Implementation of Project-Based Learning in Social and Human Sciences Course for First Year Students in Dentistry in Morocco

Mohamed Taiebine*, Amal El Ouazzani Ech-Chahdi, Chakib Nejjari

Euro-Mediterranean University of Fez, Route Principale Fès-Meknès, 30000, Fès, Morocco *Corresponding author, email: m.taiebine@ueuromed.org

Article History

Received: 18 May 2024 Revised: 29 May 2024 Accepted: 2 July 2024

Keywords

Dentistry Human Learning Morocco Neuropsychological Project Social

Abstract

The purpose of this study was to report on the experience of using Project-based learning (PBL) in the human and social sciences course taught to first year students in dentistry at the Euro-Mediterranean University of Fez. The assessment method involved self-assessment using a questionnaire. The course plan used PBL methodology in face-to-face format as well as asynchronous meetings via Moodle[®]. The findings showed that students were satisfied while experimenting PBL which creates a dynamic learning environment. Based on the findings, we suggest an innovative neuropsychological framework of PBL encompassing socio-cognitive, socio-emotional and metacognitive domains. Such learning enhances students' understanding of human sciences applied to dentistry, develops critical thinking skills, promotes collaboration, and prepares them for clinical practice.

How to cite: Taiebine, M., Chahdi, A. O., & Nejjari, C. (2024). Implementation of Project-Based Learning in Social and Human Sciences Course for First Year Students in Dentistry in Morocco. *Buletin Konseling Inovatif*, 4(2). 71–77. doi: 10.17977/um059v4i12024p71-77

1. Introduction

Project-based learning (PBL) is an instructional approach that emphasizes context-specific learning, active student involvement, and social interaction for knowledge sharing (Kokotsaki et al, 2016). This approach is rooted in constructivist principles and is linked to Vygotsky's social constructivism, which highlights the role of interpersonal interactions in cognitive development (Handrianto et Rahman, 2018). Research has found PBL to be effective in improving students' thinking skills, encouraging in-depth knowledge gathering, and enhancing research skills (Anazifa & Djukri, 2017). Moreover, PBL's theoretical and conceptual underpinnings are supported by activity theory, which emphasizes the achievement of objectives through a systematic approach (Almulla, 2020). The successful implementation of PBL also depends on school support and teacher motivation, with collegiality and teacher competence being significant factors (Lam et al., 2010). Additionally, PBL has been shown to contribute to high-achievers' acquisition of technological knowledge and skills, leading to a positive change in attitude towards technology and consistent design styles (Mioduser & Betzer, 2007).

Project-based learning (PBL) has been recognized in dental education as a productive approach for fostering active learning and enhancing students' critical thinking abilities. Costa-Silva et al. (2018) reported positive results from a PBL course designed for dental students. This course emphasized active learning strategies, such as problem-based and case-based learning, which are essential components of dental education reform (Nadershahi et al., 2013). Moreover, Hill et al. (2020) emphasized the importance of evidence-based dentistry and the process of lifelong and self-directed learning in dental education.

Experiential learning, especially in community-based settings, has been acknowledged as a beneficial approach in dental education. Studies have shown the positive outcomes of implementing

oral health educational programs and experiential learning for dental students in school-based communities (Yoo et al., 2020). Furthermore, research has demonstrated the impact of community oral health curriculum on graduates' dental practice choices and volunteerism, emphasizing the importance of service-learning activities and community-based clinical rotations in dental education (Choi et al., 2018). Post-pandemic shift to PBL capitalized on online platforms that integrate technology to improve learning experiences like Google Classroom and various digital tools which have facilitated remote learning, collaboration, and feedback. (Yulhendri et al, 2023)

Reflective learning and interdisciplinary education have also been identified as important aspects of dental education. suggested the inclusion of student-directed, science-related research projects in the dental curriculum to enhance the appreciation of academic research and evidence-based dentistry (Youhanna, 2021; Crawford et al, 2024; Duś-Ilnicka et al, 2024). Furthermore, they emphasized the development of an interdisciplinary course in information resources and evidence-based dentistry, which was well-received by respondents and contributed to enhancing critical appraisal skills (Levine et al., 2008).

