EVALUATING AN E-PORTFOLIO FOR A LINEAR ALGEBRA COURSE USING RUBRICS

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Abstract

There is always a need to evaluate training skills acquired for, in this way, to know whether they have achieved the learning objectives. The use of the e-portfolio becomes more common among teachers then, becomes increasingly necessary define a good evaluation system. E-Portfolio evaluation criteria should take into account operational, appearance, evidence and reflection indicators. Considering all these aspects and to respond to such needs is chosen to create a rubric to assess. Remember that scoring rubrics are descriptive scoring schemes that are developed by teachers or other evaluators to guide the analysis of the products or processes of students' efforts.

In creating the rubric, first we analyzed what the analytical evaluation criteria to be considered for a course in linear algebra of first year engineering degree and taking into account the skill sets required to demonstrate that they have acquired the skills set by the University in the course to evaluate. In so far as a mathematics course, we must not forget the following levels of quality corresponding to Solving, Reasoning and Proof, Communication, Connections, and Representation, from excellent to poor, for a specific assignment.

For the specific subject of linear algebra of the first year of Engineering at the ETSEIB of Polytechnic University of Catalonian, two rubrics are proposed, the first one for the student self-assessment as well as for peer assessment, and the second one for the assessment of student work from the teacher. The rubric to evaluate students' work consists of 3 sub-rubrics, one to analyze the formal part of the portfolio of the student (structure, spelling, level of language, among others) and the other two for evaluating projects that students must perform.

Keywords: E-portfolio, rubric, Moodle.

1   INTRODUCTION

Whenever there is a formation is created the need to evaluate the skills acquired by well know if you have achieved the learning objectives. Bloom, Madaus and Hastings in [1], assert that to improve in learning, it is necessary an assessment because it helps to consolidate the learning. The assessment should not only be to the students but an evaluation for teachers is also necessary because as he says Koh in [2] a teacher who knows its shortcomings then he is able to improve them, and for that the rubric is a good tool.

For learning tasks that require a more complicated performance in achieving the objectives than a simple completion of a number of requirements, an evaluation using a rubric can be more useful than a simple checklist. Among the tasks that a rubric can evaluate is the portfolio.

We can list several reasons why using rubrics for assessment. A first reason is because a rubric can improve student performance, as well as monitor it, by making clear the expectations of the teachers and by showing students how to meet these expectations. A second reason that rubrics are useful is that they help students become more critical of their work and that of their peers. Besides, the rubrics help reduce the time spent by teachers evaluating student work and provide. With a rubric the student receives more informative feedback about their strengths and about areas in need of improvement. The structure of the rubric allows adapting heterogeneous classes. And finally, the rubric is easy to use and to explain.

In Assessing Academic Programs in Higher Education, Mary Allen [3], explains that the construction of an evaluation process should consist on "a framework for focusing attention on student learning and for provoking meaningful discussions of program objectives, curricular organization, pedagogy, and student development". From this point of view a rubric must involve four components namely, Task

Description, Scale, Dimensions and Description of the Dimensions. And, in the construction of a rubric must be followed these four steps: Reflecting, Listing, Grouping and Labeling and Application. Following these criteria, in this work we present a rubric constructed to evaluate a course in linear algebra. In fact, two rubrics are proposed, the first one for the student self-assessment as well as for peer assessment, and the second one for the assessment of student work from the teacher. The rubric to evaluate students' work consists of 3 sub-rubrics, one to analyze the formal part of the portfolio of the student (structure, spelling, level of language, among others) and the other two for evaluating projects that students must perform.

2 E-PORTFOLIO

The French word "portefeuille" that means briefcase for carrying books, papers, etc..., has been taken to describe a "portfolio" that is defined as a collection of works or documents that are representative of skills and accomplishments of a person.

When it comes to university teaching, the word comes from "portfolio assessment" or "portfolio process", so it has the sense of "assessment folder" or a broader form of "learning portfolio". In the case where this activity takes place on a digital platform called an e-portfolio. More specifically in our particular context, the portfolio is a method of teaching, learning and assessment, it is the contribution of different types of productions by students through which they can be judge their abilities in the context of a discipline or field of study.

2.1 E-portfolio for undergraduate Linear Algebra course

Historically the use of e-portfolios was more common in other areas of knowledge than mathematics in general and particularly in linear algebra. The most common areas where the portfolio has been used are architecture and arts fields, for example.

With the advancement of Information and Communication Technology (ICT) has begun a rapid change in the world of education and one tool in within the ICT context is the use of e-portfolio (see [4], [5]).

