

Introducing BeA into Self-Regulated Learning to provide Formative Assessment Support

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Abstract—BeA (Blended e-Assessment) is an e-assessment solution that supports both teachers evaluating and students accessing and reviewing their assessments on line, anytime and anywhere. Students perform their tests, exams or exercises in paper, but the assessment made by teachers and reporting of results to students is performed on-line using scanned copies of the papers. BeA includes functionalities allowing teachers to classify and manage common errors, guaranteeing coherence and consistence along the assessment process. This paper introduces a work in progress using BeA to support Self-Regulated Learning and Formative Assessment. This involves promoting a reflective dialogue among teacher(s) and students around the assessment results. BeA statistical tools enable teachers to identify the more frequent mistakes and to group students based on such mistakes. Teachers can send general or specific feedback to learners and use predefined prompts in order to initiate student self-reflection and self-awareness of their mistakes and misconceptions.

Keywords— *e-assessment; self-regulated learning; formative assessment.*

I. INTRODUCTION

The development of e-learning functionalities is usually focused on the support of innovative learning activities in new scenarios and contexts. Then, many of these functionalities can be also used in traditional face-to-face educational settings, such as Learning Management Systems (LMSs) that are being used in our subjects. Nevertheless, there are specific developments of software tools that are carried out to support learning activities directly in a traditional face-to-face contexts, as they were done before technology. This is the case of BeA to enable the on-line assessment of paper-based examinations.

In our university it is mandatory to provide learners with paper-based examinations. In addition, many teachers use paper-based questionnaires and exercises in a frequent basis as a main part of their teaching practice. Learners are requested to perform and provide these examinations as part of their work at the classroom. In the past, the teacher collected all the student papers (some times several hundreds) and took them to the office (or home) to assess them. Later, the teacher communicated to the students the results and reviewed the main mistakes and issues with the students. BeA is provided as an innovation to this process because after the examinations are collected by the teacher, he/she can scan the papers and then all

the process is done on-line. This facilitates the assessment of the teacher, the communication of results to students, and the management of the large amount of papers providing some protection as the exams have not to be taken out of the university.

After some years using BeA to support examinations we are now considering the use of BeA to support new pedagogical approaches. More specifically: self-regulated learning and formative assessment. Taking into account the functionalities already provided by BeA, we are going to research if they can be helpful to manage more frequent and short classroom exercises, continuous assessment and the provision of reflective feedback to learners.

The rest of the paper is structured as follows. Section II briefly introduces the pedagogical background underlying self-regulated learning and formative assessment. Section III outlines a short description of the main functionalities of BeA. Section IV introduces the new developments of BeA to support the new pedagogical approaches. Finally, section V presents the conclusions and the future work.

II. PEDAGOGICAL BACKGROUND

A. Self-Regulated Learning

Self-Regulated Learning (SRL) is an educational approach that tries to make learners aware and accountable for their own learning [1, 2, 3]. In few words, SRL stresses that learners align their goals with their strategies and plans, performing a continuous monitoring of their development and self-reflecting about their learning results. These ideas are well positioned with the need for life-long learners demanded by current societies, for example in the European Higher Education Area [4]. SRL is being considered in several projects and initiatives to improve teaching and learning [5, 6, 7].

SRL embodies a quite extensive set of strategies that can be used by students in order to improve their learning results. Well-recognised authors in this area have provided different classifications for these strategies [1, 2, 3]. Particularly, Pintrich arranges strategies into the following areas [1]:

- Motivation, including beliefs and feelings about why to learn.

- Meta-cognitive, focused on the process followed to learn: goal setting, planning, monitoring assessment, and reflection
- Cognitive, about the performance of specific tasks: to read, to write, to solve exercises, to prepare exams, etc.
- Time, space and resource management.

Students that have a good knowledge of these strategies usually achieve better learning results. Nevertheless, despite some of these strategies are quite simple, freshmen students do not demonstrate neither a good understanding nor a good management of them. In our work we focus on monitoring assessment and reflection as key strategies to be supported.

B. Formative Assessment

Formative Assessment is usually introduced in contraposition to summative assessment, related to the final evaluation and grading of students. Formative assessment main goal is not to grade, but to check if the learning is being achieved as expected. According to [8] two types of formative assessment can be distinguished: (i) formal formative assessment, that take place with reference to a specific curricular assessment framework involving activities required by students and teachers; and (ii) informal formative assessment, which takes place in the course of events, but not stipulated in the curriculum design (e.g. instantaneous feedback). It is important that teachers adopt this assessment approach in order to facilitate: (i) learners to be aware of the learning goals; (ii) teachers and learners to compare the real knowledge and skills acquired by the learners at a given moment with the desired ones; and (iii) teachers and learners to tailor learning activities in accordance to the results obtained.

Formative Assessment can be considered as an intrinsic aspect of the SRL approach. It promotes students becoming self-regulated learners [9]. They are invited to make an active regulation and monitoring of their progresses by identifying learning goals and monitoring their achievement. The formative approach produces more feedback to support learners in their active regulation.