The present study aims to investigate the motivations and satisfaction of first-year students in dentistry while incorporating PBL in a social and human sciences course. Also, It seeks to assess the influence of PBL on student engagement, knowledge acquisition, and the development of critical thinking and communication skills. Furthermore, this study might examine the practicality and challenges associated with implementing PBL and sugged a new neuropsychological framework within the prevailing curriculum for dentistry in Morocco.

2. Method

The implementation of PBL in firts year course at the Euro-Mediterranean University of Fez from September to December 2023 was evaluated and developed by the professor and the deanship of dentistery. The first measure implemented was the training of faculty members in the PBL methodology, which included readings and discussions facilitated by experts (Figure 1). The course design was collaborative, with a focus on learning and exchanging experiences. At the end of the semester, 53 students were asked to evaluate the course using a questionnaire that included global assessment questions.

When it comes to designing PBL experiences, it's important to carefully select and identify relevant projects that align with learning objectives (Costa-Silva et al, 2018). In addition to assigning projects to students, it's also important to create collaborative and transdisciplinary groups to foster a sense of teamwork and cooperation. As an instructor, it's crucial to provide guidance, support, and resources to help students succeed. This includes facilitating group discussions to promote active engagement and critical thinking. Finally, it's important to provide feedback and assess student learning outcomes to ensure that they are meeting the desired learning goals.



Figure 1. The steps for implementing PBL in dentistry (Costa-Silva et al, 2018)

3. Results

Fifty-three undergraduate students from the first semester of medical studies in dentistry participated in the course which was conducted in a face-to-face format, with synchronous activities consisting of lectures and dialogues, round tables, and tutorial meetings. Asynchronous activities were also provided, which supported and supplemented the course content, giving students additional time to work on projects using the Moodle® platform.

The students began their participation in the PBL course by attending a theoretical class that introduced them to the teaching methodology. Each group was assigned a topic related to human and social science issues applied to the field of dentistry, and an interview with the dean, dentists, and experts was an asset in the implementation of PBL. Some groups used serious gaming applications to engage their peers and assess their knowledge, while others used video-conferencing tools, such as Zoom.

At the end of the course, each of the five groups presented their projects. The themes, educational objectives, instructional design, and final products of these projects are summarized in Table 1.

Tuble 1. Themes of the Trojects Tresented by the Luch Group					
PBL	Driving question	Project theme	Educational purpose	Final	
group				product	
Group	What is benefits and risks	Oral medicine vs traditional	To know the beliefs and social	Oral	
1	of traditional healers?	healing	perceptions of traditional healing	presentation	
	How this practice may			Video	
	impact dentistry practice?			Social media	
Group	What is the impact of new	Dentistry in the digital age	To explore the applications of	Oral	
2	technology and Artificial		new technologies in dentistry and	presentation	
	Intelligence on dentistry?		how machine learning may		
			enhance diagnosis and		
			therapeutic interventions		
Group	What are the rights of	Medical ethics and quackery	To know professional deontology	Oral	
3	dentists and how they		of dentists and how fake news or	presentation	
	face fake news?		quakery may impact their clinical		
			practice		
Group	What are the duties of	Ethical responsibilities of	To investigate the rights and	Oral	
4	dentists towards	the dentist towards patients	responsibilities of dentists	presentation	
	colleagues and patients?	and colleagues:	towards their colleagues and		
		nomenclature of	clients.		
		professional acts			
Group	How dentists may deal	Psychological and social	To share information about	Oral	
5	with psychological issues	problems relating to oral	psychological symptoms and	presentation	
	displayed by themselves,	hygiene problems: children,	prevention of burnout	-	
	their colleagues and	adolescents and the elderly	•		
	clients?	· · · · · · · · · · · · · · · · · · ·			

Table 1. Themes of the Projects Presented by the Each Group

Table 2. Results of the questionnaire distributed to students

Question	Number of	Percentage
	responses	
Following the experiment with project-based learning, do you have the feeling of being	Yes: 49/53	92.4
more competent or more competent in relation to the following skills?	No: 4/53	7.6
Would you say that you learned less, as much or more on the above topics using	a) Less learning	9.4
project-based learning compared to what is generally done in the classroom (lectures,	5/53	47.1
flipped classroom, case presentation)?	b) So much	65.7
	learning 25/53	
	c)More learning	
	23/53	
Do you believe that the development of your skills as a future dentist would be	Yes: 38/53	71.6
facilitated if project-based learning was used for the entire course?	No: 15/53	28.4
Should we repeat this experience with other students from other faculties of allied	Yes: 43/53	81.1
health/ health sciences/medicine?	No: 10/53	18.9

Given the incorporation of PBL in the course of human and social sciences, it became important to involve a formative evaluation that was conducted at the end of semester, with the aim of integrating the students' and group performance into the teaching-learning process.

