ONLINE ASSESSMENT USING DIFFERENT TOOLS AND TECHNIQUES IN HIGHER EDUCATION

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Abstract

Assessment can be a crucial component in the teaching and learning process and should measure or certify results. Online assessment means using the technology to provide assessment which can be diagnostic, formative or summative and can be considered a valuable tool in higher education as it allows teachers, on one hand, to have quick access to students' performance and, on the other hand, students can receive instant and individual feedback, which helps them to structure their own learning path.

There are many different ways to efficiently assess students' learning online, the purpose of this paper is to introduce some online assessment tools and techniques that can be used in education to assess student performance using technology. In general, learning management systems, such as Moodle, use online assessment tools, some of which will be presented, based on the corresponding learning requirements and objectives. Several online assessment techniques, that undeniably support training, engage students, and provide instructors with perception of their students' learning process, will also be analyzed. Furthermore, several tools and techniques related to mathematics will be presented, like for instance STACK (System for Teaching and Assessment using a Computer Algebra Kernel) and iSpring Suite 9. STACK, an online assessment package for mathematics, is an open-source system that supports the development of sophisticated and challenging assessments for STEM subjects, enabling the direct and systematized feedback delivery to help students improve their performance and understanding. The iSpring Suite 9, a fully e-learning toolkit, with a Math equation editor which allows the development of interactive assessments and quizzes for e-Courses. Some advantages and disadvantages about the online assessment process will be also presented.

Keywords: Online Assessment; Higher Education; eLearning; STACK; iSpring Suite 9; Assessment tools; Computer Based Test System; Assessment Techniques.

1 INTRODUCTION

Learning is a complex process with several dimensions and variables. Assessment, is an important part of the learning process, also complex, with many factors and dimensions to consider before it can be properly appreciated [1]. Educational assessment is considered as a method for determining the degree of efficacy and quality of all factors that come together to produce an educational event, in order to compare this degree to reference parameters and determine what should be done [2].

Assessment can be an extremely important component in the teaching and learning process, and it should serve to improve knowledge as well as measure or certify results [3]. Developing assessment procedures that are fragmented or disconnected from the teaching modality is a significant didactic concern. When this occurs, evaluation puts the pressure on the learning process and takes on a punitive aspect that differs from its genuine meaning [4]. Students' experience is heavily influenced by assessment. One of the main goals of assessment is for students to demonstrate that they have achieved the learning objectives [5]. Assessment is frequently the most motivating factor for students, influencing when and how they study [5], [6]. Student assessment is one of the central aspects of the transformation of higher education.

Online assessment can be defined as the use of technology to provide diagnostic, formative, or summative assessment. It is a valuable tool in higher education because it allows instructors to have quick access to students' performance on the one hand, and students to receive immediate and personalized feedback on the other, allowing them to structure their own learning. With the use of information technology, we can analyse one's cognitive skills, practical skills, and knowledge through online evaluation [7]. If online teaching is a barrier for certain higher education instructors, online evaluation is a huge roadblock in the educational process [8]. Many factors play a role in this, including people's innate resistance to change and the technical limits of the systems designed to give specific computer support for tasks that are mostly planned to be performed face-to-face.

Online technologies are becoming increasingly important in higher education institutions, on account of the convenience and speed with which all procedures can be performed. There are some studies that present the use of several tools available to improve teaching-learning processes, as well as the evaluation process. For instance, Yu Lu [9] proposed the integration of a virtual online assessment management system, in the assessment of higher education courses, ensuring that all students are treated equally during the examination and that the proposed system improves the effectiveness of assessment. Shen et al [10] investigated the relevance of an assessment system in the Web-based distance learning education environment and established an intelligent assessment system model with high performance and adaptability.

Following the COVID-19 health crisis, with all its impact in the online/distance educational system, particular relevance was given to the assessment procedures in many research studies. Cabello and Nemecio [11] pointed out the main problems in the assessment process of a population studied during the transition from a face-to-face mode to virtual environments as in relation to the teaching staff, it is a lack of technological knowledge, both of purely technical elements and of pedagogical tools and formulas for assessment suitable for virtual environments; this technological obstacle has been overcome. In a similar study, [12] realized that online assessment necessitates a review of the subject assessment system; that is, the appropriate way is not to attempt to recreate traditional tests in an online environment. This presupposes both methodological and technological skills in order to understand the functionalities and limitations of information technology tools; however, it also demands an understanding that technology is merely a facilitator of the assessment process and will not provide answers to the assessment process objectives on its own.