III. BEA PLATFORM

BeA is a Web platform used in the University of Vigo that provides assessment functionalities. BeA stands for Blended e-Assessment, namely, it mixes the classical exam with pen and paper with the electronic management of assessment. In Fig. 1 we can see the several stages of the life-cycle of the BeA exam:

1. The exam can be designed by using any text editor following some specific rules related to the margins of the document: a header of 5 cm. at the top of each page of the exam to introduce identifying data by BeA, and 1 cm. of separation between questions in order to avoid overlapping errors during scanning. Once the exam was edited following these rules, a PDF file containing

it has to be uploaded to BeA, where the header data will be added to every page of the exam.

2. The final PDF file of the exam with the header added by BeA is available for printing. The teacher prints as many copies of the exam as necessary.
3. The copies of the exam are delivered to the students in the classroom in order to perform the exam. Once the exam is finished, all the pages of the exam with the answers of the students are scanned, converted to PDF format, and uploaded to BeA. Before to proceed with the assessment, the teacher has to mark out the area occupied by every question/answer in order that BeA knows the area assigned to every question. Besides, at this point, the teacher can upload the solved exam. Therefore, after these steps and before the assessment, a student can gains access to both his/her answered exam and to the solved one.
4. In the assessment stage, cf. Fig. 2, BeA is focused on a view based on the questions instead of the students. For instance, if the exam has 5 questions and it was answered by 100 students, BeA is designed to show to the professor the answers of all the students to one specific questions at a time (i.e., the 100 answers of the question 1, the 100 answers of the question 2, and so on). BeA was originally designed to provide atomistic assessment [13]. According to this kind of assessment, the answers are considered correct a priori and consequently with the maximum score, and when an error is found then the teacher adds penalties to the mark. To do that, the teacher can define a list of errors, everyone with its specific penalty score and a short description. When the teacher finds some error in a question, he/she can assign it to that question with a single mouse click. Therefore, a specific error is always described and scored alike. And as all the exams are stored in BeA, and as they are accessible through any device connected to Internet, the assessment can be carried out anywhere and anytime without the need to have the paper exams. Moreover, different questions can be assessed by different teachers anywhere and anytime.

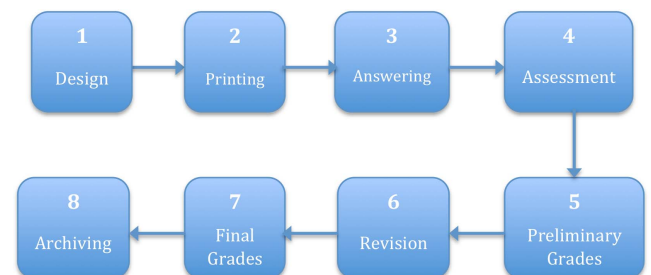


Fig. 1: Stages of the life-cycle of an exam

The screenshot shows the BeA interface. At the top is a navigation bar with links: Cursos, Inicio, Alumnos, Asistentes, Exámenes, Notas, and Versiones. The main content area is titled 'Código (3 puntos). Escriba un código en el lenguaje C que' followed by two instructions: 1. solicita al usuario que escriba por teclado menos de 30 caracteres incluyendo los espacios. 2. escribe en pantalla el porcentaje de espacios escritos por el usuario con 2 decimales. A note below states: 'Nota: Su código puede asumir que el usuario escribió menos de 30 caracteres.' Below this is a text area containing the student's C code. To the right of the code is a panel titled '#Parámetros' showing a score of 3.0 and a maximum score of 3.0. Below this is a panel titled '#Descripciones de error' showing three error descriptions: E-1 - Resumen: No conta caracteres (Penalización 0.2), E-2 - Resumen: Alerta (Penalización 0.1), and E-3 - Resumen: Instrucción (Penalización 0.2).

Código (3 puntos). Escriba un código en el lenguaje C que

- solicita al usuario que escriba *por teclado* menos de 30 caracteres **incluyendo** los espacios.
- escribe en *pantalla* el **porcentaje** de espacios escritos por el usuario con 2 decimales.

Nota: Su código puede asumir que el usuario escribió menos de 30 caracteres.

Código:

```
#include <stdio.h> //biblio. estándar
#include <stdlib.h> //biblio. strings.

int main () {
    char cad [31]; int i, espacios; //Declaración variables
    scanf ("%s", &cad); // Introducc. de caract.
    espacios = 0; // inicialización de espacios
    for (i = 0; i < 31; i++) { // bucle for recorre la cadena
        if (cad [i] == ' ') { // si encuentran un espacio
            espacios++; // incrementa "espacios"
        }
    }
}
```

#Parámetros

☐ #Puede puntuar negativamente
3.0 #Puntuación máxima

#Descripciones de error

E - 1 - Resumen: No conta caracteres
Descripción
Su código no cuenta los caracteres
Penalización 0.2

E - 2 - Resumen: Alerta
Descripción
Cuidado!!
Penalización 0.1

E - 3 - Resumen: Instrucción
Descripción
Instrucción mal escrita
Penalización 0.2