Students of the first-year of the University at the ETSEIB have been using the different e-portfolio-platforms to support their learning on Linear Algebra. Concretely the platforms used are the integrated Moodle and Mahara (Mahoodle) platform, as well as the simultaneous use of platforms Exabis inside Moodle and Google Sites.

The open source e-learning platform Moodle also known as a Learning Management System is used for the teachers as a repository in the sense of a storage area, from which students can retrieve files or different objects that can be useful for their tasks. Then, students deposit their achievements at their personal e-portfolio.

In order the students prepare the e-portfolio has been essential that the professor defines the goals which the instructors want that the students reach as well as the topics that are considered basic to overcome objectives.

3 EVALUATION OF E- PORTFOLIOS: RUBRIC

Whenever there is a formation is created the need to evaluate the skills acquired by well know if you have achieved the learning objectives.

An assessment has another utility, use it and provide feedback, as it not only indicates the score, but it provides information about the difficulties and errors of the participants and thus improve or work on those aspects. To evaluate in this manner, it is necessary, within the global importance of this learning, that the evaluation be separated into small groups of knowledge or skills to be able to evaluate them separately and more accurately know what to improve or enhance in the future. Taking into account all these considerations and in order to respond to these needs was created rubric.

3.1 Rubric

A rubric is an assessment tool that lists the criteria for a piece of work. It lists the things that students, either as individuals or groups, must do or include to receive a certain rating.

In other words, a rubric is a tool for assessment that is used to evaluate a range of student performance through some different criteria. For each criterion or category, a rubric defines the specific attributes that will be used to score the student's performance and to differentiate between different levels of performance.

Rubrics make assessing student work in a quick and efficient manner, and in turn they help teachers justify the grades that they assign to students.

For the linear algebra course, the following two rubrics are proposed, the first one for the student self-assessment as well as for peer assessment, and the second one for the assessment of student work from the teacher. The rubric to evaluate students' work consists of 3 sub-rubrics, one to analyze the formal part of the portfolio of the student (structure, spelling, level of language, among others) and the other two for evaluating projects that students must perform.

Before creating a rubric, firstly is necessary to make clear the purpose of the assignment and identify what task students should learn. The rubric must be based on the purpose of the learning task that it will be assessed, consequently it is very important that the purpose being well defined at the beginning.

The reflective questions that we propose in order to construct the student's rubric are:

- Your work has coherence between the template and the result proposed.
- Your portfolio has been written in, at least, two languages.
- You have used enough and adequate bibliographical resources.
- The items have been selected adequately.
- Your site is readable.
- Your site has a coherent graphic design.
- Your portfolio's language is competent and proficient.
- Your tasks have worked on data analyse.
- Your tasks have worked on unknowns.
- Your tasks have worked on modelling.
- You have solved the problems.
- You have verified the solutions.
- You have made a reflection and critique of your work.
- Previous knowledge about the topic of the tasks.
- You consider that you have learnt something new by doing these tasks.
- And for teacher's rubric the reflective questions are:
- Selection of Items.
- Graphic Design, Multimedia, Navigation, Readability.
- Citation, bibliography.
- Quality of Writing and Proofreading.
- Exercise comprehension, data analysis, unknowns, modelling, resolution and verification of solution.
- Reflection/Critique.
- Using two languages.
- Coherence between the template and the result proposed.

In the following subsections we present the used rubrics on the experience acquired in the course of Linear Algebra.

3.1.1 Teacher's Rubrics

Teacher's rubrics evaluate the two different tasks of the students and the structure and the relation between the templates. Following we have the three different rubrics that has been used to evaluate the work of the students.

Table 1: Task 1 Rubric.

