Useful Educational Exercises for the Community

Habib M. Fardoun, Daniyal M. Alghazzawi, and Lorenzo Carretero González

Information Systems Department,
King Abdulaziz University (KAU),
Jeddah, Saudi Arabia
{hfardoun,dghazzawi,lgonzalez}@kau.edu.sa

Abstract. In a lot of cases, the contents given by the educational system don't leave a mark on students due to that it doesn't reach to pay enough attention for it has a positive effect on the learning. For that reason, we propose a system able to help for carrying the learning task out and for solving the problem raised with the lack of students' attention related to the lack of awareness of the place to apply the new taught contents. That makes necessary the incorporation of new technologies, like the use of a Cloud system and the communication via of Web Services when users access by mean of mobile devices, which provide a global site of consults that helps to students to understand contents given and associate them to the real world.

Keywords: Cloud, Web Services, e-Learning, Educational System, practical exercises.

1 Introduction

The academic failure of a determined student is not only associated to the student in particular, but also to the context into that student is. In this global context coexist familiar factors, friends, educational system and teachers. If we focus on the academic field, in a lot of cases the contents given by the system don't reach students' mind due to that those contents don't call enough the attention to have a positive effect on the learning. Part of it occurs because exposed information is, in some cases, too theoretical; and in other cases it doesn't show a practical situation where use it in the future.

If we put as example the Mathematics subject, we can check that when we work with derivatives, the academic staff often limit themselves to explain how it must be done and the basic rules to do it. However, as much as students know how to derivate perfectly, it won't have any sense nor utility if they don't know for what and where, inside of real life, they can use those formulas. For that reason, the ideal form to make the learning task is to show a real situation with images, which are close to students' life; joined to it to represent, in a graphical form, the scenario as it is usually represented on any problem; And lastly to make the exercise solving the problem described.

G. Meiselwitz (Ed.): SCSM 2014, LNCS 8531, pp. 314–321, 2014.

Because of that, we propose a system able to help to carry the learning task out and to solve the problem related with the lack of students' attention associated to the lack of awareness of the place where to apply the contents given. For that reason, it is necessary the incorporation of new technologies to provide a global site for consulting doubts about the material that students are studying and thus to associate it to the real world. This system located at the Cloud consists of the storage of practical examples, which follow specific steps previously commented. Each exercise should be composed by:

- A video, images or any other material that shows its application on the real world.
- A graphical representation of the content for its resolution.
- The problem resolution.

The users of the system give points to the exercises such that the most valued are shown at the first positions because their use helps, in a clearly form, to understand the didactical material taught. In addition, all of these examples serve to the teaching community as assistance for teaching to their students the appropriate didactical contents. Thus, any teacher from any place of the world can show to the students through a projector, TV screen, laptop or mobile device, the activities that help more to understand the subject contents. Anyone is able to consult by mean of his/her personal computer or mobile device, the different topics in the system, finding exercises about derivatives, electronic circuits, etc., taking into consideration that the fact of that every resolved problem is associated to a real problem where it is understandable its use, is a very important factor.

2 Exercise Structure

As we have talked previously, to that an exercise can be suitable enough for the target of call the student attention and so can keep it in the memory, it must accomplish a structure, whose content resemble to a real situation and whose resolution is clear. Thus, the main elements inside of this structure are as follow:

- **Area**. It is the topic related to the exercise content. So, if we are treating an exercise where, the physical principles of the bodies' movement without take into consideration the forces where they come from, are evaluated, then we were talking about kinematic. Thus, the area would be "Physics – Kinematic".
- **Statement**. Detailed explanation of a real situation close to the students where the variables to take into consideration or the phrases to evaluate are described.
- **Resource**. It contains a video, image or another element that shows the situation described in the statement.
- **Representation**. Graphical element that shows the problem from a practical point of view to evaluate, in a easier way, the elements that take part of the suggested situation.

With all this information, the system's users have everything that they need to understand the explained things and thus to learn the contents related with that scope

in particular. Following, in the figure 1, we show an example where we put in practice the detailed structure previously treated and where we can observe each of the described sections.

