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Evaluation of Student Attitudes in Problem-Based Learning within Interdisciplinary Integrated Courses on User Interface Design

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ABSTRACT

Problem-Based Learning (PBL) is an instructional approach that utilizes real-world scenarios to cultivate students' skills in inquiry, reasoning, and decision-making, ultimately enhancing their problem-solving capabilities and professional development. PBL is characterized by collaborative group learning, which deepens students' abilities to effectively identify and resolve issues. It also promotes teamwork skills and offers a framework for the development and evaluation of interdisciplinary curricula. In the context of this particular study, PBL is introduced within a user interface design course. The course encompasses diverse themes such as smart homes, digital learning, pandemic and life, audio-visual entertainment, and financial business. Current events are utilized as guiding principles for learning, creating a dynamic and engaging learning environment. Students with various backgrounds, including design and technology, collaborate in a learner-centered approach with a focus on fostering creative problem-solving. Additionally, industry experts are involved to provide feedback and guidance to students, and user testing is employed to refine their work. The overall assessment of teaching effectiveness, utilizing statistical methods, indicates positive feedback with high reliability (Cronbach's alpha: 0.93). Notably, there is a notable difference in how PBL is perceived between students with design backgrounds and those with technology backgrounds, particularly regarding teamwork and information gathering skills. As a result, the students' work demonstrates improved creativity and the development of integrated interdisciplinary projects. This instructional approach empowers educators to comprehend and assess students' cognitive processes and attitudes, enabling them to offer personalized guidance and support. With PBL and a student-centered approach, it is well-suited for guiding students in both user experience and user interface design. In future curriculum planning, this approach can continue to be employed, leveraging the expertise of students from diverse interdisciplinary backgrounds to effectively address relevant topics and projects.

Keywords: Problem-based learning (PBL), User interface design, User experience design, Interdisciplinary projects

INTRODUCTION

The research project focuses on integrating Problem-Based Learning (PBL) into the teaching of User Experience (UX) and User Interface (UI) Design

in university-level courses. The project aims to encourage students to independently learn and practically apply the principles of UX and UI in project design, guided by instructors. Besides lectures, the course emphasizes experiential learning, allowing students to practice these skills in class and culminating in the presentation of mobile device projects at the end of the term. The project presentations highlight interface design and innovation in UX evaluation.

The objectives in this research are:

1. To use Problem-Based Learning to cultivate students' abilities in autonomous learning and problem-solving. Workshops focusing on user experience methods will help students explore user needs and manage the workflow of UX-related projects.
2. To require students to integrate their learning into presentations and deliver oral reports, thereby enhancing their synthesis and presentation skills.
3. To provide hands-on experience with interface design techniques in the classroom. Students will receive insights from industry experts and analyse real-world demands. The course also incorporates user testing methods to refine and improve students' project work.

LITERATURE REVIEW

Problem-Based Learning (PBL)

In PBL, students engage in both independent learning and teamwork to solve complex and loosely structured problems, drawing from real-life contexts (Barrows & Tamblyn, 1980). PBL is learner-centered, using problems as a catalyst for learning, making it a dynamic process where students independently learn and understand problem-solving (Fidan & Tuncel, 2019). The steps of PBL can be summarized as follows (Torp & Sage, 1998):

(1) Engage: Presenting the problem to make students understand the context and its connection to their lives.
(2) Analyse: Establishing a framework for discussion, such as ideas, facts, learning issues, and action plans, outlining content, possible solutions, and discussion frameworks.
(3) Explore: Students work in groups to collect relevant information and devise solutions.
(4) Present Solutions: Groups report and present collected information and outcomes, evaluating each solution.
(5) Assess Learning Outcomes: Feedback on learning and assessment of learning effectiveness.

This research project follows these teaching steps. Learning how to become a designer is crucial for students in design-related fields; observing and practicing designer behaviors aids their learning (Budge, 2016). Design courses aim to provide students with the ability to generate creative designs (Sawyer, 2017). Thus, the teaching methods go beyond mere knowledge transfer in the classroom, considering the cultivation of creativity and design behaviors.

This project's teaching methods, taking into account UX and UI design, focus not just on theoretical knowledge but also on experiential learning, using PBL to teach how to undertake design projects, aiming to develop students' autonomous learning abilities and align with industry needs.

User Experience Design and Teaching

User Experience (UX) is vital in both industry and academic research, with high demand for UX design in the technology industry (Anderson, 2020). UX designers should adopt a user-centered approach, prioritizing users' changing experiences, attitudes, skills, habits, and personalities (Institution, 2019). Research on integrating UX into service design shows the need to explore user needs and possibilities (Leinonen & Roto, 2023). Incorporating UX's user-centered focus in interdisciplinary innovative product design courses enables students to effectively understand and apply course content creatively (Raviv, 2015). Teaching UX design requires solving real problems, developing core competencies of UX designers, establishing industry relations, and using industry feedback to adjust course content (Getto & Beecher, 2016). Workshops on UX have been proposed to develop course designs, covering themes like visual and interactive performance, social and research methods, design philosophy, technical skills, teamwork and leadership, and global awareness (Vorvoreanu et al., 2017). Beyond practical UX design, consistent learning and planning are required in information architecture and design, visual rhetoric, ethics, and communication with technology (Getto et al., 2013).

RESEARCH METHOD

This research focuses on mobile devices as the primary development platform through the implementation of problem-based learning. The research structure is divided into three main parts: User Experience (UX) Design, User Interface (UI) Design, and Project Integration and Evaluation.

In the UX Design phase, students engage in workshops where they practice UX design methods such as personas, service blueprints, and user journey maps. These methods help students understand and meet user needs, shaping the functional specifications of the project.

In UI Design, the process involves introducing design project workflows and visual requirements. The students develop and design the visual interface of mobile devices through software demonstrations and practice.