Fig. 2: Screenshot of BeA showing a part of the student answer to an exercise and the assessment marks and descriptions

- The preliminary grade for a student is the sum of all the scores in every single question. Although BeA is oriented to assess focusing on questions, when observing the preliminary grades, the teacher can have a global vision of the student's exam, especially when the score is on the borderline of passing the exam. In that case, the teacher can see the full exam of a student with all the questions and has the option to add the comments and adjustments to the grade he/she considers appropriate. Once the exam is completely assessed, the teacher can give access to the students to see their corrected exams, with their errors, and their corresponding marks, descriptions and comments (if any).
- In the reviewing stage the students can dialogue with the professor about the assessment of every single question. The students can choose to review their exams online, indicating which error want to review and chatting with their teachers, who can reconsider the assessment of the corresponding question. In that case BeA enables this task facilitating a direct link to the question to be assessed again.
- After the review, the grades turn into permanent without any chance to modify them.
- In the archiving stage, BeA saves scanned exams and also their corresponding errors (score, description and comments if any) and all the dialogue between the teacher and the student in the revision stage (if any). Therefore the exam can be reconstructed as the original submitted by the student (without assessing), or with the assessment and comments.

A complete explanation of the functioning of BeA is explained in [10,11,12].

IV. NEW DEVELOPMENTS

These functionalities available in BeA are used and extended in order to introduce mechanisms that promote self-regulated learning and formative assessment [14]:

- For the beginning of the course an instrument that assesses students' self-regulated learning skills is administered. This is the Metacognitive Awareness Inventory (MAI) [15] that involves 52 item classified by type of cognitive knowledge (declarative, procedural and conditional) or by specific metacognitive process (planning, information management strategies, monitoring, debugging strategies and evaluation). This is performed as an individual written exercise. In addition to collect information from learners about their learning skills, this activity provides an opportunity to introduce self-regulated learning to the classroom.
- For the beginning of each course module an initial assessment about the content is administered. Using BeA functionalities students answers can be assessed by the teacher. BeA is extended to enable students to identify the learning goals taking into account the initial assessment. This activity promotes that students think deeper about the module challenges and demands. The identified learning goals are managed in the BeA extended version to guide students during next assessment activities.
- At the middle of each module, following the principles of formative assessment, students are evaluated. A key idea is to give students the opportunity to improve and solve learning problems. This is performed through a short exercise performed in classroom. BeA assists teachers providing detailed feedback and suggestions to students based on the identified problems. The BeA extension facilitates to group learners with similar

problems in specific groups, or to connect students that are more advanced with students that need some support. Another interesting idea is to open BeA reviewing functionalities to enable peer assessment. In this way, each student is required to assess the exam of other students. They should take care of performing a right assessment, as the teacher can review it, but this is mainly an opportunity for learners to find alternative approaches or solutions. Rubrics can be provided to guide this peer assessment.

- Another exercise to promote self-regulation is student-developed test questions. Students in small groups are required to create multiple-choice items about the module contents. This induces student to review the material and decide what is important related to the learning goals. This is a richer self-regulated learning exercise if students are required to classify their questions by cognitive operation according to some taxonomy (e.g. Bloom). Later, these questions can be used by the teacher using BeA audience response functionalities to query the whole classroom as indicated in the previous items.
- Concepts of flipped classroom are introduced as well. Using flipped classroom the learning is firstly focused on every individual student, and it turns into an individualized learning. Afterwards, the classroom becomes a dynamic and interactive environment where the teacher guides the students (as a group) to apply concepts about the learning matter. So, the teacher is able to provide feedback to the students.
- During an exam, students are requested not only to solve problems but they are also required to rate their confidence in their ability to solve each problem, first before they tackle it and again after solving it. This activity has demonstrated to significantly reduce students' overconfidence and improve accuracy of self-evaluations. Alternatively a kind of knowledge survey can also be incorporated into the exam. BeA is extended to take into account this data to affect to the final grade. This can be done automatically.
- After the exam, BeA facilitates self-assessment, corrections and reflections. All these activities are very important in order to improve the feedback and create a fruitful dialogue using a new specific service. For example, it is very easy to ask students about how effective their preparation methods were: Had they put it enough study time? Had they worked enough practice problems? What else had they done to prepare? When the teacher provides the graded exam, in case of failed problems it is very easy to explain what is the error. As an extension BeA can also be used to propose other problems similar or alternative to give students the opportunity to check if they have really understood what they did wrong. In BeA once an error is identified and described for one student it can be reused as many times as needed. Another idea related to after-exam-

activities is a revision sheet in which students identify and correct errors relating them to learning goals.

- At the end of the course a self-assessment about SRL skills is a good option. This can show students new learning habits they have acquired.

V. CONCLUSIONS

This paper introduces a set of extensions to the BeA functionalities related to SRL and formative assessment. We need to research the actual effectiveness of these new developments in real classrooms, but at this moment we have found that BeA functionalities are behaving as a very appropriate platform for the development of these ideas.

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