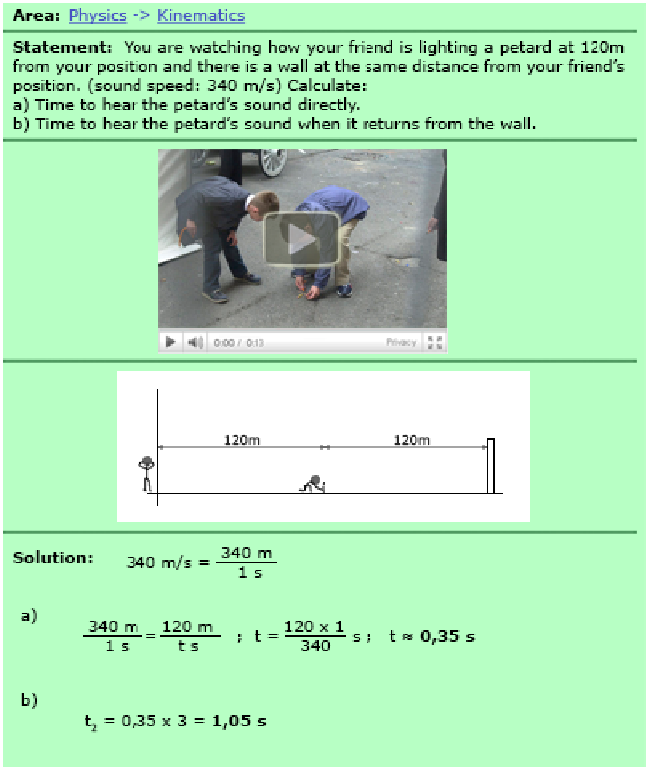

Fig. 1. Example of exercise

As we can see, the example is a very easy problem but it contains every part of the structure. With it any user will have access to a complete exercise and with a big similarity to situations that users can find in their real life. However, the exercise of the previous example doesn't suppose a total innovation due to that for any exercise of the Physics subject is necessary a lot of information and, in most cases, daily life examples are used. Instead, when we are talking about certain elements of the Mathematics subject, like derivatives or integrals, something changes. In that case, most current exercises that teachers propose come determined by the resolution of concrete equations or formulas each time more complex for evaluating the students' ability to solve them. In that moment we are creating users with a big ability to resolve equations but with little ability for applying them into the real life.

Due to previous facts, in the figure 2, we can observe an exercise where we put in practice the resolution of derivatives applied to real situations, which show to the user the utility of them in a concrete scope.

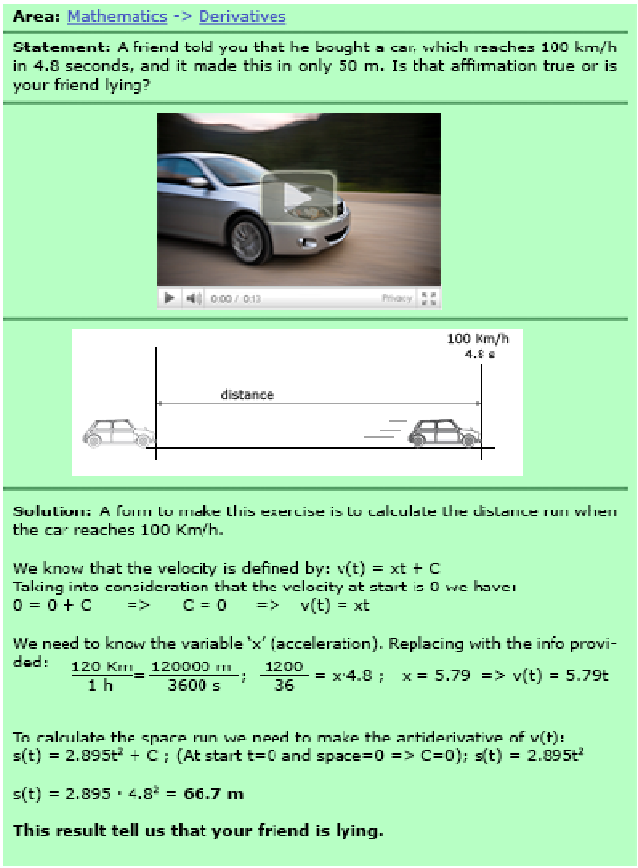

Fig. 2. Example of exercise with derivatives

As we can see in the previous example, all the provided information has a goal: to convince to the user that the exercise done has a real application, which could be useful in a future. Thus, in a unconscious form, the user assimilates better the concepts given, needing so of less time to teach a specific theme and keeping that information more time into the students' mind. This is because of they don't see the content as an ephemeral thing that they will use only for an exam or an evaluation in particular.

Although into the structure are the resources and the graphical representation, these are not necessary. However, they are useful when we want that the user associates the theoretical world with the real world.

3 System Architecture

As we want all this useful information available for everyone, we have developed an architecture in Cloud where the services and resources are located in Internet[4][5]. We start with a server where is stored the web application, which shows the contents and contacts with the data base to obtain them or create them. This application can be accessed from any device either mobile or not, through web services provided by the system or by mean of the web application [6]. At the diagram of the figure 3 we can see the complete architecture.

