Preparring Industry-ready Analysts In the Classroom: A Module Injection Approach

Emergent Research Forum Paper

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Abstract

The changes in the IT industry have diversified the role of an analyst. Analysts play an influential role in Information System Development (ISD) projects. Previous research indicates that the skill requirements of an analyst are both behavioral and knowledge based. Even though behavioral skills are critical, IS curriculum has typically focused on technological and domain knowledge skills. This research suggests an important focus of IS education should be at providing students with means to hone behavioral skills critical for systems analysts. The paper proposes that such interventions could be achieved in the form of behavioral module injection and demonstrates how such a module may be designed using existing theoretical perspectives from pedagogical research.

Keywords

Module Injection, Experiential Learning, Behavioral Skills.

Introduction

The changes in the IT industry, has diversified the roles of Information System (IS) professionals, in particular, the role of an analyst (Yen et al. 2003; Chao and Shih 2005). Analysts play an influential role in Information System Development (ISD) projects, especially in the Requirements Elicitation (RE) phase of Software Engineering (Misic & Graf 2004; Saiedian & Dale 2000). Their job is to understand the user’s needs and expectations for a proposed IS. Previous research indicates that the skill requirements of an analyst are both behavioral (such as analytical skills and interpersonal skills), and knowledge based (such as having business and technical knowledge of the IS) (Green 1989; Hunter and Beck 1996; Lerouge and Blanton 2005; Nord and Nord 1997; Misic & Graf 2004). Even though behavioral skills are critical, IS curriculum (Gorgone et al. 2003; Topi et al. 2010) has typically focused on analytical, technological and domain knowledge. Therefore there is a need for systematic pedagogical approach to impart behavioral training in the IS curriculum (Chakraborty & Sarker 2007).

If we examine current practices, behavioral elements within the curriculum are introduced through experiential learning approaches. Most approaches are semester long group projects in various forms: case studies (Tan & Philips 2005), projects with real clients (Frandsen & Rhodes 2002; Scott 2006) and role-play simulations (Avison et al. 2006; Sarker & Sahay 2004). While useful, these different pedagogical tools have a few drawbacks. Typically they are difficult to manage (Fox 2002; Tan and Philips 2005), it is hard to find multiple real projects with similar scope and complexity (Jensen and Wee 2000), and they require considerable amount of effort, involvement, and preparation (Fox 2002; Tan and Philips 2005) on the part of the instructor. In addition, behavioral aspects are not often monitored or evaluated in these projects. This paper suggests that existing experiential based interventions in the curriculum need to be complemented with more directed, short-term initiatives, and proposes learning interventions using a
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module injection approach (Taylor & Kaza 2011). A core part of this approach is to design self-contained modules that deliver content without the active involvement of the instructor. Such a module-based approach is typically used to introduce specific concepts across a curriculum. Specifically this work suggests that critical behavioral training can be systematically introduced within the IS curriculum through the design and development of behavioral injection modules. This specific article draws on this premise to propose how such module can be conceptually designed, provides an exemplar focused on the important activity of questioning clients for requirements, and also directions for its validation and pedagogical evaluation under quasi-experimental conditions. The design of the module is theory-driven, and contains two sections a) a content-based section aimed at disseminating domain knowledge related to RE; and b) a dialogue system, giving students an environment for practicing questioning techniques. The premise of our research is that if such behavioral modules were effectively injected within the IS curriculum, they would a) introduce certain industry-critical behavioral skills, b) improve the capabilities related to key RE tasks. Our empirical research is guided by the following research questions:

**Q1**- How can one design a pedagogical intervention for IS students that would be self-contained and impart critical behavioral training?

**Q2**- How can such an intervention be empirically evaluated in the classroom?

### Literature Review

**Critical Behavioral Skills required by Analysts**

An analyst remains a critical actor in the IS development process, and is responsible in assembling systems requirements, through interaction with the clients. While this role requires significant technological skills, research has consistently identified a multitude of behavioral skills critical for the analyst to be successful in their tasks. **Table 1** shows the different behavioral skills synthesized from previous work classified within three main categories of skills – Analytical Skills, Communication Skills, and Management Skills.