The outcomes of the final evaluation administered on paper indicate the success of the methodology implemented in relation to the accomplishment of the intended goals. A total of 53 students participated in the survey (Table 2). The outcomes of the project presented here reveal that PBL has significantly enhanced students' perception of the value of the knowledge acquired in the course. Specifically, in the student satisfaction survey, 92.4% students reported being satisfied with PBL. Regarding the second question, "Would you say that you learned less, as much, or more on the above topics using project-based learning compared to what is generally done in the classroom (lectures, flipped classroom, case presentation)?" 65% of respondents reported learning much more with PBL than other learning methods. Additionally, 71% of students believed that PBL should be implemented in the entire course of psychology and sociology of health. With regard to their intention to replicate this experience with other students from other faculties of medicine/health sciences, 81% of respondents expressed a positive attitude. These results demonstrate that the students as a group showed increased self-efficacy and satisfaction following the implementation of PBL.

4. Discussion

The course was held in a conventional face-to-face setting on campus, which allowed for interactive teaching and learning experiences through PBL. This later fosters an educational environment that encourages collaboration and promotes individual as well as collective actions. This environment is established by sharing experiences and enhancing professional understandings through collaborative efforts between professors and students. Several authors have emphasized the significance of PBL in promoting meaningful learning (Sanchez-Muñoz et al, 2022). According to these authors, PBL is an effective method of promoting learning that is relevant to real-life situations and proposes solutions to address the identified needs. A study conducted through an integrative literature review investigated the use of digital technologies in nursing education for non-face-to-face teaching, such as the Moodle E-learning Platform, which is reported to be one of the most commonly used technologies for this purpose (Amandu et al., 2013). This platform provides a range of tools, including forums, chats, questionnaires, wiki-like texts, portfolios, and other options, which offer flexibility in terms of the content being taught.

PBL has been utilized in dental education to adapt the learning framework to include inclusion, principles, design, implementation, and supervision of the CBL framework [Nizami et al, 2023]. PBL has also been used to improve the learning experience of students. For instance, implementing a PBL approach to teach cell biology to dental students, demonstrating the effectiveness of this method in engaging undergraduate dental students (Costa-Silva et al., 2018). Additionally, highlighted the potential benefits of incorporating student-directed, science-related research projects in the later stages of the dental curriculum to better integrate basic sciences with the clinical phase, potentially enhancing the appreciation of academic research and evidence-based dentistry (Scheven, 2011.

Indeed, incorporating interdisciplinary courses that concentrate on information resources and evidence-based dentistry has been demonstrated to be advantageous in enhancing critical thinking skills among dental students (Levine et al., 2008). Additionally, it has been emphasized that establishing the fundamentals of evidence-based practice during the undergraduate curriculum is crucial to assist dental students in acquiring the skills to practice evidence-based dentistry (Azarpazhooh et al., 2008).

Collectively, these studies suggest that project-based learning and interdisciplinary approaches, particularly those that focus on evidence-based dentistry, can significantly contribute to the education of dental students by fostering critical thinking, research appreciation, and evidence-based decision-making skills.

4.1. Educational, neuroscientific and neuropsychological underpinnings of PBL

The neuropsychology of PBL involves examining how the brain processes information, engages in learning, and responds to the cognitive demands associated with PBL (do Amaral et Fregni, 2021). Although specific research on the neuropsychology of PBL is limited, we can draw upon general principles of learning and brain function to understand its potential impact (Taiebine et Keegan, 2022). We suggest a novel neuropsychological model of PBL which encompasses neurocognitive

components such as language, memory, perception, executive functions (attention, focus, reasoning, initiative, thinking, and decision-making), metacognitive, socio-cognitive and socio-emotional components (motivation, resilience, empathy, collaboration, interpersonal communication, and teamwork) (Figure 2).

