aDBenture – learning SQL in a game-based way

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Abstract: The aim of the poster is to introduce aDBenture, a web-based and responsive tool that allows learners to work with SQL in a game-based way. With aDBenture, learners can play adventures that can be solved with SQL. Teachers can reuse existing open adventures or define their own adventures. Also, analyses of the players' results are possible. The authors will also talk about how they flexibly integrated aDBenture into a MOOC on databases to create as much interactivity for the learners as possible.

Introduction and Motivation

The subject area of databases and thus the handling of relational databases is present in many technical curricula. However, teachers often lack interesting sample data and exercises for their students to practice on. Usually, typical example data is downloaded from the web or a very small set of sample data is created. Based on this data, teachers design exercises in form of documents for the students mostly without embedding them into a motivating context. Then, students are expected to install a special database management system on their workplace computers and upload the sample data. So, they usually have to prepare their isolated environment and to solve the given exercises there. What problems and successes the students experience over the course of their SQL exercises, and whether and how much practice is done, is not apparent to the teachers in this way.

For students, the installation of the database management system requires their own workplace computer with specific installation rights. Mobile devices like phones or tablets are not suitable to do the hands-on practice. Existing SQL editors are also often very complex for database beginners and do not provide enough feedback when developing solutions for given exercises.

We are currently working on two projects that focus on training students in databases: In the eInformatics@Austria project (eInformatics@Austria), we are developing an interactive and engaging MOOC on databases. In the aDBenture project we are working on a web-based and responsive tool that allows learners to work with SQL in a game-based way. As part of this project, we developed a web-based tool (also called aDBenture) to help teachers motivate students to actively practice SQL by solving tasks given as part of an adventure game.

Learning SQL with aDBenture

Students can practice with the frontend of aDBenture SQL in a game-based way. There, they can play several open SQL adventures as guest players to train their SQL skills easily and anonymously. Concrete adventures can be searched for using the filter icon in the toolbar. However, in order to be able to save an adventure score, registration and login is required.

Figure 1 shows the aDBenture landing page of a player. It displays the adventures a student has already played and the current status of these plays. Logged-in players also have access to private adventures that can only be played with a key. The keys are generated by the teachers and announced to the players.
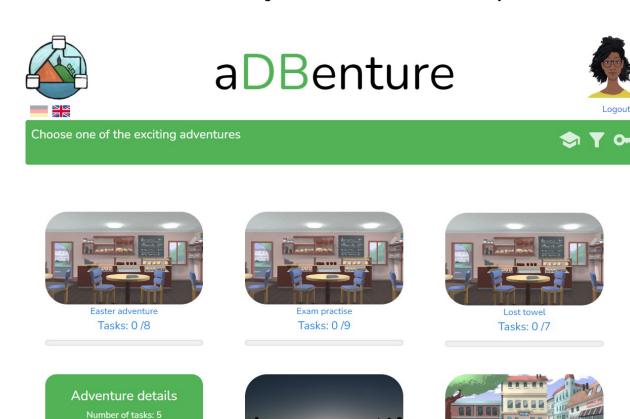
Figure 1: A logged-in player on the landing page of aDBenture

When the player starts or continues an adventure, they are presented with the first task immediately and can try to solve it using SQL queries (see Figure 2). Each task has a certain number of points that a player can receive if they solve the task correctly and a task description. On the right-hand side the player finds the schema view with the tables, attributes and data types that have been recommended by the teacher for solving the task. It is also possible to show the UML diagram for the database schema. Below, the player finds an SQL editor. Depending on the feedback level the teacher has set, the player also has the option to display the expected result (like in Figure 2).

