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The student journey in PBL: using individual portfolios to promote self-reflection and assessment as learning

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Abstract

This paper aims to present findings based on students' journey within a Project-based learning (PBL) experience, with particular emphasis on the development of an individual portfolio by students, as part of the assessment process. The PBL project involved three curricular units (Research Methods and Techniques II, Ethics and Education and Sociology of Education), from the field of Education Sciences, integrated in the first year of the study plan of the Social Education degree programme at Portucalense University, Portugal. This paper describes student assessment within this educational approach, including both formative and summative methods. It calls attention to the concept of assessment *as* learning, which can be understood as a process where students are able to learn about themselves as learners and take responsibility for their own learning and monitor future directions. One of the assessment methods included in the PBL approach is the development of an individual portfolio with the purpose of enhancing student self-reflection and assessment of their work on a regular basis. The portfolio allowed students to share evidence of the project journey, with particular focus on the student's learning process. The students were provided with general guidelines to develop their portfolio, but the flexible nature of this educational resource allowed students to record and highlight their individual and team contributions in a very creative and personalized way. The analysis of qualitative data from the individual student portfolios reveals student self-reflection on individual achievements, project milestones, teamwork skills, impact of teacher feedback, celebration moments, amongst others. Implications of these findings for PBL assessment practices will be discussed further in the paper.

Keywords: project-based learning (PBL); student assessment; assessment as learning; individual portfolios

1 Introduction

Project-based learning (PBL) is an educational approach which focuses on student-centred learning, the articulation between theory and practice and the development of student skills (Powell, 1999; Powell & Weenk, 2003). It has been widely used in higher education programs to improve student engagement, promote active learning and provide significant learning experiences (S. Fernandes et al., 2014; Lima, R. M., Dinis-Carvalho, J., Sousa, R. M., Alves, A. C., Moreira, F., Fernandes, S., & Mesquita et al., 2017; Prince, 2004).

Student assessment in PBL differs from traditional assessment. It focuses on assessment as an integrated process, with the purpose of improving student learning through relevant feedback and self-reflection (S. Fernandes et al., 2012; S. Fernandes, Alves, et al., 2021; S. R. Fernandes et al., 2010; M. I. R. Ortigão, D. Fernandes, 2019). Far beyond the concept of assessment *of* learning, student assessment in PBL emphasizes the concept of assessment *for* learning or assessment *as* learning, which can be understood as a process where students are able to learn about themselves as learners and take responsibility for their own learning and monitoring future directions (Earl & Katz, 2006; Sambell et al., 2012).

Student portfolios are a formative assessment method that promotes student engagement, motivation, self-reflection and, consequently, significant learning (Marinho et al., 2021). By using portfolios, teachers can support students in the construction of their own knowledge through metacognition and self-regulation processes. This is particularly relevant in PBL approaches where the monitoring and assessment of the students' learning process is carefully planned and enhanced (S. Fernandes, Alves, et al., 2021).

This paper aims to present findings based on students' journey within a PBL experience, with particular emphasis on the development of an individual portfolio by students, as part of the assessment process. It focuses on a case study developed in the field of Education, where PBL has been implemented in the past few years (Abelha et al., 2020; Abelha & Fernandes, 2021; S. Fernandes et al., 2018; S. Fernandes, Conde, et al., 2021).

2 Context of Study

The PBL project involved three curricular units (Research Methods and Techniques II, Ethics and Education and Social and Educational Intervention Models), from the field of Education Sciences, integrated in the first year of the study plan of the Social Education degree programme at Portucalense University, Portugal. In PBL, student assessment includes several milestones where the student groups present their projects development state. These milestones aim to provide students with moments of feedback on the project development and an opportunity to clarify doubts regarding the integration of the curricular units in the project. Table 2 presents the milestones of the project, according to the last five editions of PBL projects in the Social Education degree at UPT.

