, design techniques, etc., related to this issue, it often fails to provide exposure to real systems analysis and design situations, which is critical for future effectiveness. In order to address this issue, IS educators have emphasized the importance of experiential learning [e.g., Heim et al., 2005], where students have a “direct encounter with the phenomena being studied” [Borzak 1981, p. 9]. Experiential learning can take on a variety of different forms, ranging from simulation and gaming to collaborative learning and role-playing [Heim et al. 2005]. In this study, we report on three different types of systems analysis and design [SAD) projects that were undertaken at the authors’ university to facilitate students’ experiential learning. A key research question that we sought to address through this process is:

Which is the most effective experiential learning technique for imparting SAD education to IS students?

The rest of the manuscript is organized as follows: First, we review existing literature on experiential learning and role-playing. This is followed by a description of the three techniques used by us to provide experiential learning to our students, and a comparison of these techniques. Finally, we conclude with a discussion of some future plans.

II. IS EDUCATION, ROLE-PLAY SIMULATIONS, AND THE GROUP PROJECT

In order to provide IS students experience in complex systems development projects IS educators have often opted to incorporate group projects or other forms of collaborative learning within their courses [Jones and

McMaster, 2004]. It is believed that group projects lead to the development of certain cognitive and interpersonal skills that cannot be emulated by a lecture based instruction technique [Livingstone and Lynch, 2000]. Group projects have specifically been encouraged in SAD courses, and have been found to be effective in increasing students' learning on a variety of different dimensions [e.g. Jones and McMaster, 2004; Tetard and Patokorpi, 2005], and in exposing them to "real-world" situations. While different types of "realistic" group projects have been used, such as prepared case studies [Tan and Philips, 2005] or projects with real clients [Frandsen and Rhodes, 2005; Scott, 2004], it has been acknowledged that such "real" group projects are often fraught with difficulties. Specifically, researchers argue that it is often difficult to recruit real-world clients, or find multiple "real" projects with similar scope and complexity [Jensen and Wee, 2000]. Further, management of such projects is also difficult [Fox, 2002; Tan and Philips, 2005]. Researchers have thus proposed the use of role-play simulation in SAD courses [Avison, Cole and Fitzgerald, 2006].

Simulations and role-playing exercises "form one of the most important techniques in experiential learning" and have been used in disciplines such as Law and Medicine as means for professional training [Vincent and Shepherd, 1998]. Role-playing simulations have been proposed to have considerable advantage where the objective is to gain an understanding of complex, dynamic social systems [Gredler, 1992]. Studies on simulation have acknowledged the superiority of this technique in providing direct experiential learning of complicated systems [e.g. Maidment et al, 1973; Brookfield, 1990]. As such, the systems development project represents a complex social system and role-playing simulations can be an effective mode of instruction that would expose students to such social complexity. In the next section, we provide details of the use of such role-play in our classroom instruction of SA&D undergraduate courses.

III. THE STORY OF THREE CLASSROOM PROJECTS

The focus of this endeavor was to simulate "real-world" systems analysis and design situations, and aid students' learning through role-playing and collaborative learning. Semester-long projects were designed, where student groups performed the analysis and design of an information system. The projects also required students to collaboratively generate project artifacts typically associated with the analysis and design phases of the development lifecycle. For example, students developed the 1) business requirements document, 2) an intermediate design document consisting of the high-level process and data models, and 3) the final document consisting of the detailed, drilled down process and data models of the new information system, the design of the interface and mock-up of screens, and a complete project dictionary. Each of the projects attempted to incorporate realism on a variety of dimensions, such as on the extent of client involvement and interaction, and on distribution of the group members. We describe these projects in further details below.

PROJECT I – INTERACTING WITH "REAL" BUSINESS CLIENTS

This project was designed to expose the students to the rigor of interacting with "real" clients. In this project, the students were expected to play the roles of system analysts and conform to the levels of professional competence expected of "real-world" systems analysts and were briefed explicitly about such an expectation. While such projects have been designed in prior courses, and have been considered to be problematic, we believe that such a project enabled us to set the baseline, and then compare its effectiveness with the other alternative role-playing projects. The business clients were recruited directly by the students or through contacts provided by the course instructor (one of the authors). Based on meetings with the clients, the student teams produced a business requirements document. After receiving feedback from the client and the instructor on the document, the student teams (acting as the analysts/designers) created the detailed design document, and developed the interface of the

information system. It needs to be noted that each team interacted with only a single representative from the client's organization. The team projects were driven by the following assumptions:

- The client has a clear understanding of the systems requirements, and is able to accurately articulate them.
- The students were *experts* in terms of the technological needs, cognizant of the appropriate tools and techniques for designing the system, and therefore, very easily able to elicit and internalize the requirements from the client.

