

# Immediate feedback tool in teaching database and its contribution to the learning of students on Computer Science course

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**Abstract**—Feedback is considered an important element in the learning process of students, because it can detect their mistakes allow comparison between what was expected and what was done. Studies show that students who receive feedback quicker tend to retain more content and to perform better in activities and tests. This paper presents an automatic feedback tool for database discipline, taught in higher education courses in Computer Science, called EDB, a web based software aimed at supporting practical lessons of Database discipline where student submits built query in order to solve issue and EDB performs automatic correction and gets back through a result value to the student - that can be a right or wrong answer. The EDB has been used by 53 students in practical lessons database. Students received a Diagram Entity Relationship (DER) and a list of exercises containing description of queries they were supposed to perform on DER. Students made use of a Database Management System (DBMS) that has been released by the professor, properly populated to build a query which would satisfy the exercise. After the construction and test of the queries at the DBMS, students entered data at the EDB environment, available on a web page by choosing the exercise and submitting the query prepared for them, that supposedly would solve the proposed exercise. The correct query, which had previously been registered by the teacher, allowed comparison between correct answer and student's answer, who immediately received a feedback from their attempt. Thus, students who were unsuccessfully solved the exercise had the opportunity to review their answers and then could submit to EDB judgment. During practical classes and practical assessments on the discipline, immediate feedback increases dynamism of classroom practice and encouraged teaching and learning process. It is believed that the use of EDB in practical classes was essential for an increase of up to 78% in the adoption of discipline compared to the latest offers, and such observation is expected to plan experiments to confirm this hypothesis, and also improve the tool to turn it more efficient in regard to the process of teaching and learning.

**Keywords**—*immediate feedback; teaching database; earning database; conceptual map*

## I. INTRODUCTION

The lecture plan taught in database discipline at Computer Science of Federal University of ABC (UFABC) has a theoretical workload of 4 hours per week plus 2 hours per week of practical classes. As regards to the theoretical part of the course it is taught business analysis, data modeling,

conceptual and physical data model, normal forms and relational algebra. Finally, the practical part of the course is taught through Data Definition Language (DDL), Data Manipulation Language (DML), as well as part of Database programming such as triggers, stored procedures, cursors etc. Exactly at this point of the discipline, especially in DML, where wished to turn the course into a more dynamic and productive issue through the use of a tool that would enable immediate correction of the activities with the possibility of increasing quantity and quality of exercise, and not let student expect feedback from activity performed. Therefore, we enabled EDB, a web based tool for automatic correction of queries sent to the server able to correct instantly exercises submitted.

Activities carried out by EDB provided quantitative data on student's learning, however, it is important to highlight that they may be evaluated qualitatively as well. Thus, on the new proposals of the use of EDB it is also an objective to use concept maps because it can show whether some, and which were the concepts students changed through the use of EDB.

This article is organized as follows: In section 2 importance of immediate feedback to the process of teaching and learning will be described. Then, in section 3 of the EDB tool environment judgement of queries in the Database discipline will be detailed. The section 4 describes concept maps and how it is expected that this tool may assist us in the evaluation of the course learning progress. The EDB application experience in a class of 64 students is described in section 5. Finally, in section 6 are listed contributions that we expected to be achieved with the use of EDB and plan experiments proposed in this paper.

## II. IMMEDIATE FEEDBACK

There are many researches on the experience and importance of feedback in learning process regarding students [1,2,3].

Researches involving time and feedback interactions date from 1982 and are performed to the present day, mainly because of the growth of e-learning [3, 4].

It is possible to classify feedback through informal feedback, formal, direct and indirect [3]. In informal feedback

students receive their answers usually verbally, through casual conversation, these may even be in groups. In formal feedback responses are made upon successes and mistakes made in tests and assessments, submitted by metrics such as approval and disapproval notes. Direct feedback is made directly to the student after an evaluation, while indirect feedback does not mention names, or specific students, it is the most general way to provide feedback.

The feedback in addition to the above indicated ratings can be an immediate type, and can be understood according to [5] a response of a system from user actions, which happens in a quicker way.

A positive feedback is the one performed by the student per activity / task that can make students feel more secure about their performances [3]. Then, the use of tools which enable performance of immediate feedback seem very conducive to the student engagement in learning process. To confirm this, it was found an experiment example conducted with immediate feedback, [6] to analyze traditional feedback methods (not immediate feedback). In this experiment it was observed that students retained for longer periods of time, information in their memories, also answers of exercises they experienced in the immediate feedback, and they were able to build their knowledge as they were assessed.