Table 1. PBL-LES Project Milestones Schedule

#	Week	Milestone
1	2nd Week	Presentation of the PBL-LES Project
2	3rd Week	Open Lecture on the Project Theme
3	4th Week	Presentation # 1 (Submission in Moodle)
4	10th Week	Presentation # 2 (Submission in Moodle)
5	13th Week	Presentation # 3 (Submission in Moodle)
6	13th Week	Preliminary Project Report Submission
7	14th Week	Preliminary Project Report Feedback (for each CU)
8	15th Week	Final Presentation and Discussion of the Project (Submission of the Final Project Report)
9	15th Week	Submission of Individual Portfolio

Concerning the project's assessment components, these are distributed at different times, throughout the semester, including the following elements and weights: Presentation #1, #2 and #3 (15%), Preliminary Project Report (20%), Final Project Report (30%), Final Presentation and Project Discussion (15%), Individual Portfolio (20%). The development of an **individual portfolio** has the purpose of enhancing student self-reflection and assessment of their work on a regular basis. The portfolio allows students to share evidence of the project journey, with particular focus on the student's learning process. Students are provided with general guidelines to develop their portfolio, but the flexible nature of this educational resource allows students to record and highlight their individual and team contributions in a very creative and personalized way.

3 Methods

This paper is based on a qualitative study which aims to give answer to the following research questions:

- How do students describe their journey during the PBL experience?
- How do individual portfolios contribute to promote self-reflection and assessment as learning?

Data analysis is based on the results of a content analysis of the qualitative data available in the individual student portfolios. For the elaboration of their portfolios, students were provided with some guiding questions, including the following: What have I learned from this curricular unit? What did I learn from participating in the PBL project? What motivated me the most in the PBL project? What difficulties have I encountered? Why? How did I get over them? What could I have done better? What did I learn about myself? What are my strengths and weaknesses? What did I learn about others? What new experiences have I done? What do I do differently now from what I have done in the past? What are my plans for the future? What goals do I have for the next semester?

Based on these topics, students based their reflections on their individual achievements, the project milestones, teamwork skills, impact of teacher feedback, celebration moments, amongst others.

4 Results

As stated previously, this paper aims to present findings based on students' journey in a PBL experience, described in an individual portfolio developed by students. The most important topics explored by students in their self-reflections are presented in the following subtopics.

4.1 What did I learn? / What skills did I develop?

When asked about what they had learned and what type of skills they had the opportunity to develop during the PBL, the students highlighted the learning outcomes that referred to the technical skills of the course units of Research Methods and Techniques I and Social and Educational Intervention Models, as can be seen in their speeches:

With the PBL project (...) I learned how to conduct questionnaire surveys, develop scripts, protocols and interviews, as well as their transcriptions (...) I learned how to carry out research projects, which should be included in the structure of a research report (...) (S6)

This project represented an area of growth for me, as it allowed me to understand how a social project should be developed, addressing the importance of each of the phases that constitute it (S5)

(...) I also learned how to conduct and transcribe an interview, something I had never done before (S10)

The PBL project was a great opportunity to acquire knowledge and enabled me to broaden my vision of the area of Social Education. (S3)

Interdisciplinarity was another aspect highlighted by students when they stated that the PBL project:

(...) was very beneficial and enriching in my learning as a Social Education student, because it allowed me (...) to apply knowledge from several areas at the same time. (S3)

(...) cross knowledge from different curricular units and take advantage of them (...) (S6)

Students mentioned that they had the opportunity to develop several transversal competencies, namely *communication skills, time management, decision-making, interpersonal skills, and teamwork skills*, as shown in the following excerpts:

(...) this project facilitated better communication as a group and a close relationship between students and teachers (S5)

One of the lessons I learnt was that developing this type of project goes far beyond communicating, it also involves collaborating, which presupposes the confrontation of ideas, the acceptance of different opinions, as well as the ability to construct joint solutions as a team. (S4)

With the PBL project, I learned to manage time better, the importance of teamwork and the allied difficulty (...). (S6)

Throughout this project, I learned to work as a team and that when you work together everything becomes easier and we can achieve a better result (...). (S10)

Today I feel more able to establish forms of communication appropriate to situations, to work in a team, to establish a relationship of trust with the other members, to build my professional identity and to present relational and helping attitudes. (S3)

(...) one of the most relevant aspects of the project was also the opportunity to develop collaborative work, which presents difficulties, but also many possibilities for growth, because with everyone's contribution, with their different ideas and critical views, the final product is certainly more enriching. (S4)

(...) allowed for a greater capacity of time management for the tasks in which it would be necessary, through this capacity of time optimisation, I was able to finish the tasks in a more profitable way (S5)

