

Promoting assessment as learning in PBL: findings from blogs created by first year engineering students

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DOI: <https://doi.org/10.5281/zenodo.7057850>

Abstract

This paper aims to present findings from first year engineering students involved in a Project-Based Learning (PBL) approach developed within the first cycle degree of Industrial Engineering and Management (IEM) – University of Minho, Portugal. Student assessment in PBL includes both formative and summative assessment, with a variety of different methods and purposes. One of the assessment methods in this PBL approach is the creation of a blog by each project team with the purpose of providing student reflection of their work on a regular basis. The blog allows students to share evidence of the project journey, with particular focus on the student's learning process. This idea is aligned with the concept of assessment as learning, where students are able to learn about themselves as learners and take responsibility for their own learning and monitor future directions. Based on the analysis of both quantitative and qualitative results from an online survey applied to students and the content analysis of each of the blogs, it is possible to conclude that the assessment task was considered as a positive learning experience for students. Quantitative data from the questionnaire show that the blog was a positive educational tool useful for: i) the organization and dissemination of the project team; ii) the selection of the project content and organization; iii) keeping an up-to-date record of the project's progress; iv) encouraging writing about project content and other curiosities. The qualitative data based on the content analysis of the blogs revealed students' capacity to reflect upon their journey, by critically analysing the feelings, achievements, fears, thoughts, and future plans, throughout the thirteen weeks of the project duration.

Keywords: project-based learning (PBL); student assessment; assessment as learning; blog as educational tool;

1 Introduction

Promoting assessment as a tool for learning is at the core of the higher education agenda (Evans, 2020; Zhang et al., 2019). Far beyond the traditional perspective of assessment as a task that takes place at the end of a unit, designed to confirm what students know and verify if the curriculum goals were met, the concept of assessment has enlarged its perspective to include a type of assessment that is mainly focused on students' learning process and therefore occurs throughout the learning process and is aimed at improving student learning through feedback and self-reflection (Sambell et al., 2012). These ideas are based on what Earl and Katz (2006) identified as the three purposes of classroom assessment: assessment of learning, assessment for learning, and assessment as learning. Each of these forms of assessment entail different assessment purposes, types and methods, as show in figure 1.

Student assessment plays a major role in how students learn, their motivation to learn, and how teachers teach (Earl & Katz, 2006). Assessment promotes awareness of the knowledge, skills, and beliefs that students bring to a learning task, promoting student learning. Learning is also enhanced when students are encouraged to think about their own learning, to review their experiences of learning (What made sense and what didn't? How does this fit with what I already know, or think I know?), and to apply what they have learned to their future learning (Earl & Katz, 2006). This type of assessment is usually used in teaching and learning environments which focus on student centred learning and assessment methods that engage students in meaningful learning. Project-Based Learning (PBL) is one of those approaches (Alves et al., 2021).

One of the characteristics of student assessment in PBL is the diversity of assessment methods and purposes (Fernandes et al., 2012a, 2012b, 2021). PBL approaches include both summative and formative assessment practices. However, the great emphasis that is put in the student's learning process gives formative assessment

a very important role in PBL, as it aims to monitor, guide, improve, support and regulate student learning. To meet this goal, alternative assessment methods, such as rubrics, portfolios, simulations, blogs, etc. are highly recommended.

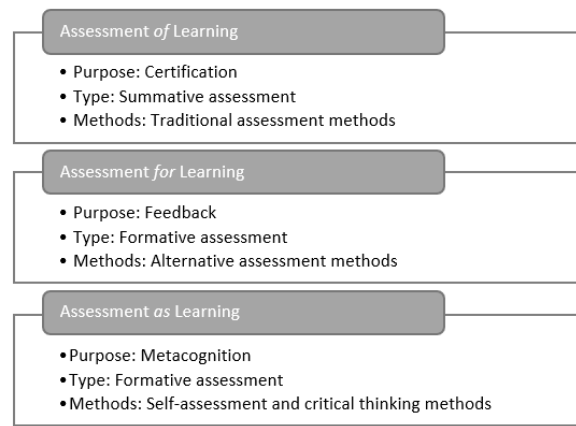


Figure 1: Assessment Purposes, Types and Methods (Fernandes et al., 2021)

Based on this assumption, this paper will present findings from the use of digital blogs in PBL with the purpose of providing student reflection of their work on a regular basis. The blog allows students to share evidence of the project journey, with particular focus on the student's learning process (Alves, Pereira, et al., 2020; Ifinedo, 2017; Jackling et al., 2015; Marinho et al., 2021). This idea is aligned with the concept of assessment learning, where students are able to learn about themselves as learners and take responsibility for their own learning and monitor future directions. Student assessment in PBL recognizes the importance promoting assessment as learning, giving students several opportunities to reflect and take responsibility for their own learning process.