PBL often involves real-world, hands-on projects that can enhance engagement and motivation. The brain's reward system, including the release of neurotransmitters such as dopamine, plays a role in motivation. When students find relevance and meaning in their projects, it can positively impact their motivation to learn (Fulmer et Frijters, 2009;2011).

PBL has been specifically developed to improve attention, critical thinking, and problem-solving skills. Research has demonstrated that the prefrontal cortex, which is responsible for higher-order cognitive functions, is active during these processes (Uden et al., 2023). In addition, emotions play a significant role in learning, and PBL's social, collaborative, and experiential nature can influence the limbic system, contributing to emotional engagement and regulation. Studies have shown that positive emotional experiences during learning can enhance memory and cognitive processing (Taiebine, 2023; Taiebine et Louise, 2023). Furthermore, social brain networks, including the mirror neuron system, are activated during collaborative activities, leading to a richer learning experience (Dorantes-Gonzalez et al., 2021; Dorantes-Gonzalez, 2022).



Figure 2. A Novel Neuropsychological Framework Shows an Overlapping Between Cognitive-Emotional, Socio-Cognitive and Metacognitive Domains in PBL

5. Conclusion

The implementation of PBL in the course of human and social sciences was effective in attaining the learning objectives, particularly in enhancing the abilities required for planning, constructing, developing, and evaluating educational projects in dentistry. The guidance provided was vital for the progress and productivity of students, allowing them autonomy and liberty to investigate and learn about human and social sciences applications in dentistry, as indicated by the students' satisfaction in the course assessment. Therefore, PBL enhances student motivation and engagement by fostering a sense of purpose and pertinence to their learning.

Author Contributions

All authors have equal contributions to the paper. All the authors have read and approved the final manuscript.

Funding

No funding support was received.

Declaration of Conflicting Interests

The authors report no conflict of interest. The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Acknowledgement

The authors would like to acknowledge and recognize the important participation of the first year students in dentistry in this study.

References

- Almulla, M. A. (2020). The effectiveness of the project-based learning (PBL) approach as a way to engage students in learning. Sage Open, 10(3), 2158244020938702.
- Amandu, G. M., Muliira, J. K., & Fronda, D. C. (2013). Using moodle e-learning platform to foster student self-directed learning: Experiences with utilization of the software in undergraduate nursing courses in a Middle Eastern university. *Procedia-Social and Behavioral Sciences*, 93, 677-683.
- Anazifa, R. D., & Djukri, D. (2017). Project-based learning and problem-based learning: Are they effective to improve student's thinking skills?. *Jurnal Pendidikan IPA Indonesia*, 6(2), 346-355.
- Choi, M. S. (2018). Application of a Project-Based Learning on Community Dental Hygiene. Journal of Convergence for Information Technology, 8(6), 31-41.
- Costa-Silva, D., Côrtes, J. A., Bachinski, R. F., Spiegel, C. N., & Alves, G. G. (2018). Teaching cell biology to dental students with a project-based learning approach. *Journal of Dental Education*, 82(3), 322-331.
- Crawford, L. K., Arellano Carmona, K., & Kumar, R. (2024). Examining the Impact of Project-Based Learning on Students' Self-Reported and Actual Learning Outcomes. Pedagogy in Health Promotion, 23733799241234065.
- do Amaral, J. A. A., & Fregni, F. (2021). Applying neuroscience concepts to enhance learning in an online project-based learning centered course. Journal of Problem Based Learning in Higher Education, 9(2).
- Dorantes-Gonzalez, D. J., Tsvetkova, N., Veledinskaya, S., Babanskaya, O., & Çakar, T. (2021, June). Toward a Novel Neuroscience-Based System Approach Integrating Cognitive and Implicit Learning in Education. In International Conference Cyber-Physical Systems and Control (pp. 661-673). Cham: Springer International Publishing.
- Duś-Ilnicka, I., Paradowska-Stolarz, A., Mazur, M., Radwan-Oczko, M., Perra, A., Paula, V. S. D., ... & Dominiak, M. (2024). Blended intensive programme's implementation in dental education: post-pandemic evolution of learning. BMC Medical Education, 24(1), 352.
- Fulmer, S. M., & Frijters, J. C. (2009). A review of self-report and alternative approaches in the measurement of student motivation. *Educational Psychology Review*, 21(3), 219-246.
- Fulmer, S. M., & Frijters, J. C. (2011). Motivation during an excessively challenging reading task: The buffering role of relative topic interest. *The Journal of Experimental Education*, 79(2), 185-208.
- Handrianto, C., & Rahman, M. A. (2018). Project based learning: a review of literature on its outcomes and implementation issues. LET: Linguistics, Literature and English Teaching Journal, 8(2), 110-129.
- Heffler, B. (2001). Individual learning style and the learning style inventory. Educational studies, 27(3), 307-316.
- Hill, M., Peters, M., Salvaggio, M., Vinnedge, J., & Darden, A. (2020). Implementation and evaluation of a self-directed learning activity for first-year medical students. *Medical education online*, 25(1), 1717780.
- Kokotsaki, D., Menzies, V., & Wiggins, A. (2016). Project-based learning: A review of the literature. *Improving schools*, 19(3), 267-277.
- Lam, S. F., Cheng, R. W. Y., & Choy, H. C. (2010). School support and teacher motivation to implement project-based learning. *Learning and instruction*, 20(6), 487-497.
- Levine, A. E., Bebermeyer, R. D., Chen, J. W., Davis, D., & Harty, C. (2008). Development of an interdisciplinary course in information resources and evidence-based dentistry. *Journal of Dental Education*, 72(9), 1067-1076.
- Mioduser, D., & Betzer, N. (2008). The contribution of Project-based-learning to high-achievers' acquisition of technological knowledge and skills. *International Journal of technology and design education*, 18, 59-77.
- Nadershahi, N. A., Bender, D. J., Beck, L., Lyon, C., & Blaseio, A. (2013). An overview of case-based and problem-based learning methodologies for dental education. *Journal of Dental Education*, 77(10), 1300-1305.