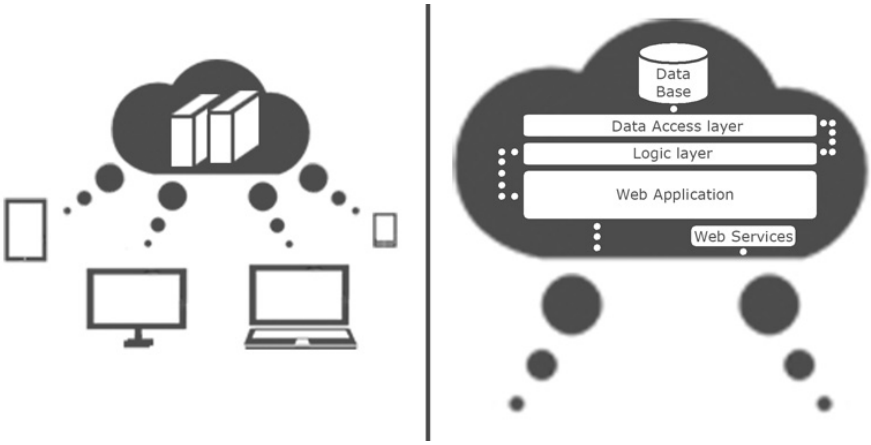

Fig. 3. Architecture

As we can see in the figure above, the elements inside of the server are divided in function of their labour into the system. Below, we are going to explain in detail each one of these elements:

- **Web Services.** They are the entrance gate to the services that the system offers to users. Thus, a particular student, with the application installed at his/her mobile device, will be able to access to the resources and information needed without make use of the web site directly.
- **Web Application.** The web application is the whole system, but in the figure is shown as the presentation layer where a user can access to create or to obtain information.
- **Logic layer.** It is the layer in charge of storing and treating the application's objects. In this layer is developed the system's functionality.
- **Data Access layer.** Through this layer we perform the exchange of data between the system and the data base, in other words, this layer is in charge of translate the data from the data base to recognizable objects for the system.
- **Data Base.** Into the data base is stored all the information related to users, exercises, themes, areas, stars, etc.

This type of architecture is ideal due to we don't need too much resources; in consequence the cost is so reduced. In addition, as we commented previously, it provides an isolated access to devices, which facilitates the user's work.

4 Exercise Evaluation

Once defined the structure of the exercises to store and the architecture of the system, next thing to do is the exercise evaluation. This point will determine what exercises are more intuitive to users, and due to that, more voted. All the registered users have the opportunity to vote the exercises that they see into the system to determine which ones are the exercises that are more identified with the philosophy, in other words, the best resolved exercises must be the ones that are closer to the user's reality, the most intuitive and better explained.

The voting system is defined by a stars system. A similar method is used in [7] where stars are used for evaluating specific characteristics. The most valuated will have five stars and the less valuated will have zero. Thus, an exercise with two stars and a half will mean that is a medium quality exercise. The figure 3 shows how this classification based on stars is visualized into a determined exercise.

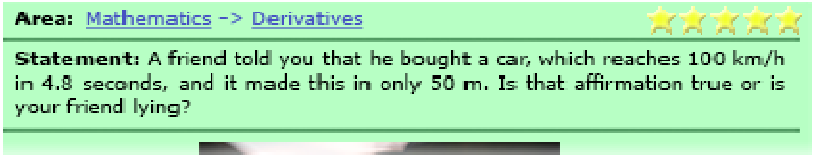

Fig. 4. Exercise score based on the stars system

Basing the exercises on this type of classification, it is easier and quicker for users and/or students to find examples that are really useful, avoiding thus an exhaustive search that expends time and moral. For this motive, it is essential that the exercise is scored by a quantity of people as greater as possible to adjust its mark. In addition, if the mouse is maintained over the stars (PC users) or if someone makes click on them (mobile device users), the number of users, who have voted the exercise will be shown. It is useful to evaluate this score. Besides the previous facts, we have to take into consideration that the exercises are divided in different themes to facilitate the search labour.

5 Repercussions into the Educational System

Due to the global character of the system, any teacher has access to the uploaded exercises in the data base. Thus, these examples can be shown to the students for bracing their knowledge about a subject in particular. For that reason, it helps to teaching staff at time to find adequate and useful material that can call the students' attention and with it, to improve the learning. In relation with students, they have also

access to the platform, so that the learning followed by the studies plan is accompanied by the realization of exercises that show to the student a reality where to use the concepts studied[8][9][10].