Although the experiences with the use of tools that provide immediate feedback has good contributions to students' learning, further investigations are needed, especially those relating to the further use of the tool. Moreover, is importante to know the desing of the feedback tool , its mode of operation and objectives that were architected for it.

### III. THE EDB ENVIROMENT

The idea of EDB came up as an application for helping the teacher on the practical part of the Database discipline, where the Queries are elaborated under a database. At first, the EDB didn't have the intention to improve the learning of the students, only provide an environment where the students could send their Queries and automatically receive a simple feedback, if the Query is correct or not, turning the practical lessons more dynamic and allows the student to have the opportunity to revise the mistakes of the submitted Query and resubmit for another correction.

The EDB is a web base application, which means that it can be accessed with any device with a internet browser. Each student have a unique account and in the main screen, they have a list of the activities for submission. (Figure 1)

Each activity is made of a Entity Relationship Diagram (ERD), Figure 2, a list of questions that need to be answered with the Queries under the Database made with the ERD in Table 1 and the access to a Data Base Management System (DBMS) with the Schema of the activity already done and populated, so the student can make query for the answer and then make the submission.



#### Listas de Exercício

#	Lista	
1	Lista Northwind 4	Enviar Resposta
2	Lista Northwind 3	Enviar Resposta
3	Lista Northwind 2	Enviar Resposta
4	P2 - Northwind Tipo 1	Enviar Resposta
5	P2 - Northwind Tipo 2	Enviar Resposta

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Fig. 1: The main screen of EDB, with a list of the activities



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BANCO DE DADOS

#### Esquema do Banco de Dados Northwind

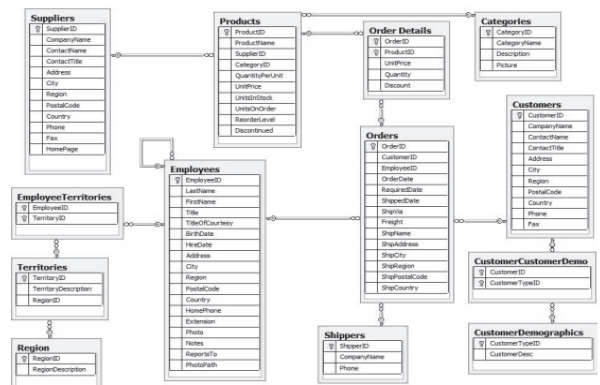


Fig.2. Part of an activity applied using the EDB.

- List full name, in a unique column, birthday and hiring date of all employees.
- List order id of the orders that were not sent.
- List id and first name of employees that are coordinator.
- List order id and customer id of the orders sent in May of 1997.
- List last name of employees that made some order to any Argentinian customer.

TABLE 1. Some questions to be answered about the ERD of the Fig. 2.

After using the DBMS tool to build the query and test it, the student can select the Activity and the Question on EDB and send the query that supposedly fill the activity, as shown in Figure. 3:



Exercícios Submissões Alterar Senha Sair

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## Enviar Resposta

Exercício

Ex7

Query

SELECT orderid  
FROM ORDER\_DETAILS  
WHERE productid IN ( SELECT productid  
FROM PRODUCTS NATURAL INNER JOIN SUPPLIERS  
WHERE country = 'Brazil'  
)


Salvar

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Fig. 3: The submission Web page for the answer.









After submission, student can check whether the answer was accepted or rejected by the EDB, by consulting a web page with the score of submissions, as shown in Figure 4, where the presence of a dice means that the question was properly answered. Or yet, in the own submission page (Figure 5), where the green color alert means that the query was accepted, while the red color alert means that it was rejected.



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## Submissões

Lista	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6	Ex. 7
Lista Northwind 4							
Lista Northwind 3							
Lista Northwind 2							
P2 - Northwind Tipo 1							
P2 - Northwind Tipo 2							

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Fig. 4 Score web page

Furthermore, the student is able to see the differences, which lines are left or missing between the sent answer and the correct answer on the EDB, as shown in Figure 5.

## IV. CONCEPTUAL MAP AS A SUBSIDY FOR EVALUATION AND FUTURE APPLICATIONS

The meaningful learning requires two conditions: the student has a desire to learn and the subject to be learned is



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Query executada com sucesso!


