Designing Project Courses with Purpose: How Benefiting Others Enhances Bachelor Student Motivation

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Abstract

Student motivation is a critical factor in computer science education, particularly in project-based courses where collaboration and sustained engagement are essential. Research in software engineering contexts shows that motivation strongly influences productivity and project outcomes, while low motivation is associated with project failure. In educational settings, this raises the question of how to foster not only external motivation, such as grades, but also intrinsic motivation, which is closely linked to deeper learning and long-term competence development.
This paper presents a case study from a Bachelor programme in Software Development, where project courses across three years have been designed to include elements of purpose by engaging students in projects that benefit others, such as health-related applications and real-world collaborations. The study is grounded in Illeris' theory of learning, which conceptualizes learning as an interaction between cognitive, emotional, and social dimensions.
Data were collected through course evaluations, student reflections, surveys, and teacher observations. The results indicate that students' experience increased motivation, improved collaboration, and deeper engagement when working on meaningful projects. Furthermore, students demonstrate signs of developing professional identity and reflecting on their roles within teams.
The findings suggest that incorporating purpose-driven project design into computer science education can enhance both learning processes and student motivation, contributing to more effective and meaningful educational experiences.

Keywords: *Computer Science Education, Project-Based Learning, Intrinsic Motivation, Empathy, Service-Oriented Learning*

1. Introduction

Student motivation is a central factor in successful learning, particularly in computer science education where project-based courses require sustained engagement and collaboration. In software engineering practice, motivation has been shown to significantly influence productivity, team performance, and project outcomes, while low motivation is associated with project failure [1][2].

In educational contexts, this highlights the importance of designing learning environments that support not only external motivation, such as grades and deadlines, but also intrinsic motivation. Intrinsic motivation is closely linked to engagement, persistence, and deeper learning processes, making it particularly relevant in complex and collaborative learning settings.

One approach to fostering intrinsic motivation is to introduce elements of purpose into learning activities. When students perceive their work as meaningful or beneficial to others, their engagement and commitment may increase. In computer science education, this can be achieved by designing project courses where students develop solutions for real-world problems, particularly in domains such as healthcare or social good.

This paper explores how purpose-driven project design, with a focus on benefiting others, influences student motivation and learning processes. The study is grounded in Illeris' theory of learning [3], which conceptualizes learning as an interaction between cognitive, emotional, and social dimensions.

The contribution of this paper is a case study from a bachelor's programme in Software Development, where project courses across three years have been designed to include elements of empathy and real-world impact. The study examines how these design choices affect students' motivation, collaboration, and learning.

2. Theoretical Background

2.1 Illeris' Three Dimensions of Learning

Illeris [3] describes learning as a process involving three interconnected dimensions, as outlined by Figure 1:

- Cognitive dimension, related to knowledge, understanding, and skills
- Emotional, or affective, dimension, including motivation, feelings, and volition
- Social dimension, involving interaction with others and the surrounding environment

Effective learning requires the integration of all three dimensions. The cognitive dimension alone is insufficient without emotional engagement and social interaction. Intrinsic motivation plays a key role in activating the emotional dimension, which in turn supports deeper cognitive processing.

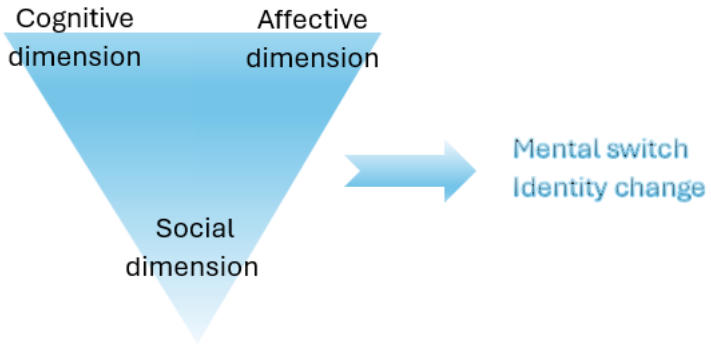

Fig. 1. the three dimensions that contribute to the outcomes that can be understood as a mental switch and identity change in software development students

The three dimensions jointly contribute to outcomes that can be understood as both a *mental switch* and an *identity change*. At the **cognitive dimension**, individuals revise their frames of reference, assumptions, and ways of interpreting situations, resulting in a mental switch toward new patterns of thinking. At the **affective dimension**, shifts in motivation, values, and emotional engagement support a deeper internalization of these new perspectives. Finally, at the **behavioral (or social) dimension**, sustained changes in actions, roles, and participation consolidate these transformations. Together, these dimensions interact to produce not only a temporary cognitive adjustment but a more enduring identity change, in which individuals come to see themselves differently in relation to their practices, roles, and communities.

2.2 Intrinsic Motivation and Empathy

Intrinsic motivation refers to engaging in an activity for its own sake, driven by interest, enjoyment, or perceived meaning. In contrast, extrinsic motivation is driven by external rewards such as grades or recognition.