- Nizami, M. Z. I., Xue, V. W., Wong, A. W. Y., Yu, O. Y., Yeung, C., & Chu, C. H. (2023). Challenge-based learning in dental education. Dentistry Journal, 11(1), 14.
- Sanchez-Muñoz, R., Carrió, M., Rodríguez, G., Pérez, N., & Moyano, E. (2022). A hybrid strategy to develop real-life competences combining flipped classroom, jigsaw method and project-based learning. *Journal of Biological Education*, 56(5), 540-551.
- Scheven, B. A. A. (2012). Perceived relevance of oral biology by dental students. *European Journal of Dental Education*, 16(1), e64-e72.
- Taiebine, M., & Keegan, L. C. (2022). E-Mentorship in Speech-Language Pathology. Teaching and Learning in Communication Sciences & Disorders, 6(3), 8.
- Taiebine, M. (2023). E-learning and Intercultural Online Education Pre-and Post-Covid-19. In Transforming Teaching and Learning Experiences for Helping Professions in Higher Education (pp. 96-113). Brill.
- Taiebine, M., & Keegan, L. (2023). E-mentorship as a medium to foster soft skills during COVID-19. Journal of the Neurological Sciences, 455.
- Uden, L., Sulaiman, F., Ching, G. S., & Rosales, J. J. (2023). Integrated science, technology, engineering, and mathematics projectbased learning for physics learning from neuroscience perspectives. *Frontiers in psychology*, 14, 1136246.
- Yulhendri, Y., Prima Sakti, M. R., Sofya, R., Ritonga, M., Alisha, W. P., Sudjatmoko, A., & Susanti, N. (2023). Strategies for Project Based Learning during the Pandemic: The Benefits of Reflective Learning Approach. SAGE Open, 13(4), 21582440231217885.
- Yoo, S. H., Bae, S. M., Shin, B. M., & Shin, S. J. (2017). Evaluation of project-based learning on community dental hygiene practice education. *Journal of dental hygiene science*, 17(4), 368-374.
- Youhanna, K. M. Y., Adam, L., Monk, B. C., & Loch, C. (2021). Dentistry students' experiences, engagement and perception of biochemistry within the dental curriculum and beyond. *European Journal of Dental Education*, 25(2), 318-324.