This paper is structured in five sections. This introduction is followed by the PBL approach adopted in IEM. Third section presents the methodology. Fourth section shows the results obtained and, finally, fifth section presents the discussion and final remarks.

2 PBL approach at Industrial Engineering and Management (IEM)

The PBL was introduced in 2004 by a team of teachers of IEM in School of Engineering of the University of Minho (UMinho) (Alves et al., 2020; Lima et al., 2007). Since then, many improvements were implemented, including a formal structure change that introduced formally the Integrated Project of IEM1 (Alves et al., 2014). Nineteen editions were carried out by teams of teachers, tutors and researchers (Alves et al., 2021). A journey of continuous improvement has been carried out every year (Alves et al., 2017; Alves & Leão, 2015).

The cohort of 2021/22 involved more students than in previous years, i.e. 67 students were enrolled at this academic year. These students were organized in eight teams of seven-nine members. Each team had to develop a project in the context of the course Integrated Project in Industrial Engineering and Management I (IPIEM1). Every year the project theme (Moreira et al., 2011) is different and this year teams had to design of a production system to produce a more sustainable packing and should apply the contents learned in the five different courses, presented in Figure 2.

Regime	Curricular Unit
Year 1	
S1	Calculus for Engineering
S1	Computer Programming I
S1	Integrated Project in Industrial Engineering and Management I
S1	Introduction to Economics Engineering
S1	Introduction to Industrial Engineering and Management
S1	Linear Algebra for Engineering

Figure 2. Curricular plan of IEM first-year, first semester, IEM11

Each course has their own assessment methodology that includes a project component. Nevertheless, the contents of each course included in the IPIEM1 is assessed in the presentations, reports, blog, prototypes, that the teams delivered to be assessed. Table 1 shows the milestones of the IPIEM1 and the weight of each deliverable in the assessment methodology. Individual grade of each student is the result of team grade influenced by a correction factor that result from the peer assessment (Fernandes et al., 2009; Fernandes et al., 2020; Uebe-Mansur & Alves, 2018) (90%) and the grade obtained to the IEM@ProjectNetworking (third milestone) (Alves et al., 2013, 2022). As can be seen, the blog is part of the fifth milestone and should be finished until de last day of the project.

Table 1. Milestones (Ms) and weight of each in the assessment

Ms	Week	Deliverable	Weight (%)
1	Week 2	1st presentation	not assessed
2	Week 6	2nd presentation	7,5 (team)
3	Week 8	IEM@ProjectNetworking presentation	10 (individual)
4	Week 11	Preliminary report	25 (team)
5	Week 13	Final report + Prototypes + blog	30 + 20 + 5 (team)
6	Week 14	Final presentation & discussion	12,5 (team)

Each team created a blog, that was regularly presented and discussed by the team members and the tutors and teachers. Table 2 also includes the links to each of the team blogs.

Table 2. Team blogs of IEM first-year students 2021/22

Teams	Team name	Link to the Blogs
1.	KEY	https://keykeepthenvironment.wixsite.com/websitekey
2.	GreenBox	https://grupo2legi1.wixsite.com/website
3.	Eco-Sumaco	https://eco-sumaco.wixsite.com/eco-sumaco
4.	HEARTH	https://grupo4egiuminho.wixsite.com/website
5.	LEAF	https://rosa-gil.wixsite.com/leaf
6.	BioPackage	https://pleg62122.wixsite.com/biopackage
7.	United for Change	https://piegigrupo7.wixsite.com/blog
8.	E-Thinking	https://grupo8piegi.wixsite.com/website

3 Methodology

This paper aims to give answer to the following research questions:

- How do students describe their PBL experience in their team blogs?
- What importance to students give to the blog as a learning tool?
- How do blogs contribute to promote assessment as learning in PBL?