4.2 What do I now do differently from what I have done in the past?

With regard to what they consider that they now do differently from what they did in the past, as a result of the experience of the PBL project, students highlighted the greater capacity for critical reflection, reasoning, creativity, the ability to make more constructive criticisms, and the ethical care taken during the preparation and implementation of the project itself, as evidenced in the students' speeches:

(...) when comparing my pathway last year and currently, my evolution in many aspects is evident, namely today I am able to analyse more critically any procedure to be performed, as well as the reason for it. (...) (S3)

I became much more careful in the collection and processing of information, looking for suitable and reliable sources and also in the respect for copyrights and Copyright rules. (S4)

What changed most from my initial work to the final one was my ability to provide a basis, which is strongly present in the report we prepare and my capacity for creativity (...) (S5)

The way of reflecting on my own work and that of the group (...) (S6)

I learnt to make more constructive criticism on subjects which I did not know so well and which I now know more about (...) (S7)

4.3 What did I learn about myself? / What did I learn about others?

Resilience and the capacity to overcome oneself were the two aspects most often mentioned by students when they were asked to reflect on what they learned about themselves during the completion of the PBL project, as evidenced by the students' speeches:

(...) I managed to know that (...) when faced with a difficulty I do not give up and always try to find a solution. (S3)

I learned that my effort will always be rewarded and that giving up should not be an option. I also learned to value the work I do, giving my best, in a demanding context and under less than ideal conditions. (S4)

My capacity for resilience and overcoming, my level of demand, my organizational capacity and my interviewer side, eheh! (S6)

I have learned that no matter how tiring a job may be, I can find the strength and the will to do anything, that with dedication I can do anything, all I need is the will, and I have learned that I can be more committed than I had imagined. (S10)

With regard to what they consider they have learnt about others, the students' reflections focused essentially on teamwork: its implications, difficulties, added value, as can be seen in the students' discourse:

I learned that group work is not always easy. Working in a team implies communicating and collaborating, living with very different points of view and opinions, having to overcome problems together and outline solutions collectively. (S7)

Working in a team also means having the ability, by understanding the strengths and the less strong points of each member of the group, to seek to establish bridges and consensus, giving our contribution to the final product. (S4)

Regarding the others, I have learned that together we can overcome any challenge. Everyone has their own and unique characteristics, which has allowed us to have projects which are so different, but at the same time so complete. (S5)

5 Final Remarks

Assessment as learning aims to guide and provide opportunities for each student to monitor and critically reflect on their knowledge and identify the next steps. The use of the portfolio to report a student's learning process has impact on students as it provides the deepening of knowledge and reflecting on what is learned and how it is learned, besides also promoting the articulation of theory and practice (Marinho et al., 2021).

The portfolio is an assessment method that elicits students' learning and metacognitive processes. Data collected from student's self-reflections in the portfolio prove the theory about the usefulness of a portfolio, in the present case, applied in a PBL project, which allowed them to enrich the learning experience. In addition to technical aspects, they developed transversal competencies, such as communication skills, time management, decision-making, interpersonal skills, and teamwork skills which are essential in the present days. Also, the general portfolio guidelines enhanced greater creativity.

Critical reflection and ethical care are also very important achievements. As a matter of fact, when asked about what they did differently from what they have done in the past, their evolution is obvious, emphasizing their capacity for constructive criticism either about the other team members or their own performance. PBL's interdisciplinarity was considered advantageous, crossing knowledge from different curricular units.

Above all, if it would be possible to hierarchize in the present pandemic context, we would highlight the «resilience» and «capacity to overcome oneself» expressed by several students. This study induces us to conclude that the permanent contact with each other, either as a teamwork or celebration moments, including teacher's feedback related to portfolio construction, contributed to motivating and improving assessment as learning and taking responsibility for their learning and monitoring future directions.