To enhance the project's feasibility and foster design innovation, advices from industry experts are incorporated. Furthermore, user testing is conducted to refine and optimize the completeness of the design project.

RESULTS

This research used the questionnaire at the end of the semester to understand students' learning feedback. In addition to understanding the personal information of the respondents, including grade (junior or senior year), group (design or technology), and any relevant internship or work experience,

the questionnaire consists of thirty-three questions divided into four main aspects. The response format is based on the Likert scale, with options ranging from 1 to 5, representing 'strongly disagree', 'disagree', 'neutral', 'agree', and 'strongly agree'. Below is the analysis table of the learning feedback questionnaire, with higher feedback scores displayed on a blue background.

Table 1. Analysis table of the learning feedback questionnaire.

Category	Question	Mean	SD
Problem-Based Learning (PBL)	I feel that PBL can promote my ability to think diversely	4.04	0.713
	PBL can link to my learning experiences	3.92	0.679
	PBL can stimulate my interest in this course	3.98	0.668
	The PBL method suits my abilities and level	4	0.715
	I feel I can learn how to cooperate in groups	4.27	0.536
	I believe group discussions are conducive to my learning	4.27	0.644
	PBL helps enhance my problem-solving skills	4.21	0.582
	PBL aids in my ability to collect and use various information	4.29	0.544
User Experience	I believe the user experience design taught in this course is well related to future work	4.31	0.512
	I think the user experience design taught in this course will enhance my professional skills	4.35	0.565
	The user experience design workshop can provide tools useful for future work	4.25	0.601
	The content of the user experience design workshop offers clear tools for future application	4.35	0.601
	I have a good understanding of the design of "Empathy Maps" and can operate them myself	4.04	0.683
	I have a good understanding of "Personas" design and can operate them myself	4.27	0.676
	I have a good understanding of "User Journey Maps" design and can operate them myself	3.88	0.789
	I have a good understanding of "Service Blueprint" design and can operate them myself	3.98	0.729
User Interface Design	I believe the user interface design taught in this course is well related to future work	4.27	0.536
	I think the user interface design taught in this course will enhance my professional skills	4.29	0.617
	The principles of visual design in user interface design can be useful for future work	4.31	0.624
	User interface design provides a clear process for future application	4.23	0.66
	I have a good understanding of Figma and can operate it myself	4.15	0.618
User Testing and Design Thinking	I believe the user testing taught in this course is well related to future design professions	4.21	0.504
	I understand the importance of user testing and its relation to actual projects	4.1	0.555
	I have a good understanding of user testing and can conduct it myself	4.17	0.595
	I understand that the results of user testing need to be reflected in my design	4.23	0.472
	I understand that industry expert advice is substantially helpful for my design work	4.25	0.668
	I comprehend the content and focus of mid-term and final project presentations	4.33	0.519
	I can learn different features and contents from other students' works	4.42	0.613
	I understand the relationship between user experience and user interface design	4.33	0.559
	I believe that user experience tools can assist in planning and discussing before interface design	4.29	0.544
Connection between UX and UI	After the course, I understand the relationship between user experience and user interface design	4.25	0.526
	I believe that user experience tools can assist in planning and discussing before interface design	4.15	0.505
	After this course, would you be willing to work in UX or UI-related jobs if given the opportunity	3.92	0.767

Out of 48 valid questionnaires, the reliability analysis yielded a Cronbach Alpha value of 0.093, indicating high reliability. Subsequently, an independent samples t-test was conducted to examine the differences between two

groups (25 from the design group and 23 from the technology group), identifying questions with significant differences (p-value < 0.05). The following items showed significant variance:

1. I feel that I can learn how to cooperate in groups.
2. PBL helps in my ability to collect and use various information.
3. I believe the user experience design taught in this course is well related to future work.
4. I believe the user interface design taught in this course is well related to future work.
5. The principles of visual design in user interface design can be useful for future work.
6. I believe the user testing taught in this course is well related to future design professions.
7. After the course, I understand the relationship between user experience and user interface design.
8. I believe that user experience tools can assist in planning and discussing before interface design.

Therefore, it is evident that students in the design group have a better understanding of the importance of self-collecting and using various information through PBL learning. They also show a greater comprehension of the professional relevance of user experience and user interface design to future professions.

CONCLUSION

Following the conclusion of the project, semi-structured interviews were conducted with three experts who participated in the expert review. The compiled recommendations are as follows:

1. PBL (Problem-Based Learning): The problems were set close to the students' thoughts and life experiences, which engaged students more in discussions and development. Future recommendations include integrating considerations related to product strategy and marketing to cultivate students' acuteness in real-world issues and planning methods for problem-solving.
2. UX and UI Teaching: The UI component needs to strengthen color schema designing skills. This reflects the fact that nearly half of the students are from the technology group, hence, using case studies in the future to explain methods of color schema could be beneficial for those students.
3. Presentations and Overall Performance: There were two group presentations in whole semester. The recording and feedback from the first presentation allowed students for self-reflection and improvement, enabling a more focused approach to problem-solving in the second presentation and expert review.

Post-project and course completion, based on the analysis of student feedback, student project performance, and results of expert interviews, the following points can be considered for future course arrangements:

1. PBL Course Design: Currently, major issues are set and considered before the course. As it aligns with the students' perspective, it appropriately guides them in developing comprehensive and detailed plans in user experience design and user interface operation and related design. Future courses can continue in this direction, considering the integration of students' expertise across different disciplines to appropriately develop related issues and projects.

2. Combining User Experience and User Interface: From the students' work in this course, it is possible to deepen the design of service blueprints and user journey maps in user experience, linking them to the user interface design process. This will benefit students in integrating their overall planning and actualizing it in practical projects.

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