Definició del problema	No presentat. 0 punts	No ha descrit el problema correctament perquè no ha comprés quina és la problemàtica a solucionar. 1 punts	Ha entès el problema, però no ha estat capaç de descriure el problema correctament. 2 punts	Ha entès el problema i ho ha descrit correctament. 3 punts	Ha descrit el problema perfectament i ha entès quina és la problemàtica a solucionar. 4 punts	Ha descrit el problema perfectament, ha entès quina és la problemàtica a solucionar i ha valorat altres possibles problemes a tenir en compte. 5 punts
Recerca de la informació i modelització	No presentat. 0 punts	No ha trobat la informació necessària per solucionar el problema, i per tant no han trobat la fòrmula adequada 1 punts	Ha trobat informació però no ha estat capaç de modelitzar-la adequadament per solventar el problema. 2 punts	Ha trobat informació i l'ha modelitzat correctament. 3 punts	Ha trobat informació, l'ha modelitzat perfectament. 4 punts	Ha trobat informació, l'ha modelitzat perfectament i ha descrit els passos de com ha arribat a aquella conclusió. 5 punts
Resolució del problema	No presentat. 0 punts	No ha sigut capaç de trobar la matriu del sistema. 1 punts	Ha trobat una matriu del sistema, però que no és la correcta. 4 punts	Ha descrit correctament la matriu del sistema, però no ha estat capaç de plantejar el sistema d'equacions correctament. 8 punts	Ha descrit correctament la matriu del sistema, ha estat capaç de plantejar el sistema d'equacions però no ha arribat a la solució correcta. 12 punts	Ha descrit correctament la matriu del sistema, ha estat capaç de plantejar el sistema d'equacions i ha arribat a la solució correcta. 15 punts
Anàlisi crític del resultat	No presentat. 0 punts	No ha fet una valoració crítica adequada del problema que ha resolt... 1 punts	Ha valorat de forma crítica la resolució del problema, però tenint algun error en aquesta 2 punts	Ha valorat correctament la resolució del problema. 3 punts	Ha valorat de forma crítica la resolució del problema perfectament 4 punts	Ha valorat de forma crítica la resolució del problema perfectament i ha tractat de establir relació amb altres possibles problemes. 5 punts

Table 2: Task 2 Rubric.

Definició del problema	No presentat. *0 punts*	No ha descrit el problema correctament perquè no ha comprès quina és la problemàtica a solucionar. *1 punts*	Ha entès el problema, però no ha estat capaç de descriure el problema correctament. *2 punts*	Ha entès el problema i ho ha descrit correctament. *3 punts*	Ha descrit el problema i ha entès quina és la problemàtica a solucionar. *4 punts*	Ha decrit el problema perfectament, ha entès quina és la problemàtica i ha valorat altres possibles problemes a tenir en compte. *5 punts*
Recerca de la informació i modelització	No presentat. *0 punts*	No ha trobat la informació necessària per solucionar el problema, i per tant no han trobat la fórmula adequada *1 punts*	Ha trobat informació però no ha estat capaç de modelitzar-la adequadament per solventar el problema. *2 punts*	Ha trobat informació i l'ha modelitzat correctament. *3 punts*	Ha trobat informació, l'ha modelitzat perfectament. *4 punts*	Ha trobat informació, l'ha modelitzat perfectament i ha descrit els passos de com ha arribat a aquella conclusió. *5 punts*
Resolució del problema	No presentat. *0 punts*	No ha estat capaç de les equacions del sistema discret. *2 punts*	Ha trobat les equacions del sistema discret, però no són les correctes. *4 punts*	Ha descrit correctament el sistema homogeni, però no ha estat capaç de plantejar el sistema discret complet correctament. *6 punts*	Ha descrit correctament el sistema discret però no ha arribat a la solució teòrica del problema... *8 punts*	Ha descrit correctament el sistema discret, ha estat capaç d'arribar a la solució teòrica utilitzant correctament les eines d'àlgebra lineal de forma correcta. *10 punts*
Resolució del cas pràctic	No presentat. *0 punts*	No ha trobat la solució numèrica. *2 punts*	Ha descrit el procediment però no ha estat capaç de trobar el resultat correcte. *4 punts*	Ha trobat la solució però no ha descrit el procediment per arribar a aquest resultat. *6 punts*	Ha trobat la solució i ha descrit el procediment per arribar a aquest resultat. *8 punts*	Ha trobat la solució, ha descrit el procediment per arribar a aquest resultat i ho ha fet amb suficient generalitat per poder aplicar el mateix procediment per a altres dades numèriques. *10 punts*
Anàlisi crític del resultat	No presentat. *0 punts*	No ha fet una valoració crítica adequada del problema que ha resolt. *1 punts*	Ha valorat de forma crítica la resolució del problema, però tenint algun error en aquesta. *2 punts*	Ha valorat correctament la resolució del problema. *3 punts*	Ha valorat de forma crítica la resolució del problema perfectament *4 punts*	Ha valorat de forma crítica la resolució del problema perfectament i ha tractat de establir relació amb altres possibles problemes. *5 punts*

Table 3: Structure of the e-portfolio Rubric.