For data collection a questionnaire was used to collect feedback from students at the end of the PBL experience. This questionnaire was organized based on a set of items that explore the way the PBL process was developed

and perceived by students. From the 58 statements/items based a 5-point scale of agreement (1- strongly disagree, to 5- strongly agree), 4 items were selected from the questionnaire to be analysed for the scope of this study. These items are related to the importance given by students to the blog as a learning tool. The items are the following:

- Q14 – useful for the organization and dissemination of the team project;
- Q15 - helps to select, organize and register the contents related to the project;
- Q16 – helps to keep an updated record of the project’s progress; and
- Q17 – stimulated writing (in English) about the contents related to the project and some curiosities.

Besides this analysis, the content of the blogs was also carefully analysed, through the identification of the main categories that relate to the principles of assessment as learning.

4 Results

Based on the analysis of the results from the questionnaire applied to students and the content analysis of each of the blogs, the following section presents the organization of the analysis of results according to the main categories identified in the qualitative and quantitative data. For the quantitative analysis the non-parametric test Mann-Whitney (U) for comparison between the assessment of two independent samples (students gender), after verification of normality by Shapiro-Wilk test, was used. Data were stored in Excel and later analysed with the statistical software SPSS 28.0.

4.1 Student satisfaction with blogs as an educational tool: a quantitative analysis

Data in this study, as previously mentioned, was gathered using four items in the PBL questionnaire that 72% of the enrolled students voluntarily and anonymous filled, and then analysed using statistical methods.

The sample included students from the all teams, however not all the members of each team answered the questionnaire, varied from 50% (in one team) to 88% (in one team). The majority of participant students (70.8%) are female, reflecting the gender balance of the course with 63.2% of female students. The main descriptive statistics measures obtained based on students’ perceptions for the four items Q14, Q15, Q16 and Q17 are presented in Table 3, total and by gender.

Table 3. Main descriptive statistics obtained for Q14, Q15, Q16 and Q17 students’ perceptions (F – female, M – male).

Descriptive Statistics		Q14	Q15	Q16	Q17
n	F	34	34	34	34
	M	14	13	13	14
	Total	48	47	47	48
mean ± s.d.	F	4.03 ± .83	4.03 ± .63	4.29 ± .72	4.50 ± .62
	M	4.07 ± .83	4.08 ± .76	3.69 ± .85	3.71 ± 1.14
	Total	4.04 ± .82	4.04 ± .78	4.13 ± .78	4.27 ± .87
median	F	4	4	4	5
	M	4	4	4	4
	Total	4	4	4	4
min	F	2	3	3	3
	M	3	3	2	2
	Total	2	3	2	2
max	F	5	5	5	5
	M	5	5	5	5
	Total	5	5	5	5

Generally, quantitative data from the questionnaire show that the blog was a positive educational tool useful for: i) the organization and dissemination of the team project (mean=4.04); ii) the selection of the project

content and organization (mean=4.04); iii) keeping an up-to-date record of the project's progress (mean=4.13); and iv) encouraging writing about project content and other curiosities (mean=4.27).

Notwithstanding the overall positive assessment of the blog, when the analysis by gender was made, some differences between genders have been uncovered (Figure 4). The differences statistically significant encountered between genders were in the two items Q16 and Q17, with female student assessing these two items with a higher mean ($U=135.0$, $p<.05$, for Q16 and $U=142.5$, $p<.05$, for Q17). That is, regarding keeping an up-to-date record of the project's progress (Q16) and encouraging writing about project content and other curiosities (Q17) female students attributed more importance. Also, Figure 3 illustrate the students' assessment distribution for both genders regarding item Q17 where the highest difference between genders were occurred.

