ABSTRACT

Data flow diagrams (DFD) and Use Cases are two popular methodologies in teaching as well as in practice. We recently used both methodologies in teaching eight sections of a required systems analysis course. Questionnaire results indicate that students perceive these methodologies as equally easy to understand and use. Students believe that data flow diagrams are better at communicating with users and programmers.

Keywords: comparative study; data flow diagrams; IS education; object-oriented analysis; process modeling; use cases

INTRODUCTION

The Date Flow Diagram (DFD) technique was introduced in the late 1970s (DeMarco, 1978; Gane & Sarson, 1979) and has become a popular process modeling tool for information systems. Research has shown that DFDs are also one of the most common tools taught in systems analysis and design courses (McLeod, 1996).

While many believe that object-oriented design methodologies provide an “easier modeling process” and “improved communication” among developers as well as between developers and users (Johnson, Hardgrave, & Doke, 1999), empirical studies seem to disagree. Empirical research by Vessey and Conger (1994) shows that DFDs are easier to learn and use, at least by novice users. An empirical study by Freeman (2003) indicated that a short review of the methodology tends to improve the accuracy and process satisfaction for novice users. Agarwal and Atish showed that DFDs produce higher-quality solutions in process-oriented tasks and are not inferior to object-oriented methodologies, even in object-oriented tasks (Agarwal & Atish, 1996).

In our systems analysis course, we have been using a simplified version of DFDs as proposed by Millet (1999), whereby each data store symbol represents a database rather than a single table. This modification makes DFDs easier to create, understand and maintain. It also
reduces the overlap with the Entity-Relationship Diagram technique. The CASE tool we have been using for DFDs is Sybase’s ProcessAnalyst. In the Fall 2003 semester, we added the Use Case methodology and rational CASE tools to the course. Rational Rose was chosen because it was the primary Unified Modeling Language (UML) CASE tool offered by Rational Corporation, the company (later purchased by IBM) whose name is most closely associated with UML (Grossman, Aronson, & McCarthy, 2005). We used questionnaires to evaluate student responses to the DFD and use case methodologies to investigate novice user perceptions of these two competing methodologies.

To our knowledge, this is the first empirical investigation of how novice users perceive the DFD compared to the Use Case methodology. Since both methodologies aim to model the services provided by a system, and since many instructors face the question of which of these methodologies they should use, such a comparison is both meaningful and warranted. Unlike the conclusions reached by Vessey and Conger (1994), our results indicate that students perceive these methodologies as equally easy to understand and use. However, students believe that DFDs are better at communicating with users and programmers. Another key result is that, if instructors elect to teach both methodologies, it does not matter which methodology is introduced first.

We start this article by describing the design of our empirical research and questionnaire. We then discuss the quantitative results and provide qualitative context through examples of student comments. After providing design suggestions for course assignments, we summarize the implications of this study for the coverage and sequencing of the DFD and Use Case methodologies in the IT curriculum.

**RESEARCH DESIGN**

From Fall 2003 through Spring 2006, 12 sections of our systems analysis course were introduced to structured analysis techniques as well as object-oriented methodologies. The same instructor taught all 12 sections, two in each of the six semesters.

Having two sections in each semester allowed us to assign each section to either a “DFD First” or “Use Case First” treatment group. This was done to balance and investigate the sequence effect of introducing one methodology before the other. For example, in the Spring 2006 semester, we assigned one section with 26 students to the “DFD First” treatment group, and the other section with 19 students to the “Use Case First” treatment group.

The “DFD First” group was introduced to data flow diagram concepts during Lecture #1. In the next class (Lab #1), this group was given a lab session and an assignment on DFDs using Sybase’s ProcessAnalyst as the CASE tool. During Lecture #2, the “DFD First” group was given a lab session and an assignment on Use Cases using Rational Rose as the CASE tool.

The individual assignment we used for both methodologies was a Work Order System case adapted from Shelly, Cashman and Rosenblatt (2006). This is a small case with three main processes and three external entities/actors. The students had two days to complete each assignment.

During the fifth class meeting, students were asked to complete a questionnaire (see Appendix A) comparing the two methodologies.

As shown in Table 1, the same approach (but in reverse sequence) was taken with the “Use Case First” group. This group was exposed to Use Cases before DFDs.

This study was repeated for the two Systems Analysis sections in Spring 2004, Fall 2004, Spring 2005, Fall 2005 and Spring 2006. Questionnaire results from all 12 sections provided a total of 251 observations.

**QUESTIONNAIRE**

As shown in Appendix A, the questionnaire consisted of student classification by semester standing and major, as well as five questions about the two methodologies. The classes were composed of mostly business management information system (MIS) stu-
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