| Disseny de la pàgina: facilitat de navegació, llegibilitat...	No presentat. 0 punts	El portfoli és un caos i no té cap tipus d'estructura ni coherència. 1 punts	El portfoli té una estructura complexa i costa seguir el fil del que pretén explicar. 2 punts	El portfoli està en ordre i té una estructura coherent. 3 punts	El portfoli està en ordre i té una estructura coherent, a més de tractar de vigilar la imatge del mateix. 4 punts	El portfoli està perfectament organitzat i té una estructura coherent i detallista. Tots els detalls han estat tractats de la forma adequada. 5 punts
Qualitat d'escriptura i revisió ortogràfica i gramatical	No presentat. 0 punts	Errades ortogràfiques i gramaticals greus. El text no es pot llegir per la manca de coherència. 1 punts	Algunes errades ortogràfiques i gramaticals. El text és pobre i és nota que no s'ha revisat. 2 punts	Alguna errada ortogràfica o gramatical, però que s'entén com tipogràfica. El text està ben escrit i és comprensible. 3 punts	Escrit sense errades ortogràfiques ni gramaticals. La redacció és bona i bastant comprensible. 4 punts	Escrit sense errades ortogràfiques ni gramaticals. La redacció és molt bona i es comprèn tot. 5 punts
Bilingüisme	No presentat. 0 punts	No ha fet servir cap altra llengua que la pròpia. 1 punts	Ha fet servir la llengua pròpia i una llengua estrangera però de forma inadequada i amb errades ortogràfiques i gramaticals. 2 punts	Ha fet servir la llengua pròpia i una llengua estrangera de forma adequada però amb errades ortogràfiques i gramaticals. 3 punts	Ha fet servir la llengua pròpia i una llengua estrangera de forma adequada i amb prou correcció. 4 punts	Ha fet servir perfectament la llengua pròpia i una de segona estrangera amb perfecció, com si es tractés d'una llengua pròpia. 5 punts
Eines multimèdia	No presentat. 0 punts	No ha fet servir cap tipus d'eina multimèdia 1 punts	Ha fet servir alguna eina multimèdia però sense sentit i sense cap tipus de necessitat. 2 punts	Ha fet servir les eines multimèdia bàsiques de forma adequada. 3 punts	Ha fet servir les eines multimèdia bàsiques de forma coherent per donar consistència a la seva feina. 4 punts	Ha emprat eines multimèdia de forma coherent per donar consistència i un valor extra a la seva feina. 5 punts
Citació i bibliografia	No presentat. 0 punts	No ha citat ni nombrat cap autor. 1 punts	Ha citat algun autor i ho ha fet amb errades en el format APA. 2 punts	Ha citat els autors adequats però s'ha trobat algun error en el format APA. 3 punts	Ha citat en el format APA sense errors i ha trobat els autors adequats. 4 punts	Ha citat en el format APA sense errors, ha trobat els autors adequats i a més, altres autors que corroboren i donen excel·lència al treball. 5 punts
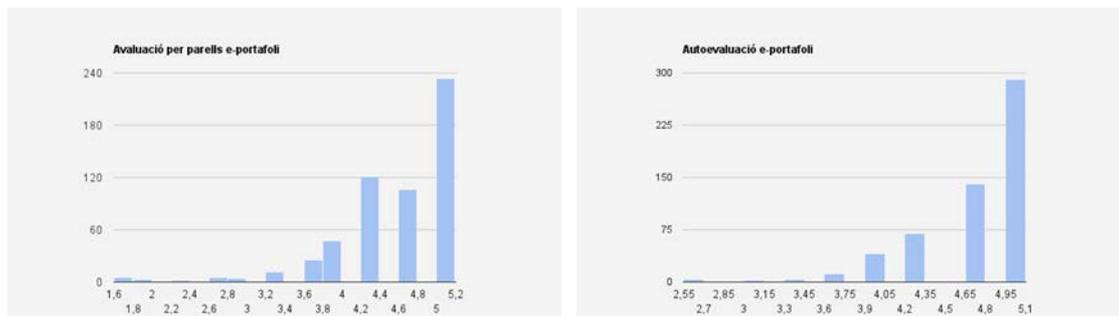
Fig.6. Evaluation per peers and Self-evaluation of E-portfolio design.

4   CONCLUSION

In creating a rubric, first of all it is necessary to analyze what the analytical evaluation criteria to be considered for the specific course to be evaluated. In particular for a mathematics course, do not forget the following levels of quality corresponding to Solving, Reasoning and Proof, Communication, Connections, and Representation, from excellent to poor, for a specific assignment.

For the specific subject of linear algebra of the first year of Engineering at the ETSEIB of Polytechnic University of Catalonian, we have proposed two rubrics, the first one for the student self-assessment as well as for peer assessment, and the second one for the assessment of student work from the teacher. The rubric to evaluate students' work consists of 3 sub-rubrics, one to analyze the formal part of the e-portfolio of the student and the other two for evaluating projects that students must perform.

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