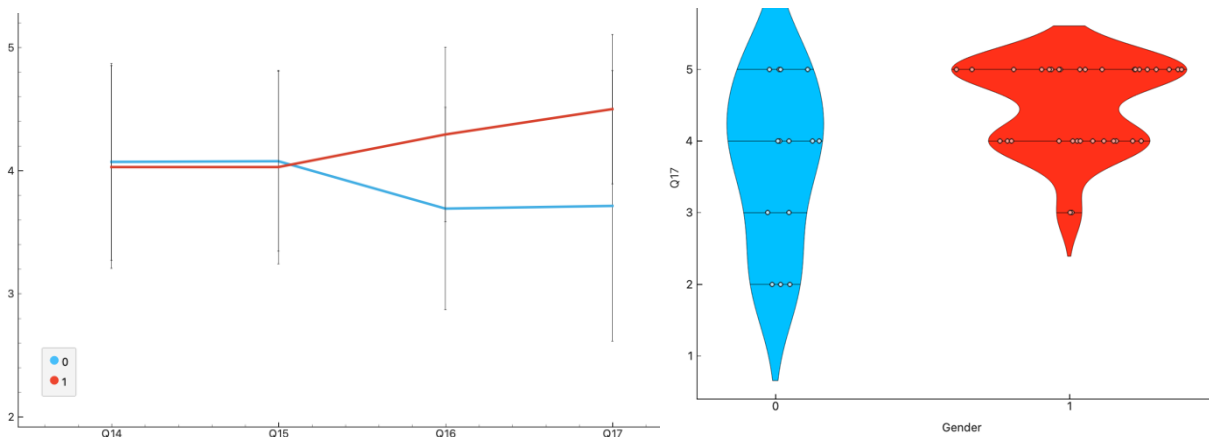


Figure 3. Students' assessment by gender: (a) mean values for all items and (b) distribution for Q17 (blue male and red female students).

To some extent, this positive results seems to be in line with a previous preliminary study regarding gender difference in peer assessment, where female students obtain peer assessment higher marks in comparison with their male colleagues (Alves, Moreira & Leão, 2017) and that it is usually the female students who develop writing tasks and keep the tasks up to date.

4.2 Promoting student self-reflection through blogs: a qualitative analysis

The qualitative data based on the content analysis of the blogs revealed students' capacity to reflect upon their journey, by critically analysing the feelings, achievements, fears, thoughts, and future plans, throughout the fifteen weeks of the project duration. The following sections reveal, through examples extracted from the blogs, students' capacity of self-reflection regarding their team roles and the weekly meeting reports.

4.2.1 Team member characteristics and roles

The content of the blogs reveal that the teams focused on presenting information about their initial expectations and motivations in regard to the project and also identifying their preferred team role, according to the nine roles considered in the Belbin test (Figure 4). This helped to characterize the team as whole.

"We are a team constituted by 8 members of the engineering and industrial management at the University of Minho, willing to spread awareness about environmental and sustainability causes".

"Eco Sumaco is the result of the hardwork of 8 dedicated Industrial Management and Engineering students in the University of Minho".

"During the third week, we did some important things for our project. We had to complete the so called "Belbin tests", which were useful to make us understand the role of each member of the group. Also, besides the natural organisation that we had to do in all of our social media to keep it updated, we were able to be in a position where we would have some individual feedback in terms of our contribution to the project, by doing the peer evaluation."

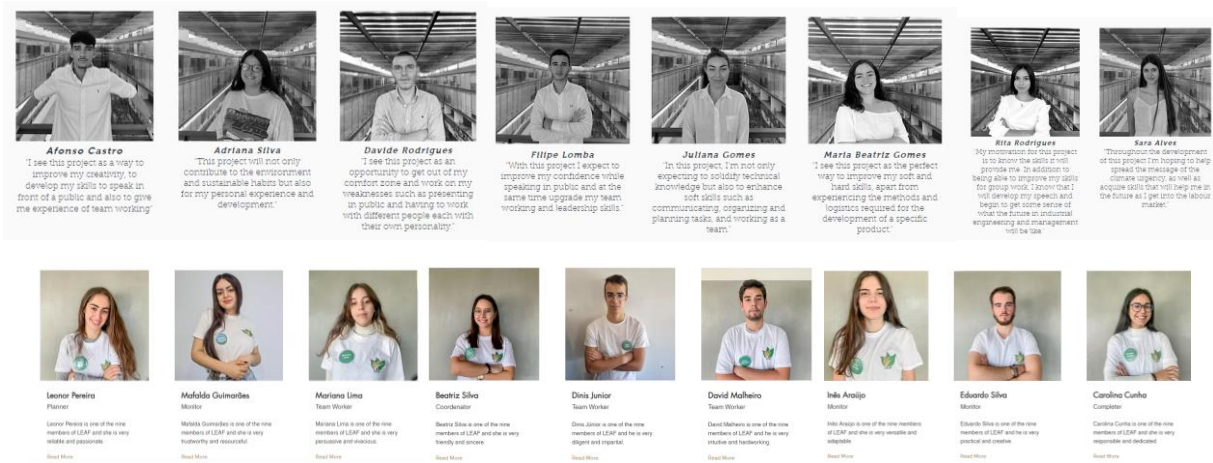


Figure 4. Examples of how teams presented each team member and their roles in the project

Students also expressed, at an initial phase of the project, their expectations and motivations in regard to the project. This reflection shows how students related the objectives of the project with the development of their individual competences. For students to be able to improve, they must develop the capacity to monitor the quality of their own work.