Enviar novamente

## Query Executada

SELECT orderid  
FROM ORDER\_DETAILS  
WHERE productid IN ( SELECT productid  
FROM PRODUCTS NATURAL INNER JOIN SUPPLIERS  
WHERE country = 'Brazil')

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Query não retornou o resultado esperado

Enviar novamente

## Query Executada

SELECT orderid  
FROM ORDER\_DETAILS  
WHERE productid IN ( SELECT productid  
FROM PRODUCTS NATURAL INNER JOIN SUPPLIERS  
WHERE country = 'USA')

## Registros Faltando

orderid
11073
10885
11051

Fig.5. Web pages with the details of the rejected submission by the EDB

meaningful to him/her [7,8].

The desire to learn from the student can be spontaneous, considering certain interesting knowledge about information that caught some attention or even when stimulated by the objective of being approved in a particular discipline, for example. However, for the verification of meaningful learning, this research suggests the use of concept maps.

The concept map can be understood as a relationship of concepts, beginning with a sentence, doubt or word, which links are made using connectives like "such as", "leads to", "from results", thus establishing the relationship between concepts presented [10]. According to [7], the complexity of relations based, mainly, in the relations that the student can establish between the concepts presented to them than among the numbers of present concepts. It means that the types of

relationships and their amounts relate directly to the student understanding about the concepts that have been submitted and therefore reflect the degree of understanding of the same.

Experience with concept maps as a teaching and learning strategy in the database discipline were verified by [9], in which students of Technology Analysis and Systems Development course held conceptual pre-mapping and conceptual post-mapping. The activity was divided into three stages, which first students established relationships of concepts, so that it was not presented as a concept map, the second constructing a first map, without the intervention of the teacher and the third that was also characterized by construction of the map, but in a new context, with the same theme. The results showed many relationships and concepts correctly, that did not happen before. For the authors [9] the use of the map favors the learning of students, who even felt more autonomous and engaged to learning the topics of the course.

The results presented by [9] are according to the idea of [7], that learning becomes more meaningful when a new meaning is attributed to a previous one, previous knowledge and also to identify what does the teacher can do about the concepts that students bring and new ones presented to them.

Finally, the next experiments using EDB intend to make use of the construction of concept maps before and after application, to be checked how and what concepts were actually modified compared to the immediate feedback that the students received.

## V. TOOL USAGE

The EDB was used in a class with 64 students of Database discipline at Federal University of ABC. The course plan ranges from business modeling, conceptual and physical design, normal forms to topics of database programming, such as stored procedures and triggers, passing comprehensively by Structured Query Language (SQL). Exactly this topic, where queries are build with all SQL features is that the EDB has strongly contributed.

During the course were provided 5 properly populated databases with their respective diagrams and 270 exercises in the form of questions, such as in Table C, with complexity varied to be solved with help of EDB. In addition, two evaluative character activities were applied during the course with use of EDB with a distinct diagram and 12 exercises each activity.

## VI. INITIAL RESULTS

In the beginning the EDB environment was not thought like a student learning stimulus tool, but as a tool to facilitate correction and increase the dynamics of practical classes of SQL, providing to the student with immediate and sufficient feedback so that it has the opportunity to correct and resubmit the exercise at the same time. However, this dynamic environment was presented as fruitful for the learning process. As a part of the 64 students enrolled in the course, in this were consider 53 students, because others abandoned the course or were disapproved by excessive absences.

The total students considered, 98% were approved in the discipline and if were considered only the evaluations that used the EDB, 62% obtained maximum concept in the evaluation, 36.2% were the average concept in the evaluations and 1.8% obtained the minimum concept evaluation.

In the comparison of this result with courses that were offered in the last 3 editions, there is an increase of 61% at the least and 78% at the most, in the approval of the students.

These indices got notice of the teachers involved in the discipline, since the only change in the discipline was the implementation of EDB.

For this reason, it was decided to carry out coordinated experiments using EDB, but now in order to observe the impact it has on the teaching and learning process of the students involved, with the support of the use of concept maps. Furthermore, in the future the researchers will look for the improve the tool also, and look for theoretical basis to support the results achieved and the expected results.

## VII. CONTRIBUTIONS

After the initial results of the use of immediate feedback tool EDB have shown efficient, because the improvement of students' grades but the researchers believe they need to do further investigation, with qualitative information. To do it we will adopted the use of concept maps is expected to investigate the contributions and changes in concepts student structures, serving this aid model for teachers that will make use of instant feedback tools.

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