In order to introduce some online assessment tools and techniques that can be used in education to evaluate student performance using technology, the aim of this paper is to present some online assessment tools and techniques that can be used in education to assess student performance employing technology.

2 TYPES OF ASSESSMENTS

The general goal of assessment, according to the definition, is to evaluate and improve student learning, but the objectives can differ slightly depending on the type of assessment that is utilized.

Three basic types of assessments are often used to evaluate one's skills and abilities: formative assessment, summative assessment, and diagnostic assessment or self-assessment [13], [14] .

Diagnostic Assessment - is the process of determining a student's strengths, weaknesses, knowledge, and skills ahead of time in order to plan the teaching pattern and maintain track of the student's development throughout the course. It assists the instructor in remediating candidates and transforming the curriculum to match the individual needs of each learner.

Formative Assessment - is an assessment in which a student receives constructive feedback on his or her knowledge and skills. Students take this assessment on their own time to test their knowledge and improve their performance; it has no bearing on their final grade. A good formative assessment system should be continuous, constructive, consistent, and provide critical feedback to learners. The formative assessment gives instant evidence of student learning, with the intent of enhancing the quality of the student learning path and promoting improvements to curriculum design and teaching methods. Students receive individual comments regarding their skills and faults.

Summative Assessment – typically this kind of assessment occurs at the end of a course, semester or module, it is the last assessment of a student's performance, sometimes referred to as a final exam, which is used to make a judgement and conclusions regarding an individual's overall knowledge and skills. This is usually interpreted as the ”measure” of what the student has learned after completing a course. It can be utilized in online courses to determine whether an applicant will receive a formal or legitimate degree in the skill for which the course was undertaken.

Assessments are clearly about more than just grades. These should prepare students for success by challenging them to think, interact, and use their knowledge to answer questions, solve problems, and communicate information when they are meaningful and well-constructed.

3 ONLINE ASSESSMENT METHODS

There are many different ways of effectively assessing students' learning online. Below a short description of some online assessment approaches is presented, including those that promote training, motivate students, and give instructors insight into the learning processes of their students.

Several Learning Management Systems (LMS) and tools are available to create digital resources for courses that previously relied entirely on face-to-face instruction. Moodle (acronym for Modular Object Oriented term Developmental Learning Environment) has been acknowledged as a full and suitable platform for use in higher education by research [17]–[19]. Moodle is a Free web application that educators can use to create effective online learning sites that may offer a variety of user-friendly tools able to create digital resources for teaching and evaluation, including "quizzes," "forums," "databases," and "workshops." In 2018 and 2019, Moodle was named in the top 20 best LMSs based on user feedback [20].

Among the most common features used for evaluating students online there are:

- **Online quizzes** - are useful for assessing learning outcomes across a large group of people. If every student takes the same test, we will be able to compare and contrast outcomes across different classes, schools, and regions. Prior to the beginning of a class, a non-graded online quiz might be administered to get a sample of a student's existing knowledge. A knowledge check test can also be embedded into a module to reinforce concepts presented in the lesson, or a final graded test can be administered at the end of the course to assess students' overall performance. Online quizzes can be developed quickly and easily utilizing eLearning technologies such as iSpring Suite 9 or STACK, among others. For instance, Moodle Quizzes is a great resource for every instructor. Online quizzes can do many things that paper quizzes just can't. It allows to create different question types, randomly generate quizzes from pools of questions, allow students to retake quizzes multiple times, and have the computer score it all. These features open up a world of possibilities that just aren't practical with paper-based testing [17]. Moodle quizzes consist of two components: the quiz body and the question pools. The body is the final exam that a student will view after randomization and question selection; it is the "container" for the questions drawn from the question pools. Rules can be defined for how the body selects questions from the pools. Pools can be reused, shared between classes, and transferred between systems.
- **Online Surveys** - Surveys are a great way to get feedback from an audience directly about their experience in a course. They can be used to evaluate everything from a student's level of satisfaction to the reason why they made a particular decision during a lecture. Online Polls are incredibly engaging for students since they allow them to express their thoughts, make their message heard, and finish in a short amount of time. SurveyMonkey, for example, is an online platform that let's develop, send, and evaluate surveys.
- **Game-type activities** - A set of test questions becomes a game with game-type actions. For instance, learners might be asked to answer a given number of questions in a set amount of time, with points awarded according on the number of accurate answers. Make use of game-like activities when we want to challenge and engage your students in a new way. Since game-based assessments are not considered "tests," they are a good indicator of genuine skills and knowledge. They've also been found to improve learning by encouraging the development of non-cognitive qualities like concentration, risk-taking, cooperation, and problem-solving. Instructors can create fast-paced interactive learning games using Quizlet and Kahoot, two popular applications. Quizlet allows you to construct an online study set of flashcards for learning terminology and definitions, while Kahoot allows you to make exciting quizzes and have your students earn points by answering fast and correctly.
- **Forum posts** - Online discussion groups are known as forums because they focus on a certain subject. It is a great approach to measure students' understanding, stimulate their interest, and promote their learning to have them participate to a forum post. In this activity, students are presented with a critical thinking topic based on either a lesson or a reading, and they are expected to reflect on both of these sources simultaneously. Regarding the composition of these assessment activities, specifically in the area of Mathematics, the type of questions more commonly used are:
- **Multiple Choice Questions** - A multiple-choice question has two parts: a stem that defines the question or problem, and a collection of alternatives or possible solutions that include a key, which is the best response to the question, and a number of distractors, which are reasonable but

incorrect answers. Multiple-Choice Tests are a common form of online assessment. There are objectives which can be appropriately assessed by using Multiple-Choice Tests and others objectives which would be better assessed by some other kind of tests [15]. The disadvantages of multiple-choice tests are that these are subject to guessing and often are time-consuming to create.

- **Essay questions** - One of the most used qualitative assessment approaches is essay-style questions, which encourage students to examine their thoughts, and opinions while also assessing their overall competence of a subject. This kind of question promotes critical thinking and is best used to assess higher-level knowledge. Students need more time to think over, arrange, and compose their responses while answering essay questions [16]. One of the question types accessible in iSpring Suite 9 is essay questions evaluations. They cannot be auto-scored in online courses, unlike many other sorts of questions, therefore instructors will have to review them one by one.
- **Drag-and-drop activities** - Assessments such as drag-and-drops demonstrate a student's ability to connect different pieces of information and put that knowledge to use in solving a real-world problem. Drag-and-and-drop activities can also include images and text, giving them a more realistic feel while yet maintaining an element of fun and challenge. The iSpring Suite 9 offers a drag-and-drop framework that allows to move text boxes, images, and shapes to a specific place on the page.

Furthermore, several tools and techniques related to mathematics can be easily incorporated using learning management systems (LMSs) such as Moodle (Modular Object-Oriented Dynamic Learning Environment), and eLearning tools such as STACK (System for Teaching and Assessment using a Computer Algebra Kernel) and iSpring Suite 9.

STACK, an open-source mathematics assessment package, allows for the creation of sophisticated and rigorous exams for STEM disciplines, as well as the delivery of immediate and systematic feedback to assist students in improving their performance and knowledge. Feedback is based on computer algebra calculations, providing specific information on how to improve on the task. Teachers can also customize feedback based on the mathematical features of the students' responses. For example, partial marks may be given for an answer that is similar to the teacher's but not factorized. STACK is flexible enough to allow researchers to design very different types of mathematical problems and also can be adapted for other subjects, such as Physics or Chemistry.

Some of the most important STACK features may be seen in Fig. 1, including:

Randomization - STACK can generate questions with random variables, ensuring that different students can see different variants of a question. Random questions support practice and help to reduce copying of answers.

Teachers can create their own questions - STACK gives teachers the possibility to write their own questions, they do not have to write code to assess answers, and are instead asked to focus on the properties of students' answers, such as "algebraically equivalent to the teacher's answer" or "factorized".

Flexible input - STACK supports the use of algebraic input. This means that students can freely enter an equation, for instance.