Empathy and prosocial behavior have been shown to strengthen intrinsic motivation and support collaboration [4]. Activities that involve helping others can create a sense of purpose, which enhances engagement and persistence.

In educational contexts, this suggests that project design can play a crucial role in activating intrinsic motivation by connecting learning activities to meaningful real-world contexts.

2.3 Transformative Learning and Identity Development

Transformative learning involves changes in how individuals understand themselves and their roles, often described as shifts in perspective or identity [5]. Such changes are particularly relevant in professional education, where students gradually develop a sense of professional identity.

Project-based learning environments provide opportunities for such development, since students take on roles, collaborate in teams, and engage with realistic problems. These experiences can lead to increased self-awareness, confidence, and understanding of professional responsibilities.

3. Related Work

Student motivation and engagement have been widely studied in educational research. Fredricks, Blumenfeld, and Paris [6] conceptualize engagement as a multidimensional construct including behavioral, emotional, and cognitive components, highlighting the importance of addressing all three in effective learning environments.

Intrinsic motivation has been further developed within Self-Determination Theory (SDT) by Ryan and Deci [7], which emphasizes the role of autonomy, competence, and relatedness in supporting deep engagement and persistence in learning tasks.

Learning has also been described as a process involving identity transformation. Mezirow [8] argues that meaningful learning experiences can lead to changes in individuals' perspectives and self-understanding, particularly in contexts resembling real-world practice.

Additionally, research on achievement emotions underscores the role of emotions in the learning process. Pekrun [9] demonstrates how emotions, such as enjoyment and anxiety, influence motivation and performance, while Dahlqvist [10] shows how affective experiences shape students' learning in higher education.

Together, these perspectives suggest that learning environments should address not only cognitive aspects but also emotional engagement, intrinsic motivation, and identity development. This study builds on these insights by examining how purpose-driven project courses in computer science can support these dimensions through meaningful and socially relevant tasks.

4. Educational Context

The study is conducted within a three-year Bachelor programme in Software Development at Kristianstad University. The programme combines theoretical courses with project-based courses at the end of each academic year, where innovation is also a part of promoting engagement and motivation [11].

The project courses are designed to progressively develop students' technical skills, collaboration abilities, and professional identity.During the pandemic, the project courses continued to be delivered despite the challenges [*12*]. In addition, elements of purpose and empathy are introduced by framing projects around real-world problems, often related to healthcare or societal needs.

5. Method

This study is based on a qualitative case study approach. Data were collected from:

- Course evaluations
- Student reflections
- Surveys
- Teacher observations

Participation in surveys and reflections was voluntary.
The analysis focuses on how students' experiences relate to the three dimensions of learning proposed by Illeris: cognitive, emotional, and social. Particular attention is given to indicators of motivation, engagement, collaboration, and identity development.

6. Study Cases

Three case studies are presented as outlined in Table 1. The study cases reflect on courses students take during their first, second, and third years, respectively. The programme syllabus is, furthermore, addressed in [13].

Table 1. Study cases

Study cases	Project description	Role-forming identity	Providing support to users
Agile methodology Year 1	4-5 students/group Students are free to decide on projects that focus on mental health	Scrum master Developer Tester Supporter	Supporting individuals with mental health challenges
Android development Year 2	4-5 students/group Students work with companies to develop a prototype	Consultant	Companies, University researchers, Institutions
Software engineering Year 3	13 students/group Designing and developing from scratch Smart home system	Project manager Requirements manager Subgroup-leader Developer Tester	Smart home users, including families as well as institutions such as hospitals

6.1 Agile Methodology (Year 1)

Students work in groups of 4–5 to develop applications related to mental health, more exactly SDG 3.4 Good Health and wellbeing, is chosen by the teacher as a base for the project work, with purpose to reach the intrinsic motivation. They rotate between roles such as developer, tester, and scrum master.

The project emphasizes:

- Role exploration
- Reflection
- Empathy through application themes

6.2 Android Development (Year 2)

Students collaborate with external partners, such as companies or researchers, to develop mobile applications. They work in a consultant-like role, interacting with stakeholders and managing real-world requirements.

6.3 Software Engineering (Year 3)

Students work in larger teams (approximately 13 students) to design and develop complete systems, such as smart home solutions. The project simulates professional environments with multiple roles and sub-teams.

7. Results and Analysis

Transformative learning (TL) can be understood as a form of confirmation for us as educators that students' learning has taken place. This confirmation is reflected in multiple sources, including students' responses in course evaluations and questionnaires, their project presentations, and the ongoing dialogue between teachers and students throughout the course of the project. Through these interactions, it becomes evident that students develop in terms of their identity. For example, one student may come to realize that they do not enjoy working in a leadership role, while another discovers a strong affinity for leadership and subsequently expresses an interest in further education or courses related to leadership.

The results are first briefly reflected from the perspective of Illeris' dimensions of learning and then motivated through levels of course evaluations and observations of students' attitudes.

7.1 Cognitive Dimension

Students demonstrated increased ability to apply knowledge in complex and realistic contexts. Projects required integration of skills across programming, system design, and collaboration.

