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A WEB -BASED TOOL TO ENHANCE TEACHING/LEARNING DATABASE NORMALIZATION

Abstract

It has been challenging to persuade students to learn database normalization because they consider the subject to be boring and academic. A web-based application is being created to provide students with interactive hands-on experience with the database normalization process. The tool is appropriate for relational data modeling in systems analysis and design, as well as data management courses. This study describes the web-based application and its usefulness in teaching the relational data model. Surveys have been used to assess the tool's effectiveness. The article demonstrates that the tool has a favorable impact on students' perceptions.

Introduction

Database normalization is a well developed field since the introduction of Codd's seminal work on normal forms in 1970. Bernstein (1976), Diederich and Milton (1988), Concepcion and Villafuerte (1990), Rosenthal and Reiner (1994) proposed algorithms and tools to synthesize a normalized database using functional dependencies. Maier (1988) indicated that relational data model theory (normalization) tends to be complex for the average designers.

The classical database normalization technique has often relied on the definition of normal forms. These approaches may not be the best way to help many IS/IT students effectively understand the process. Some database books include normalization algorithms to find the canonical cover. These algorithms require extensive relational algebraic backgrounds that many students lack. The main objective of this paper is to describe the web-based database normalization tool and its effectiveness in teaching and learning of normalization.

The Web-based Normalization Tool

The cookbook normalization technique is easy to follow without extensive background in relational algebra and database theories. To decompose a relation into the third normal form, one simply eliminates attributes on the right-hand side of the functional dependencies. The number of the decomposed relations is exactly the same as the number of functional dependencies.

Research method

This study includes 45 students from two parts of a junior level systems analysis and design course. The textbook Hoffer et al.(2005) was utilized to cover feasibility analysis, process modeling, and physical design. Students worked on database normalization techniques for four 75-minute sessions. In the fourth session, students were introduced to the cookbook normalization technique as well as web-based resources for completing in-class assignments. Students were surveyed about the effectiveness of a textbook technique and web-based tool in helping them learning database normalization. The research design is a single group pretest-postest design. This design includes pretest measure followed by a treatment and a posttest for each group.

Students were asked to complete a survey after learning how to apply the textbook technique and the web-based tool in order to assess the students' perceptions of the effectiveness of the techniques. The questionnaire, which was administered at the end of the third and forth sessions, consisted of 3 questions that asked for demographic information (gender and number of courses taken previously) and included questions about structure, algorithms, and databases.

- the difficulty of learning the textbook technique/tool.
- its effectiveness and
- the difficulty of learning the textbook technique/tool.

Results and Analyses

The survey of the textbook technique was completed by 44 students, while the survey of the tool was completed by 45 students (completion was voluntary). The sample was mostly made up of men (37 male vs. 7).Nineteen students began the SA&D course with no prior database knowledge, while the remaining 26 had some database familiarity from previous courses. The distribution of student demographics among treatment conditions is summarized in Table 2.

Table 2: Demographic Frequency Counts

Technique	Gender		Course	
	Female	Male	0	≥1
Textbook	7	37	19	25
Tool	7	38	19	26

The means and standard deviations for the three items on Part II of the survey were calculated for both the textbook and tool. Table 5 illustrates that students generally viewed the tool more positively (with mean scores hovering around 4.0) than the textbook technique (whose mean scores hovered around 2.4 to 3.1). Table 3 also indicates that students perceived that they knew normalization better, grade-wise, using the tool.

Table 3: Mean Student Survey Responses for Textbook and Tool

	Textbook		Tool	
	Mean	Std. Dev.	Mean	Std. Dev.
Difficulty	2.39	.970	3.98	.753
Helpfulness	3.00	1.012	4.22	.765
Perceived Grade	3.07	.789	3.89	.832

Conclusions and Future Research Directions

A web-based normalization tool has been developed to enhance teaching and learning of database normalization. The tool is user friendly and can be accessed through the Internet. It was evaluated by students and found to be robust. Students' responses to the tool were mostly favorable. Web-base tool allows a set of 10 functional dependencies, which is adequate for teaching purposes, but more features, e.g., 'Load', 'Save', and 'Print' are still under development. The tool can be expanded to draw entity- relationship (ER) diagram. The incorporation of relational model and ER model is suggested for future work.

Reference:

Kung, H. (2006). *A Web-Based Tool to Enhance Teaching / Learning Database Normalization*.