PROJECT II – SIMULATION OF THE REQUIREMENTS ELICITATION PROCESS

Prior literature argue that ISD projects frequently fail due to the inefficiencies of *both* the users and the analysts [Lyytinen, 1988; Newman and Robey, 1992], and consequently, the users' ability to articulate the systems requirements, and the systems analysts' ability to successfully elicit them from the user, are critical. This particular project was designed to aid in the development of such skills. The project involved role-playing by undergraduate students in a SAD course, and MBA students in a general MIS course. MBA students were required to perform the role of business users, and the undergraduate students performed the role of the analysts. In accordance with activities in the "real world," the "business user" group was required to first create a business proposal surrounding a new information system. Each user team was instructed to imagine themselves as representatives of an organization that was in need of a new information system. The business proposal went through an iteration of review and modification by the instructors to ensure that they all had the same level of scope and complexity. Once the business proposal was finalized, it was presented to the "analyst" team during a scheduled meeting. Based on this meeting, the analysts prepared the initial requirements report. The "user" team reviewed this report and a requirements report walkthrough meeting was scheduled. Next, the analyst team created the final design document and submitted it to the users for review. After receiving comments from the users, the

analysts finalized, and then presented the final design through a formal presentation to the users and instructors, similar to a design walkthrough session. The analysts were allowed to interact with the clients "offline" (i.e., aside from the pre-scheduled meetings) through discussion boards and e-mails. This project enabled analyst teams to interact with a group of clients (as opposed to a single representative like in Project I), making the setting more similar to real-world contexts. Further, analysts were not expected to be experts, and the users were not assumed to have a clear understanding of the requirements. The requirements were "socially constructed" by both sets of stakeholders through an iterative process of "sense-making." The analysts' role was similar to that of "facilitators" in this sense-making process [Hirschheim and Klein 1988].

PROJECT III – DISTRIBUTED DEVELOPMENT PROJECT

Today, much of the systems development projects are conducted in teams, where members are distributed in time, space, and culture [e.g., Sahay, Nicholson, and Krishna, 2003]. Further, the rise of offshoring [e.g., Carmel and Agarwal 2002] has also led to systems development projects where the client too is distributed from the analyst and developers. The third project was designed to provide experiential learning to students on these dimensions, given that a majority of them are likely to work in such distributed projects upon graduation. Teams were composed of undergraduate students in SAD from an US and a Swiss university. The clients were either located in US or Switzerland, and were thus geographically distributed for a majority of the team-members in each team. In other words, the US and the Swiss teams played the roles of the client-side (onsite), or the vendor-side (offshore) sub-team, based on the client location. The communication between the two sub-teams and their client teams was accomplished through the use of e-mail, chat, and discussion boards only. The project objectives were identical to the SAD project described earlier, and the project required the teams to develop the typical systems analysis and design-related artifacts. The sub-team that was proximate to the clients did the final project presentation (akin to a design walkthrough session).

IV. COMPARISON OF THE THREE TECHNIQUES

As stated earlier, one objective of this study was to identify the different experiential learning techniques for imparting systems analysis and design-related education to IS students. While at this stage, we are not in a position to empirically derive the effectiveness of each of the techniques, and from that identify the "best" technique, we report on some of our initial assessments surrounding the advantages and disadvantages of each of the three different techniques. We assessed the different techniques across three dimensions – *realism, ease of implementation,* and *extent of alignment between the learning objectives and experiential learning.* Further the *realism* dimension was divided into three sub-components – *role of the analyst, realism of the process,* and *realism in the interaction with the client.*

The *realism* dimension refers to the extent to which these projects capture the complexity and dynamics of SAD projects in real organizations in terms of the actual process as well as the frequency and the interaction with the client. Another important aspect of realism is the role played by the *systems analyst*. Hirschheim and Klein [1989] proposed four distinct roles of systems analyst, based on assumptions of reality and knowledge, and the role of human actors in the ISD process. We summarize them in Table 1.

Table 1. Analyst Roles

Systems Analyst Role	**Description**
Expert	Goal of ISD (system objectives) well understood, and clearly defined by user. Analyst viewed as an expert in technology, tools, methods of system design, and project management. Analyst is neutral, and power politics in the organization is assumed not to play a role in ISD.

Facilitator	Reality is assumed to be extremely complex, socially constructed, and understood through a process of sense making. System objectives are subjective, and not universally generalisable. Analyst's role is that of a facilitator who stimulates reflection and cooperation.
Labour Partisan	Analyst is viewed as an arbitrator of the conflict between labor and management prevalent within the organization and is expected to explicitly side with one of them. The nature of the system is expected to differ based on whose side the analyst decides to be on. Analysts are encouraged to be advocates of labor.
Emancipator	This role is a combination of the previous roles. The analyst is seen as an individual with • Technical knowledge • Knowledge of mutual understanding • Emancipatory knowledge that enables them to remove constraints to social freedom and personal growth The main focus is assumed to be an effort to enable systems that promote rational discourse.

Among the four above-mentioned roles, systems analyst as a "facilitator" corresponds most closely with the real world. The other roles either represent more traditional views (e.g. expert) or radical views. Consequently, from a pedagogical aspect, projects that encourage the "facilitator" role of the analyst, has the highest potential of providing critical experiential learning to our students.