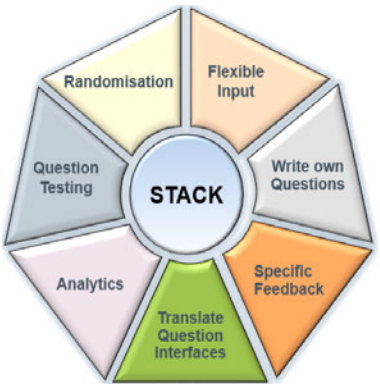

Figure 1. Main STACK Features.

In addition to its widespread use, STACK is available on several Higher Education Institutions websites in many languages, including English, Finnish, German, Japanese, among others.

Regarding the above-mentioned software, the iSpring Suite 9 (Fig.2), a fully e-learning toolkit, is a flash-based program which is integrated as an extension in PowerPoint (Fig.3). It presents the learning materials in the form of a flash slide that can contain images, animations, videos and audio. For Mathematic text editing, the iSpring Visuals 9 includes a built-in equation editor, similar to MathEquation from Office tools, that allows the direct construction and addition of equations in the interaction text.

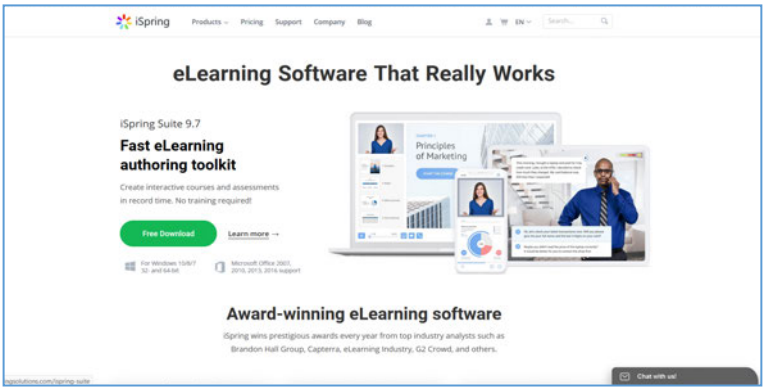

Figure 2. Print screen from ispringsolutions.com

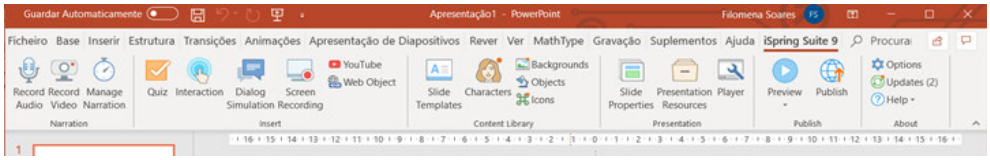

Figure 3. ISpring Powerpoint extention features.

Despite the fact that it is a paid software, its potential for the generation of interactive material is enormous, and the associated impact has been demonstrated to be beneficial in a number of documented experiences and reports, particularly in the educational field [21]–[26]. iSpring Suite 9 software can be used to do homework and control work in the form of answering problems via remote access, when it is important to supply not only the correct solution, but also the entire process of solving the problem. Meanwhile, the results of the solution are being automatically transmitted to the teacher's email account in the same manner as they do when tests are being administered. iSpring Suite 9 is a PowerPoint add-on, so it is simple and easy to use, turning an ordinary presentation into a professional training course. iSpring products are trusted by educational institutions as good e-learning tools allowing effortlessly construct excellent tests and surveys, and gather feedback from the audience without any additional abilities. For the most comprehensive and effective examination of students' knowledge, the software includes 11 types of assessments and 12 types of questionnaire questions.

4 ADVANTAGES AND DISADVANTAGES OF ONLINE ASSESSMENTS

4.1 Some Advantages

Online assessments, as opposed to paper examinations in a regular classroom learning session, can provide instructors with instantaneous feedback. When using automated online assessments, students have the flexibility to take practice tests whenever they want. Students are not always required to complete evaluations in a traditional classroom setting. Some examinations are delivered via the Internet, allowing students to complete them from the comfort of their own homes or wherever else they may choose.