7.2 Emotional Dimension

Students reported increased motivation, particularly when projects were perceived as meaningful.
Students also appreciated having autonomy in project design, which contributed to engagement and ownership.

7.3 Social Dimension

Collaboration improved across all project courses. Students developed communication skills and a better understanding of team roles.
Working with external stakeholders further strengthened their ability to interact in professional contexts.

7.4 Identity Development

Students showed signs of developing professional identity. Some discovered preferences for specific roles, while others gained confidence in their abilities. These changes indicate elements of transformative learning, where students not only acquire knowledge but also reshape their understanding of themselves.

7.5 Agile Methodology Course

The result from the survey regarding motivation, students feel that they were more motivated to learn because they got free hands to decide what kind of app to develop (even though teachers decided the theme of mental health), instead of teachers deciding the exact application to develop. Students felt that changing roles engaged them to search for more knowledge before they turn over their role work to the next student. Walking in others' shoes gave students insight into how much knowledge they have and what to work on more.

The weekly reflections indicate a progressive development consistent with transformative learning theory. Early reflections show students critically engaging with initial assumptions regarding teamwork, roles, and project planning. As the project advanced, students described changes in perspectives related to collaboration, tool usage, and problem-solving, supported by increased reflection, dialogue, and adaptive action. By the final phase, students demonstrated not only improved technical competence and stable teamwork but also evidence of perspective transformation, expressed through enhanced professional confidence, clearer role awareness, and emerging insights into personal preferences for responsibility and leadership. These findings suggest that learning extended beyond skill acquisition to include shifts in students' frames of reference and professional identity.

> The cite is taken from the course evaluation findings:
> ***It was as really beneficial to work in a "work like" environment prior to working in the industry and building up team related skills and trying out different roles. This is especially beneficial as it gave creative freedom to a degree to do what we want to and expand our own skill set based off of that which was a lovely experience.***

Myrmydon [14] is one of the many examples, including applications developed by students with a focus on mental health, striving to help another human.

7.6 Android Development Course

The results from Android development projects on motivation and on working with customers as consultants point out that many students felt it was challenging to work with companies, but they did develop a successful application in the end. Students also felt that it was much time-consuming and wished for longer time to develop. Students also reported that they got proper experience and company connections. Students had varying perspectives on their skills and future professional development, with some being less focused on it and others expressing interest in working as consultants in the mobile industry. This way of working was positively received and recommended by students for continued implementation in the programme.

Reflections about motivation and working with customers shared by two students:

- ***Both hurt my confidence and patched it up and rebuilt it.***
- ***This course has helped me develop my skills a lot and even realise a lot of my strenghts and weaknesses.***

One example of Android app developed in cooperation with company, app that prevents littering [15].

7.7 Software Engineering Course

Teachers observed that students felt frustrated at the beginning of the project, where students needed to find their own place in the group. Many students struggled to see how the project would progress, how collaboration would function, and what the completed project would ultimately look like. To address this challenge, teachers recommend the group leaders based on students' grades and communication abilities demonstrated in previous courses. It was beneficial that the projects were designed with the purpose of benefiting their target users. The leaders used the knowledge about the target users to gather the group and provide with a clear goal both in technical area, but also to develop a product that focuses on product users, families, disabled people or hospitals. Reaching the end of the project, students realized and felt safe in what their role is and what they shall deliver, how communication flows and what tools are used. Students felt very proud of their own achievement at the end of the project.

Student's reflection on motivation and on project role:

- ***It succeeds in forcing students into a real life scenario of being a part of a company. The instructors gave us freedom of choice to some extent to direct the project on own, which leaves room for creativity.***

One example of Smart home system developed, where BCI (brain computer interface) is used to interact with the house [16].

8. Discussion

The findings suggest that purpose-driven project design can positively influence all three dimensions of learning.

- The cognitive dimension is strengthened through complex, real-world problem solving
- The emotional dimension is activated through meaningful and empathetic contexts
- The social dimension is enhanced through collaboration and interaction

The use of empathy as a design principle appears to be particularly effective in fostering intrinsic motivation. When students perceive their work as meaningful, they become more engaged and invested in the learning process.

The findings align with prior research on engagement and motivation. In line with Fredricks et al. [6], students show not only behavioral participation but also emotional and cognitive engagement in meaningful project contexts. The course design supports intrinsic motivation as described by Ryan and Deci [7], through autonomy, competence development, and collaboration.
Students' reflections further suggest elements of identity development, consistent with Mezirow [8], while the observed role of emotional involvement aligns with research on achievement emotions by Pekrun [9] and Dahlqvist [10].

However, not all students are equally motivated by empathy-based approaches. Future work should explore how different motivational strategies can be combined to support a broader range of students.

9. Conclusion

This paper demonstrates that integrating purpose and empathy into project-based courses can enhance student motivation, engagement, and learning. By aligning project work with real-world needs, students not only develop technical skills but also gain a deeper understanding of their roles as future professionals. The results suggest that purpose-driven design should be considered an important component in the development of computer science education.

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