<table>
<thead>
<tr>
<th>Skills</th>
<th>Previous work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytical Skills (“Ability to understand and solve complex problems &amp; make sensible decisions based on available information”, Ahmed 2012)</td>
<td>Hunter &amp; Beck (1996); Wynekoop &amp; Walz (2000); Todd, McKeen &amp; Gallupe (1995); Misic &amp; Graf (2004); Cappel (2002); McMurtrey et al. (2008); Vale, Albuquerque &amp; Beserra (2010); Klendauer (2012);</td>
</tr>
<tr>
<td>Communication Skills (“Ability to convey information so that it’s well received &amp; understood”, Ahmed 2012)</td>
<td>Bassellier &amp; Benbsasat (2004); Lee, Farwell &amp; Trauth (1995); Green (1989); Lerouge Blanton &amp; Cheney (2005); Hunter &amp; Beck (1996); Wynekoop &amp; Walz (2000); Todd, McKeen &amp; Gallupe (1995); Curtis, Krasner &amp; Iscoe (1988); Becker, Carmel &amp; Hevner (1993); Hevner &amp; Mills (1995); Misic &amp; Graf (2004); Nord &amp; Nord (1997); Wade and Parent (2001); Cappel (2002); Kozvitz (2003); Schreiner (2007); Paech (2008); McMurtrey et al. (2008); Penzenstadler &amp; Schlosser (2009); DeSouza et al. (2009); Vale, Albuquerque &amp; Beserra (2010); Klendauer (2012);</td>
</tr>
<tr>
<td>Management Skills (“Ability to efficiently manage various tasks...”, Ahmed 2012)</td>
<td>Bassellier &amp; Benbsasat (2004); Lee, Farwell &amp; Trauth (1995); Wynekoop &amp; Walz (2000); Todd, McKeen &amp; Gallupe (1995); Klendauer (2012);</td>
</tr>
</tbody>
</table>

**Table 1: Exemplar Behavioral Skills**

One should also note that the nature and level of skills required by the analyst is also driven by the context of approach used to gather requirements. A common strategy for RE, adopted by analysts is to interview the clients (Browne and Rogich 2001). Interviews need to be conducted in a structured manner to elicit
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the specifications and functionalities of the new system. The lack of interview structure often results in asking wrong questions or omitting important questions. Such interviews require considerable skill on the analyst’s part, particularly in terms of analytical and communication skills (Brown & Rogich 2001). Research has suggested a number of different approaches to improve interviewing skills and technique (Brown & Rogich 2001; Pitts & Browne 2004). An intuitive and seemingly effective approach is the use of prompts to stimulate the user’s thought processes (Brown & Rogich 2001). Prompting techniques covers all categories of questioning for the RE and make the individual aware of good practices of asking question related to system analysis. Therefore conceptual questioning techniques and use of prompts provide an appropriate context to focus on IS students’ behavioral training.

**Experiential Learning Approach and Theoretical Framework**

There is extensive work on the development of behavioral skills in students in the broader pedagogical literature. Table 2 provides a representative set of these studies, the approach used, and the behavioral skills that were targeted. An examination of such research indicates the effectiveness of role-play simulation in impacting student behavioral skills, particularly in terms of their relative ease of implementation. The objective of using role-play simulated activities is to gain an understanding of complex, dynamic social systems by playing roles (Gredler 1996 & 2004). Previous research have (Chakarborty & Sarkar 2007; Kirs 1994) also emphasized the importance of role-play exercises as an experiential learning tool Information System pedagogy.

<table>
<thead>
<tr>
<th>Experiential Learning Tools (Authors)</th>
<th>Behavioral Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role-play using Action Memos, Case Studies, Videos, Games, Debates</td>
<td>Social skills, Interpersonal and communication skills, Improve their attitudes</td>
</tr>
<tr>
<td>(Gredler 1996 &amp; 2004; Kirs 1994; Jensen &amp; Wee 2000; Wagner 2004; Avison,</td>
<td>towards learning, Group problem solving, Behavioral skills, Active learning,</td>
</tr>
<tr>
<td>Cole &amp; Fitzgerald 2006; Chakraborty &amp; Sarkar 2007)</td>
<td>Cognitive skills, Problem solving capability and bring realism, Analytical skills,</td>
</tr>
<tr>
<td>Real-world projects (Fox 2002; Thomas and Busby 2003)</td>
<td>Real world context, Analysis and Conceptual skills</td>
</tr>
<tr>
<td>Case study method and business simulations (Merwe 2013)</td>
<td>Communication skills and team skills, self-confidence, teamwork, problem solving,</td>
</tr>
<tr>
<td></td>
<td>organizational ability and leadership</td>
</tr>
<tr>
<td></td>
<td>Generic Professional skills in accounting field-like teamwork, communication,</td>
</tr>
<tr>
<td></td>
<td>and writing skills</td>
</tr>
</tbody>
</table>