The aDBenture frontend provides intelligent and helpful feedback to the player. Intelligent error messages are issued based on stored sample solutions. These messages can contain accurate hints on errors in a query, missing statements, deviations from the expected result, and more. When the player checks a query, they will receive this feedback. aDBenture evaluates missing and unnecessary columns, tables, and conditions. It is also able to detect missing sorting criteria and inform the player when an alias is expected. If the user's query returns the exact same table as the sample solution, but there is no similar sample solution stored, the query is considered as solved, but must be evaluated more closely by the teacher via the aDBenture backend.
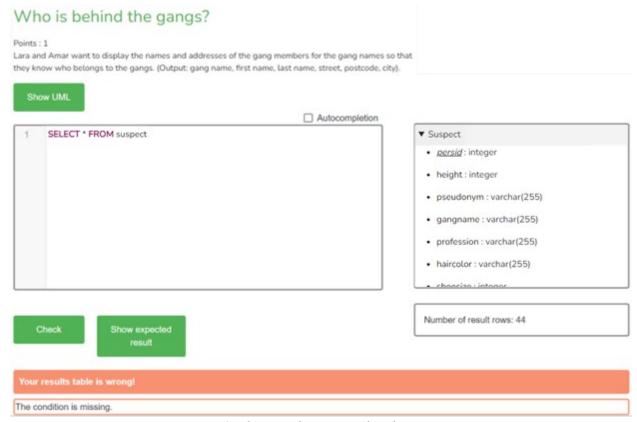
Figure 2: Player working on a task with aDBenture

Teaching SQL with aDBenture

aDBenture's backend allows teachers to create and edit their own SQL adventures or to reuse and adapt open ones. Via the backend a teacher can choose the database that will be the basis of an adventure and add tasks to this adventure to be solved by the players later. Teachers can reuse existing, open databases or upload their own training databases. They can also upload a corresponding UML diagram. After selecting the database, the teacher can set the feedback level for the players of the adventure and determine whether the adventure is open or private. In the latter case, an access key is generated by aDBenture that can be given to students to play the adventure.

An adventure includes one or more tasks. Figure 3 shows how a task can be edited: the teacher enters the title, a task description and a score. They define the schema view with the tables, attributes and data types that are recommended for solving the task. Also sample solutions are entered, which are used later during a play to check the correctness of players SQL queries and to give intelligent feedback. To supported usability, the teacher can also check their sample solutions here. There is also support for creating similar tasks, as the teacher can reuse existing tasks.

Via the aDBenture backend, the teacher can also analyse the game results of the logged-in players of their adventure and thus get an idea of the students' SQL abilities.

aDBenture can be used also for exams e.g., in the Safe Exam Browser (Safe Exam Browser), which is embedded into the Moodle platform.
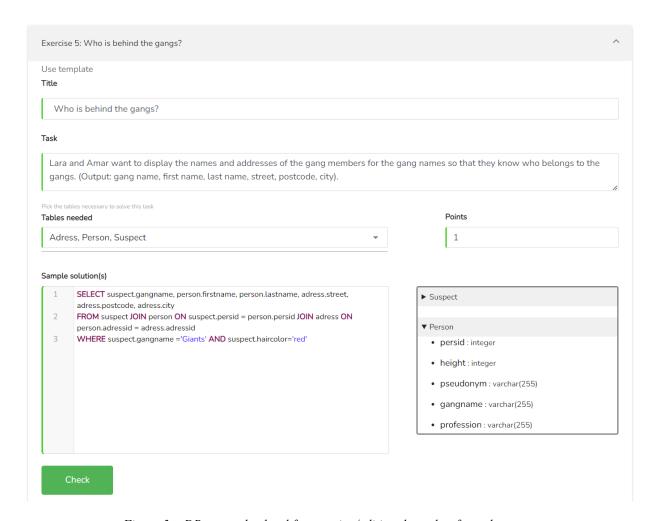
Figure 3: aDBentures backend for creating/editing the tasks of an adventure

Resumé

The poster presents the objectives, the frontend and backend of the web-based tool aDBenture. aDBenture can be used as a standalone tool to teach and practice SQL. It can also be embedded in a secure exam environment or flexibly integrated into course management systems, tutorials and MOOCs dealing with SQL. The authors are working on a database MOOC (iMooX), where they also have integrated aDBenture to create as much interactivity for the learner as possible. They can report on their experiences from a recent evaluation with 120 students. The current version is available in German, English and Spain at adbenture.aau.at.

References

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