"My motivation for this project is to know the skills it will provide me. In addition to being able to improve my skills for group work, I know that I will develop my speech and begin to get some sense of what the future in industrial engineering and management will be like."

"Throughout the development of this project I'm hoping to help spread the message of the climate urgency, as well as acquire skills that will help me in the future as I get into the labour market."

"With this project I expect to improve my confidence while speaking in public and at the same time upgrade my team working and leadership skills."

"In this project, I'm not only expecting to solidify technical knowledge but also to enhance soft skills such as communicating, organizing and planning tasks, and working as a team."

"I see this project as the perfect way to improve my soft and hard skills, apart from experiencing the methods and logistics required for the development of a specific product."

"I see this project as a way to improve my creativity, to develop my skills to speak in front of a public and also to give me experience of team working"

"This project will not only contribute to the environment and sustainable habits but also for my personal experience and development."

"I see this project as an opportunity to get out of my comfort zone and work on my weaknesses such as presenting in public and having to work with different people each with their own personality."

4.2.2 Weekly meeting records

These weekly reports reveal student's thinking about his/her learning process and the strategies or mechanisms that were used to adjust and advance in the project (Figure 5). When students reflect on their own learning and need to communicate it to others, as they did in their blogs, they are intensifying their understanding about a topic, their own learning strengths as a team and the areas in which they need to develop further.

"Today was a very special day for the team. We gather for the first time and it was awesome to get to know each other within the work context. We are looking forward to the change. What about you? Are you with us?"

"Greeting to all readers and welcome to our very first weekly report about our project. Firstly, we met our student advisor, Margarida Vasconcelos, that introduced us to many resources that we could use, as a team, from communicating to sharing media files and more. Afterwards she briefly spoke about her experience as a student, working on a project based on similar bases as ours in past years. Subsequently, we got to know our mentor Florentina Abreu that discussed what possible paths we could go to. On the second meeting, we split as pairs (after doing the personality test) working on many areas such as blog pair, research pair, presentation pair and

script pair. Here, we divided tasks, organized and built our very own work schedule as well as searching some topics about our project". (G2)

"Like every journey ever, this one has come to an end. It was a pleasure, and a big one. When we started this project the only thing we knew was our main goal, the development of some sort of sustainable packaging. We had no idea with who we were going to work, we had no idea how to even work in an "company", this was something new. The first weeks were rough, we were experiencing something outrageously out of our comfort zone. We had a chance to meet everyone involved in the project and get to know our future colleagues. This was the beginning of HEARTH. HEARTH, the combination of the words "earth" and "heart" was our little invention. A company that would create a sustainable package for cakes and little pastry items. It was exciting, it was stressful, it was everything. Every emotion possible, we felt it. From panic to laughter, from anxiety to relief, it was the full package. This was a chapter in our lives that none of us will ever forget. Our hearts are nothing but filled with joy and love after this semester of absolute madness. We loved it. There is nothing more to say. We want to thank everyone involved in the making of HEARTH, our tutors, our teachers, and of course our amazing team. Without them this would be even crazier than it was. Thank you so much, see you soon, stay safe and remember, Keep earth's heart beating. HEARTH."

"After 3 long months of hard work and dedication, we reached the end of our final project. This project has been a true challenge in so many ways that we couldn't even imagine. It has been a pleasure to complete all our given tasks from the various CUs, where we saw the practical use of our theoretical knowledge, improving not only hard skills but many soft skills, one of the many goals we had predicted. In the beginning we had no idea this project would have this sort of dimension, but we are glad that we were able to learn so much about teamwork, leadership, initiative and have a taste of what being an industrial engineer would feel like. In general, we are thankful for the proposed project, and we would like to thank everyone involved in it, including our teacher-mentor, Maria Florentina Abreu, our student-mentor, Margarida Vasconcelos, and all our CUs teachers! We hope you could learn from us to always think outside the box, see you another time. GreenBox".