Inside of educative infrastructure, the inclusion of this new system doesn't generate a revolutionary impact due to we don't need make big changes that can destabilize the system and to provoke mistrust. The cost in infrastructures of the implantation of this system into the academic center is non-existent because it doesn't depend of hardware that the center has to buy or of classes used as storage or where to put in practice the new methodologies. The only necessary thing is to have a internet connection for accessing the platform. Once into it, each teacher/user will have access to material that they need to their class. Thus, the impact of the implantation of this system is close to 0.

6 Conclusions

With the proposed environment we improve the learning and the aid to teachers for making their work, getting that students show a bigger interest as a consequence of the examples have a real practical application. In addition, the impact that the incorporation into the class of this system suppose is minimum because it doesn't require any additional device that you can't find currently at any place due to it is only needed a internet connection and a computer or mobile device to consult it. Previous facts are associated to a low economic price because the system is located on isolated servers, in other words, only a little investment is necessary to form the kernel of the platform and automatically it will be available for everyone (this investment is only necessary in case of a private platform).

However, not only the teaching staff is benefited, but also the students and users that want to use the platform, are be able to do it. Thus, using the platform helps to keep in mind the contents learned and to consult real use cases where to apply the concepts. Moreover, through the exercises' marks the platform generates a sort system where the best exercises are the most valuated by the users and, as consequence, the first ones to appear in searches. It decreases the searching time of exercises that can be useful for the student.

References

1. Sarason, S.B.: The Predictable Failure of Educational Reform: Can We Change Course before It's Too Late? The Jossey-Bass Education Series and the Jossey-Bass Social and Behavioral Science Series (1990) ISBN-1-55542-269-1
2. Noddings, N.: The Challenge to Care in Schools: An Alternative Approach to Education. Advances in Contemporary Educational Thought 8 (1992) ISBN-0-8077-3177-3
3. Duttweiler, P.C., Mutchler, S.E.: Organizing the Educational System for Excellence: Harnessing the Energy of People (1990)
4. Sultan, N.: Cloud computing for education: A new dawn? International Journal of Information Management 30(2) (April 2010)

5. Ercan, T.: Effective use of cloud computing in educational institutions. Procedia - Social and Behavioral Sciences 2(2) (2010)
6. Giurgiu, I., Riva, O., Juric, D., Krivulev, I., Alonso, G.: Calling the Cloud: Enabling Mobile Phones as Interfaces to Cloud Applications. In: Bacon, J.M., Cooper, B.F. (eds.) Middleware 2009. LNCS, vol. 5896, pp. 83–102. Springer, Heidelberg (2009)
7. Fardoun, H.M., Alghazzawi, D.M., González, L.C.: Improving learning methods through student's opinion into teacher's curricula Using graphical representations. In: Federated Conference on Computer Science and Information Systems, FedCSIS (2013)
8. Inan, F.A., Lowther, D.L., Ross, S.M., Strahl, D.: Pattern of classroom activities during students' use of computers: Relations between instructional strategies and computer applications. Teaching and Teacher Education 26(3), 540–546 (2010)
9. Brown, S., Bull, J., Race, P.: Computer-assisted Assessment of Students. British Library Cataloguing in Publication Data. ISBN 0-7494-3035-4
10. de Jong, F., Veldhuis-Diermanse, E., Lutgens, G.: Computer-Supported Collaborative Learning in University and Vocational Education. In: CSCL2 Carrying Forward the Conversation ch. 3
11. del Jesús, V.: Elementos Básicos del Cálculo Diferencial (Basic Elements of Differential Calculus). Ude@ (2007) ISBN 958-665-961-0
12. AL-Malaise, A.S., AL-Ghamdi, Fardoun, H.M., Antonio Paules, C.: Tutor Platform for Vocational Students Education. In: Federated Conference on Computer Science and Information Systems, pp. 703–707 (2013)
13. Fardoun, H.M., Mashat, A.S., González, L.C.: New subject to improve the educational system: Through a communication channel betwen educational institution-company. In: Federated Conference on Computer Science and Information Systems (FedCSIS), pp. 709–712 (2013)
14. Fardoun, H.M., Mashat, A., López, S.R.: Applying Professional Solutions within the Educational Environments by Means of Cloud Computing: Coaching for Teachers. Journal of Universal Computer Science 19(12), 1703–1717 (2013)
15. Romero, S., Fardoun, H.M., Penichet, V.M., Gallud, J.A.: Tweacher: New proposal for Online Social Networks Impact in Secondary Education. ADCAIJ: Advances in Distributed Computing and Artificial Intelligence Journal, 9–18 (2013)