Chapter VII
Student Perceptions of Data Flow Diagrams vs. Use Cases

Ido Millet
Penn State University Erie, USA

Robert Nelson
Penn State University Erie, USA

ABSTRACT

Data Flow Diagrams and Use Cases are two popular methodologies in teaching as well as in practice. For the last 4 years, we have been using both methodologies in our Systems Analysis course. Questionnaire results indicate that students find the Use Cases methodology slightly easier to understand. However, students believe that Data Flow Diagrams are significantly better at communicating with users and programmers.

INTRODUCTION

The Data Flow Diagram (DFD) technique had been introduced in the late seventies (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 some 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 to 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 et al. 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 a single data store symbol represents a whole 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 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 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). Since starting to teach Systems Analysis with both methodologies, we've been using a questionnaire to evaluate student responses of these two competing methodologies.

We published initial results of this study in the *International Journal of Information & Communication Technology Education* (Millet & Nelson, 2007). This chapter provides an updated analysis based on a larger data set (4 years, 8 semesters, 15 course sections, and 309 observations).

To our knowledge, this is the first empirical investigation of how novice users perceive the Data Flow Diagram methodology 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 Use Cases as equally easy to use and slightly easier to understand than DFDs. However, students believe that DFDs are better for 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 chapter by describing 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 Fall 2007, fifteen sections of our Systems Analysis course were introduced to structured analysis techniques as well as object-oriented methodologies. The same instructor taught all fifteen sections.

We assigned each section to either a "DFD First" or a "Use Case First" treatment group. This was done in order 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.

As shown in Table 1, 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 Data Flow Diagrams using Sybase ProcessAnalyst as the CASE tool. During Lecture #2, this group was introduced to Use Case concepts and, again, this was followed by Lab #2 where these students were given a lab session and an assignment on Use Cases using Rational Rose as the CASE tool.

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