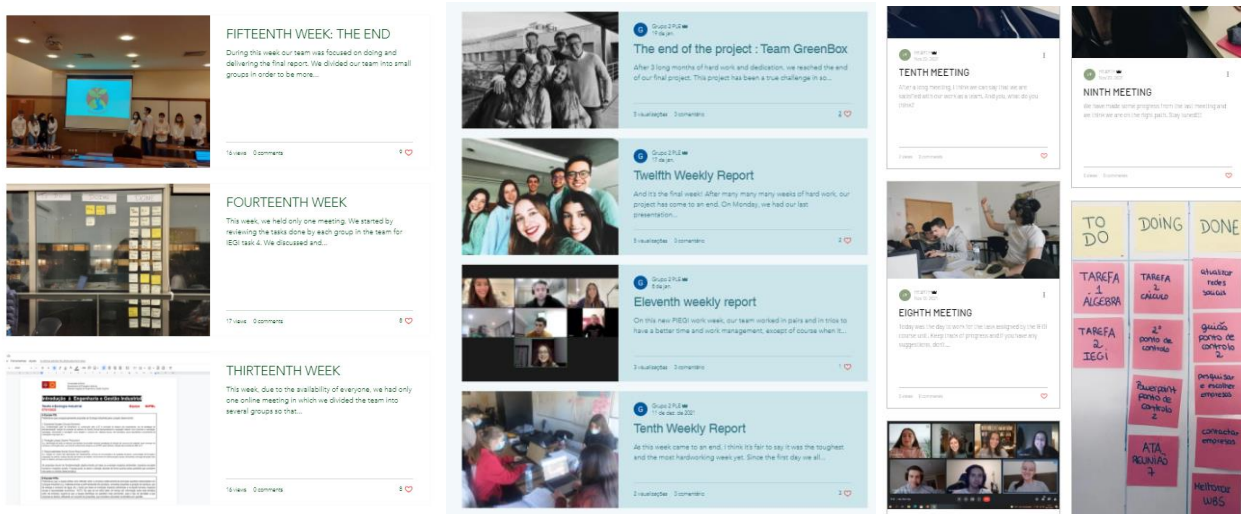


Figure 5. Examples of strategies or mechanisms that students adopted to adjust and advance in the project

5 Final remarks

This paper presents findings about the use of blogs to promote assessment as learning in a PBL context, carried out within an IEM program. The creation of a blog by the project teams as one of the assessment components of the PBL approach has allowed the first-year engineering students to share the development of the project, focusing especially on the team members' learning process and promoting the reflection and self-assessment about their work throughout the thirteen weeks of the project. According to the analysis of both quantitative and qualitative results, it was possible to address the research questions that guided the development of this study.

The first research question refers to the student's experience with their team blogs. Based on the results of the quantitative data from an online survey, the majority of students expressed a positive judgement about the blog as a useful educational tool for: i) the organization and dissemination of the project team; ii) the selection

of the project content and organization; iii) keeping an up-to-date record of the project's progress; iv) encouraging writing about project content and other curiosities.

Moreover, the second research question addresses the importance the students give to the blog as a learning tool. Based on the abovementioned results of the quantitative data, it is possible to conclude that, based on the overall analysis, the students value more the fact of being able to keep up-to-date record of the project's progress, as well as, the opportunity to write in English about project content and other curiosities. However, if the analysis is carried out by gender, it is possible to perceive that female students value more these two points, while male students attribute more importance to the usefulness of the blog in the organization and dissemination of the team project, as well as, the ease that the blog gives to organize and register the contents related to the project.

Finally, the last research question intends to understand how blogs can contribute to promote assessment as learning in PBL context. Thus, the qualitative data that resulted from blogs' content analysis, allowed to conclude that this learning tool promotes students' capacity to reflect about their work and journey, showing a strong sense of criticism when analysing their feelings, weaknesses, achievements, strengths and future plans during the development of the project.

These conclusions are aligned with the concept of assessment as learning, that aims to promote an environment where students are able to learn about themselves and take responsibility for their own learning process, while developing abilities to evaluate their own progress and direct their own learning. For graduates and professionals, the most important assessment is self-assessment. Our students should be helped to develop appropriate dispositions, attitudes and skills (McDowell & Sambell, 2007; Sambell et al., 2012).

6 Acknowledgments

This work has been supported by FCT – Fundação para a Ciência e Tecnologia within the R&D Units Project Scope: UIDB/00319/2020. Also, the authors would like to express their acknowledgement to all students that answered to the questionnaire.

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