Educators can give out different versions of tests and homework without having to keep track of which version each student got by hand. This makes it hard to cheat. Instructors also can quickly compare how well a group and an individual did on an online assessment. Report-making tools help educators figure out where students are having troubles in their learning process, be it individually or in a group. When it comes to keeping records, online assessments take up less space than paper ones. All of the

information can be kept on a single server. Online assessments can be more interactive than paper assessments because instructors can mix and match different types of questions and even add pictures.

Moreover, the influence of online assessments on the environment is one of the most significant, if indirect, benefits of taking tests online. Pen and paper tests necessitate the use of a large amount of paper in order to print out the question and answer sheets. There is also a great deal of waste as a result of printing errors or overestimations of the number of students enrolled. Online assessments are the most environmentally friendly and sustainable method of assessment.

4.2 Some Disadvantages

Most of the times, answers to online assessments can only be classified as correct or incorrect. There is no opportunity for explanation or for receiving partial credit for your response. For example, if a student is taking a geometry or calculus exam on paper, the lecturer will be able to see how he solved the problem. He can exactly identify where student went wrong and how he came up with the incorrect answer. In this case, the lecturer may be willing to grant student with a partial mark. Instructors will not be able to observe the reasoning behind a student's response if he is taking an online assessment.

Technology does not always perform as expected. If a system fails, it is possible that information will be lost. Instructors may require some technological expertise in order to create online assessments in some circumstances. In an education institution or business training setting, the costs of implementing an online evaluation system can run into the hundreds, if not tens of thousands, of euros. Essay questions as well as writing, are not the most appropriate for online assessment, but, even these types of questions will be able to be automatically graded in the future, thanks to advancements in artificial intelligence and machine learning.

5 CONCLUSIONS

In higher education, effective and rigorous assessment is crucial. It's a way of encouraging students to learn, keeping them engaged, and assessing their progress. Successful assessments need careful consideration of the students, the subject, the course content, and the learning outcomes when designing and administering them. Instructors must also evaluate how technology will interact with each of these elements in online courses.

Some of the advantages, problems and techniques of online assessments have been identified through this study. When establishing new exams/tests or converting assessments from face-to-face to online, this should be done with previous and post analysis of its objectives and expected results in its specific context. This study offered some suggestions with the goal of inspiring instructors to think and reflect about online assessment. However, this is only the beginning of the process. Assessment design is an iterative process that should be examined for effectiveness on a regular basis.

The advantages of employing online assessment are numerous. Students can learn and access information at their own pace. Cheating can be reduced by using many versions of the same test. Grading and evaluation errors are nearly non-existent. Maintains a record of the students' digital path, making it easier to retrieve in the future. By including images in electronic exams, these can be made more dynamic and easier to understand. However, there are a few limitations of online assessment. It is difficult to apply when assessing answers/essays that require a clear, concise and logical composition. Using online assessment, it is also challenging to evaluate cognitive skills. To use such assessments, instructors must first receive training. Information may also be lost if the system fails. This research presents a variety of ways for creating engaging and interactive online assessments. Educators can utilize some of the strategies described, in any online assessment.

The quality of quizzes on the Moodle platform is increased by using a range of question styles with different multi-modal instructions and rapid feedback. Because it caters to diverse student knowledge levels, the wide array of quiz questions enhances student engagement and pleasure. The variety of question styles also aids instructors in balancing the time required to construct and evaluate the questionnaire, reducing evaluation time. Several works of evaluation can be implemented, automatically corrected and the results exported to Excel. This is very helpful when the number of students is very high.

Along with creating and administering online assessments, iSpring Suite 9 software can be used when students' complete homework and control work in the form of solving problems via remote access, when it is necessary to provide not only the correct answer, but also the entire process of solving the problem. A powerful tool, iSpring Suite 9, allows you to quickly and easily construct effective tests to test your

knowledge, as well as surveys to gather feedback from your audience. The software includes different sorts of assessments and questionnaires to ensure that students' knowledge is tested in the most comprehensive and effective manner.

STACK offers many advantages in the setting of Mathematics online assessment for both students and instructors. Answering a STACK question allows students to discover faults by comparing the provided solution against incorrect solutions resulting from recognized common errors. For partially right replies or carried forward errors, it is also possible to submit a partial grade.

We leave as a suggestion a challenge for all educators, use and evaluate the different methods and techniques of online assessment and their impact on student learning outcomes, you will see that it is worth it.

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