Project I has a medium level of *realism.* While it involved "real" business clients, the expected role of the analysts (i.e., the "experts") made it different from a majority of the real-world projects. Further the interaction with the client was also not completely reflective of the real world. It was not possible to arrange frequent face-to-face interactions with the clients. Also, there was only a single individual who served as a client. This is a deviation from the real world, where, in general, one encounters a "client –team" comprising of individuals with differing perspectives about the requirements of the system. Projects II and III in our assessment demonstrate much greater realism. In both these projects the

role of the analysts was more reflective of Hirschheim and Klein's (1989) "facilitator" role. Projects II and III also show higher degrees of realism with regards to the process. Project II adhered very closely to the natural progression of the analysis and design phases, both in terms of the chronological unfolding of events, as well as the duration (typically two – three months for an average sized project in the industry). Project III also demonstrated high levels of realism in the process, especially in terms of the use of ICTs for communication among the distributed sub-teams, the inherent cultural differences that existed amongst the team members, and the restriction of synchronous communication with clients to the client-side sub-team only. The realism in terms of the nature of communication in both these projects was also high, although the frequency of interaction with the clients in Project III was less than that in a "real" organizational distributed development scenario.

Ease of Implementation refers to the ease with which the instructor can execute the projects. Project III is the most difficult to implement, given that it involves the use of globally distributed teams. Acquisition of a promise of commitment from universities in other countries to engage in such semester-long projects is often difficult. Further, management of such projects requires significant "immersion" on behalf of the instructors. Project I also has a *low* ease of implementation owing to the difficulty of obtaining external business clients.

The *learning objectives* of each of the projects were quite distinct as well. Project I aimed at providing the students with an experience of interacting with real-life clients, Project II aimed to replicate the complex and dynamic requirements elicitation process, and Project III was designed to give students exposure to a distributed development environment. We believe that both Project II and III score high in terms of providing the appropriate environment for experiential learning. Project I is less effective due to the restricted access to the clients, and a lack of exposure to the modalities of user-analyst interaction.

Table 2. Comparison of the Three Projects

Project Name	Realism			Ease of Implementation	Extent of Alignment between Learning Objectives and Experiential Learning
	Role of Analyst	Realism of Process	Realism in Client Interaction		
Project I	Low	Low	Low	Medium	Medium
Project II	High	High	High	High	High
Project III	High	High	Medium	Low	High

IV. CONCLUSION

In this paper, we report on our experiences with experiential learning initiatives for an undergraduate SAD course. The three projects that employed role-playing to varying extents attempt to provide the students with a "real-life" practice of the rigors of the analysis and design phase of the ISD process. While role-playing simulation in instruction is a well-established technique both within the field of education in general, and IS education in particular, we believe that the current study attempts to make some important contributions in this area. For example, the paper illustrates how IS students may be provided exposure to a distributed development environment. We feel that Project III provides an interesting prototype that may be replicated. While it may be difficult to create cross-cultural distributed teams (as was present in our example), a similar project may be created using on campus and distance learning students of universities. Our second contribution is the development of an initial framework of dimensions that could be used to compare and evaluate "experiential learning" initiatives in the field of IS education.

While we believe that this study provides interesting directions in using experiential aids in IS education, it should be viewed as being a research-in-progress. As discussed earlier, our ultimate objective in this study was not only to assess the effectiveness of the three different techniques to teaching SAD, but also to derive from it, the "best" technique. In this manuscript, we have provided a broad assessment based on our own observations. Our next step is to provide

an empirical evaluation of the effectiveness of the three techniques. DeLone and McLean [2003, p. 10] suggests that effectiveness of IS or IS-related phenomena be assessed by subjective measures such as “user, user satisfaction, [and] individual impacts.” Similarly, in the context of systems analysis and design, Lyytinen [1988] suggests the use of “expectations” of the stakeholders as assessments of the success or failure of a project. Therefore to effectively evaluate the effectiveness of these initiatives it is imperative that we elicit feedback from the student participants. We propose to do so as part of our ongoing research, where we are seeking explicit feedback (through a survey) from both current students and also past student participants who are currently employed in the industry on the effectiveness of the different techniques to their learning and the relevance of these techniques to their current job responsibilities. Our survey also attempts to capture students’ perceptions about the “realism” and effectiveness of these experiential initiatives as compared to their current experience at work.

Further, during the execution of the projects, we had asked each of the project teams [both clients and analysts) to develop a reflection document at the end of the project, wherein they discussed their expectations from the project in terms of learning, quality of deliverable, etc., and the extent to which they met those expectations. We believe that an additional qualitative analysis of the reflection document would enable us to more empirically (and objectively) assess the effectiveness of these techniques, and therefore, identify the best technique. We are in the process of coding these reflection documents (by two independent raters), and hope to have the final results at the conference.

Overall, we believe that systems analysis and design is a core area of IS education, and we hope that our endeavors (through three different types of projects that encouraged experiential learning) would enable us (i.e., the IS educators) to provide better quality education to our students (i.e., the future systems analysts).

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