**Table 2: Different IS Pedagogy Learning Approaches and Skills Targeted**

There are many theoretical frameworks available such as Bloom’s Taxonomy, Myers Briggs Type Indicator (MBTI), Gagne’s Theory of Learning Styles, and Kolb’s Theory of Experiential Learning that can be used to inform the design of learning interventions (Boyatzis & Kolb 1991; Yamazaki 2010). This work specifically adopts the Kolb’s learning cycle to guide the design of the behavioral injection module, because it is widely used and also focuses on a similar complement of behavioral skills. Figure 1 illustrates how pedagogical approaches may be used in different stages to nurture different behavioral skills (Svinicki and Dixon 1987). Table 3 (in the next section) demonstrates how the different parts of the module can be designed based on the perspectives of Kolb’s learning cycle.

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The Research Model

Our research model (Figure 2) suggests that the learning performance and behavioral skills of an individual is impacted by pedagogical techniques. In this context learning performance is operationalized in terms of RE Task Competency, Absorption of RE Knowledge, Application of the RE knowledge and Requirement Quality. Behavioral skills are operationalized in terms of Information skills, Communication skills, and Analytical skills of the IS students. Specifically, we suggest that pedagogical technique would moderate the relationship between the individual traits and learning performance and behavioral skills. In particular, we feel that our Behavioral Injection Module would lead to better learning performance and behavioral skills as compared to traditional lecture based instructions. Therefore, based on our research model, we have come up with the following two major hypotheses -

**H1: The Behavioral Injection Module will have a positive effect on the learning performance of an individual.**

**H2: The use of the Behavioral Injection Module will have a positive effect on critical behavioral skills development of an individual.**

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Figure 1: Kolb’s Experiential Learning Cycle and Learning Skills Profile (Adapted from Boyatzis & Kolb 1991; Yamazaki 2010)

Figure 2: Research Model
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<table>
<thead>
<tr>
<th>Application</th>
<th>Activities</th>
<th>Kolb’s Learning Cycle Stages</th>
<th>Skill Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioral Injection Module</td>
<td>Step: 1 Read background information about RE.</td>
<td>Concrete Experience (CE)</td>
<td>Information Skills</td>
</tr>
<tr>
<td>Behavioral Injection Module</td>
<td>Step: 2 Take Quiz.</td>
<td>Reflective Observation (RO)</td>
<td>Information Skills</td>
</tr>
<tr>
<td>Behavioral Injection Module</td>
<td>Step: 3 Practice question techniques using dialogue system. Use checklist for prompting technique.</td>
<td>Active Experimentation (AE), Reflective Observation (RO)</td>
<td>Communication Skills, Information Skills</td>
</tr>
<tr>
<td>Behavioral Injection Module</td>
<td>Step: 4 Prepare requirement specifications report.</td>
<td>Abstract Conceptualization (AC), Reflective Observation (RO)</td>
<td>Analytical Skills</td>
</tr>
</tbody>
</table>

Table 3: Mapping with Kolb’s Learning Cycle

Methodology

Design of Behavioral Injection Module

The Behavioral Injection Module contains two sections a) a content-based section aimed at disseminating domain knowledge related to RE; and b) a dialogue system, aimed at giving students an environment for practicing questioning techniques (simulating an RE activity). The content-based section was developed as a webpage. Some screenshots of our module webpage are available in the Appendix. Based on the module activities shown in Table 3, a quiz is given to reinforce the concepts learned from reading the background knowledge about the contents. Then the dialogue system is available for practicing the questions. The dialogue system was conceived as a closed domain Question Answering (QA) system that simulates the interaction with the analyst and the client during requirement elicitation. The QA was developed using HTML and JavaScript technologies. The dialogue system works with an existing set of questions designed based on Browne and Rogich’s prompting technique (Brown & Rogich 2001). The student is prompted to select from a choice of questions based on an autocomplete feature. The dialogue system is coded to respond to such specific questioning prompts with responses based on the user’s system requirements. The student is expected to derive the requirements of a proposed system based on a dialogue with the system that simulates interaction with the user. The simulation section also includes a checklist that allows the student to gauge the completeness/effectiveness of their questioning approach. After practicing the question techniques, the student will write a requirement specification report and submit that to the instructor for evaluation. Figure 3 below provides a diagrammatic view of the module webpage.