References

- Abelha, M., & Fernandes, S. (2021). Aprendizagem baseada em Projetos: o contributo da formação pedagógica docente. In J. Belli, S. Henriques, & C. Neves (Eds.), *Formação de Professores e Inovação Pedagógica: contextos, processos e evoluções* (pp. 87–104). Paco Editorial.
- Abelha, M., Fernandes, S., Miguel, I. C., & Sousa, E. (2020). Educação social e aprendizagem e serviço (Aps). *LAPLAGE EM REVISTA*, 6(3), 38–53. <https://doi.org/10.24115/S2446-6220202063935p.38-53>
- Earl, L., & Katz, S. (2006). Assessment of Learning What Is Assessment of Learning? In *Rethinking Classroom Assessment with Purpose in Mind*.
- Fernandes, S., Abelha, M., Fernandes, S. M., & Albuquerque, A. S. (2018). Implementation of PBL in a social education programme at the Portucalense University. *International Symposium on Project Approaches in Engineering Education*, 8, 446–455.
- Fernandes, S., Alves, A. C., & Uebe-Mansur, A. (2021). Student-Centered Assessment Practices. In *Handbook of Research on Determining the Reliability of Online Assessment and Distance Learning* (pp. 213–243). <https://doi.org/10.4018/978-1-7998-4769-4.ch009>
- Fernandes, S., Conde, A., & Abelha, M. (2021). Student motivation in the first year of University: findings from the implementation of a PBL project for a real context. In V. V.-B. Anabela C. Alves, Natascha van Hattum-Janssen, Rui M. Lima (Ed.), *Proceedings of the PAEE/ALE2021, International Conference on Active Learning in Engineering Education 13th International Symposium on Project Approaches in Engineering Education (PAEE) 18th Active Learning in Engineering Education Workshop (ALE)* (pp. 301–309). Department of Production and Systems – PAEE association School of Engineering of University of Minho, Campus de Azurém, 4800-058 Guimarães, Portuga. <https://doi.org/10.5281/ZENODO.5096981>
- Fernandes, S., Flores, M. A., & Lima, R. M. (2012). Students' views of assessment in project-led engineering education: Findings from a case study in Portugal. *Assessment and Evaluation in Higher Education*, 37(2), 163–178. <https://doi.org/10.1080/02602938.2010.515015>
- Fernandes, S., Mesquita, D., Flores, M. A., & Lima, R. M. (2014). Engaging students in learning: Findings from a study of project-led education. *European Journal of Engineering Education*, 39(1), 55–67. <https://doi.org/10.1080/03043797.2013.833170>
- Fernandes, S. R., Flores, M. A., & Lima, R. M. (2010). A aprendizagem baseada em projectos interdisciplinares: avaliação do impacto de uma experiência no ensino de engenharia. *Avaliação: Revista Da Avaliação Da Educação Superior (Campinas)*, 15(3), 59–86. <https://doi.org/10.1590/s1414-40772010000300004>
- Lima, R. M., Dinis-Carvalho, J., Sousa, R. M., Alves, A. C., Moreira, F., Fernandes, S., & Mesquita, D., Lima, R. M. M., Dinis-Carvalho, J., Sousa, R. M. M., Alves, A. C. C., Moreira, F., Fernandes, S., & Mesquita, D. (2017). Ten Years of Project-Based Learning (PBL) in Industrial Engineering and Management at the University of Minho. *PBL in Engineering Education: International Perspectives on Curriculum Change*, 33–52. <https://doi.org/10.1007/978-94-6300-905-8>
- M. I. R. Ortigão, D. Fernandes, T. V. P. & L. S. (Ed.). (2019). Para um enquadramento teórico da avaliação formativa e da avaliação sumativa das aprendizagens escolares. In *Avaliar para aprender no Brasil e em Portugal* (pp. 139–163). Editora CRV.
- Marinho, P., Fernandes, P., & Pimentel, F. (2021). The digital portfolio as an assessment strategy for learning in higher education. *Distance Education*, 42(2), 253–267. <https://doi.org/10.1080/01587919.2021.1911628>
- Powell, P. (1999). From classical to project-led education. In António Sérgio pouzada (Ed.), *Project Based Learning. Project-led Education and Group Learning*. (pp. 11–42). Thematic Network Plastics in Engineering.
- Powell, P., & Weenk, W. (2003). *Project-Led Engineering Education* (Vol. 53, Issue 9). Lemma Publishers. <https://doi.org/10.1017/CBO9781107415324.004>
- Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education*, 93(3), 223–231.
- Sambell, K., McDowell, L., & Montgomery, C. (2012). Assessment for learning in higher education. In *Assessment for Learning in Higher Education*. <https://doi.org/10.4324/9780203818268>