Figure 3: Workflow Diagram of Module Website
Experimental Design

The experimental design to be adopted for evaluating the Behavioral Injection Module, is illustrated in Figure 4. The experiment will be conducted during the course of a semester within the IS program of a large comprehensive public university in the US.

Figure 4: Timeline for Measuring Variables

Two senior level classes will be used to conduct the experiment, one of which would be the experimental group and the other the control group. Students from experimental group will be exposed to the Behavioral Injection Module. The control group will receive similar contents but through regular lecture based materials. Both groups will perform a role-play experiment of RE, at the end of the semester to apply the gained knowledge during the semester by simulating the analyst and the user—in a work environment. The role-play simulation would involve the performance of RE through user-analyst interviews. The expectation is that the experimental group would have more behavioral skills needed for the RE task and would perform better in the role play simulation. It is also expected that the experimental group would report at higher levels of self-reported behavioral skill measures. Potential measures of both the Learning Performance constructs and the Behavioral Skills constructs have been provided in Table 4.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Variables</th>
<th>Artifacts</th>
<th>Instruments (Adopted From)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning Performance</td>
<td>Absorption of RE Knowledge</td>
<td>Quiz</td>
<td>Instructor led Quiz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Questionnaires</td>
<td>Adapted from (Chakraborty 2008)</td>
</tr>
<tr>
<td>Application of Knowledge</td>
<td></td>
<td>Questionnaires</td>
<td>Adapted from (Chakraborty 2008)</td>
</tr>
<tr>
<td>RE Task Competency</td>
<td>Transcripts</td>
<td>Grade dimensions: depth and breadth (Brown &amp; Rogich 2001) Framework adopted from Generic Requirement Categories (Brown &amp; Rogich 2001)</td>
<td></td>
</tr>
</tbody>
</table>
### Table 4: Measuring Variables and Its Instruments

<table>
<thead>
<tr>
<th>Requirement Quality</th>
<th>Requirement Specifications Report</th>
<th>Using Multiple Judges’ scores; Grading Dimensions: accuracy, completeness, consistency, and feasibility (Bailey &amp; Pearson 1983); Adapted from (Brown &amp; Rogich 2001)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Soft Skills</strong></td>
<td>Information Skills Questionnaires</td>
<td>Sense-making (Krush et al. 2013 and Johnson et al. 2004); Information Gathering and Analysis (Kretovics 1999)</td>
</tr>
<tr>
<td></td>
<td>Analytical Skills Questionnaires</td>
<td>Multi-rater instrument Adapted from (Lohman 2004)</td>
</tr>
<tr>
<td></td>
<td>Communication Skills Questionnaires</td>
<td>Adapted from (Bassellier and Benbasat 2004; Lee, Trauth and Farwell 1995)</td>
</tr>
<tr>
<td><strong>General</strong></td>
<td>Demographic Attributes Questionnaires</td>
<td>Adapted from (Wade &amp; Parent 2002 and Nance &amp; Taylor 2012 )</td>
</tr>
<tr>
<td><strong>RE Knowledge</strong></td>
<td>Questionnaires</td>
<td>Adapted from (Bassellier, Benbasat and Reich 2001) and (Lee, Trauth and Farwell 1995)</td>
</tr>
<tr>
<td><strong>Interest</strong></td>
<td>Questionnaires</td>
<td>(Nance and Taylor 2012)</td>
</tr>
</tbody>
</table>

### Conclusion

This research in progress paper suggests that current IS curriculum needs to be complemented with focused short-term experiential pedagogical interventions that are designed to provide students with training for key industry-specific behavioral skills. The paper proposes that such interventions should be designed in the form of module injections and demonstrates how such a module may be designed using existing theoretical perspectives from pedagogical research. The design of the module is theory-driven, and contains two sections a) a content-based section aimed at disseminating domain knowledge related to RE; and b) a dialogue system aimed at giving students an environment for practicing questioning techniques. The next step of this research would be to empirically evaluate the effectiveness of this module, using the experimental approach outlined. This experiment will be carried out in the mid-Atlantic public universities during Spring 2015 and Fall 2015. This represents an initial step of a long term research program, and the authors believe that the behavioral injection module approach will provide important directions in developing more comprehensive approaches that prepare IS students to become industry-ready and successful analysts.

### REFERENCES:

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