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Towards a Technology-Enhanced Team Coaching Framework for Higher Education

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ABSTRACT

Numerous researchers have suggested that with the advent of the digital transformation and generative AI, teachers will need to take on the role of coaches. In support of this ubiquitous transition, this paper presents a coaching framework designed through design-based research and developed iteratively in an undergraduate computer science course in project management. The framework integrates person-centered coaching, agile practices, visualization and management tools, and generative Artificial Intelligence (genAI) to enhance students' collaborative skills and engagement. Person-centered coaching emphasizes individual student needs, active listening, and personal growth. Agile practices encourage iterative progress, continuous feedback, and adaptability. Visualization tools support transparency, structured workflows, and dynamic project management, improving team coordination and understanding. Generative AI tools, including ChatGPT, assist in ideation, content creation, and problem-solving, fostering creative thinking. These professional competencies are required for preparing students for the future workforce. The paper outlines the framework's conceptual foundation, initial evaluation of its components based on students' practical application, its adaptability to various educational contexts, including remote and hybrid settings. The paper also addresses benefits such as increased motivation, improved teamwork, and better preparation for professional work. Future research will evaluate the framework's impact on teamwork, learning outcomes, and student's professional development.

Keywords: Agile coaching, Person-centered coaching, Agile practices, Computer science, Higher education, Generative AI in education, Professional competencies, Collaboration tools, Co!Coach

INTRODUCTION

In today's rapidly evolving academic and professional environments, the demand for computer science students to possess not only technical competencies but also effective collaboration, communication, and self-management skills has increased significantly.

In this regard, agile practices, reflective practices, and emerging digital tools like generative AI (genAI) present unprecedented promising opportunities for facilitating this development. However, the integration

of these practices and the development of competences to employ them effectively and responsibly in higher education means a major organization development step needing thoughtful, timely and proactive support (Brevik et al., 2019; Lam et al., 2022).

To address this challenge, this paper presents Co!Coach, a collaborative coaching framework designed and adapted over several semesters to assists student teams in achieving enhanced project outcomes while fostering (inter)personal growth. The framework integrates structured agile practices, visual methods for progress and ideation, AI tool usage, and a person-centered coaching philosophy. The primary aim of this paper is to introduce the framework, describe each of its components, and explore and analyze student teams' initial application of its components in undergraduate computer science courses to gauche further refinement of the coCoach framework guided by Design Based Research (DBR). In this paper we answer the following research questions:

RQ 1: Which benefits and potentials for improvement do students report when exposed to prototypical realizations of each of the four components of the Co!Coach framework?

RQ 2: Which benefits, and potentials for improvement does the coach derive from their first experience in coaching student teams using the initial concept of Co!Coach?

BACKGROUND AND THEORETICAL UNDERPINNING

Agile Practices in Education

Agile methodologies, originally developed for Software Development, have been adapted for the use in higher educational settings. They support an iterative and incremental approach to project work, with a strong emphasis on continuous improvement. Their integration into the educational settings help students gain essential skills that are required by the industry (Neumann & Baumann, 2021). By applying agile practices students enhance their critical thinking, problem-solving, communication skills and overall team motivation (Al-Ratrout, 2019; Choque-Soto & Sosa-Jauregui, 2024). Moreover, they become better prepared for the demands of the professional world (Aggrawal & Magana, 2023; Dolezal & Motschnig, 2023).

Visualization and Management Tools

Project management tools such as Trello, Asana, Jira and so on, help developers to plan their work which contributes to achieving the desired results (Özkan & Mishra, 2019). A project management tool has the functionality to plan, execute and monitor the project progress as well as time, cost and resources (Arya & Kulkarni, 2024). According to (Baul et al., 2024); project management tools help organization to save more money. Visualization tools need to be interactive and show data in real-time (Ali et al., 2016). Such tools are designed to improve teams' communication, collaboration and they make communication easier and more transparent (Castro-Arquinigo et al., 2023). Collaborative tools such

as online whiteboards, are particularly valuable in remote teaching sessions (Lam et al., 2022).

Person-Centered Coaching in Agile Education

Coaching plays a crucial role in supporting students' development of key professional skills such as communication, collaboration, critical thinking, and goal orientation (Gestwicki & McNely, 2016; Morales et al., 2017; Kinzel et al., 2015). Research has also shown that coaching can positively impact academic performance and student retention (Plotkowski & Joseph, 2011; Thomas et al., 2014; Morales et al., 2017).

A particularly effective approach within educational coaching is the person-centered model, originally developed by the psychologist Carl Rogers. This meta-theoretical framework emphasizes the belief that individuals possess an inherent capacity for growth and self-actualization, which can flourish in a supportive environment where they feel unconditionally accepted (Joseph, 2006; Rogers, 1963).

In person-centered coaching, the coachee is positioned at the center of the developmental process, with an emphasis on autonomy, intrinsic motivation, and self-determination rather than external direction (Rogers, 1961). A trusting relationship between coach and coachee is essential. Coaching goals should be clearly defined and mutually agreed upon, enabling the coachee to actively shape their own journey (Van Zyl et al., 2016).

The Role of Generative Artificial Intelligence in Team Learning

Generative Artificial Intelligence (genAI) has transformed traditional teaching by introducing innovative approaches that support students in developing professional skills such as teamwork (Amar & Benchouk, 2024), conflict management (Aggrawal & Magana, 2024), communication (Dai et al., 2024), and problem-solving (So et al., 2024). These tools offer students possibilities to enhance their motivation (Šumak et al., 2024), and receive personalized feedback (Ahmed et al., 2024) on their writing. GenAI tools, such as ChatGPT, are increasingly integrated into agile educational environments to support ideation, documentation, and conceptual exploration. These tools assist students in generating content, summarizing discussions, and exploring methodologies like Scrum or Kanban. Embedding AI tools into platforms like Miro or Mural enhances usability and collaborative learning.

METHODOLOGY

The research objective is to design and develop a coaching framework for undergraduate computer science students to enhance teamwork, communication, and professional competency development. The research follows design-based research (DBR) according to Euler's approach (Euler, 2014) which is well-suited for exploratory, iterative and incremental development in an academic context. Figure 1 shows the phases of DBR as arranged in a cycle as suggested by Euler (Euler, 2014), whereby the current study followed the first three phases. The coaching framework was developed

through an iterative, experience-based design process: For several semesters, part of the framework underwent refinement through its direct application in project-based learning environments, with feedback from students playing a pivotal role in this process (Tudor et al., 2024). Development activities included: 1) Focus groups with students from a project management course to identify common challenges in team collaboration and communication. 2) Team coaching sessions where person-centered coaching methods were piloted to support team development and individual growth. 3) Pre-surveys that explored student perspectives on why previous project teams struggled (Tudor et al., 2024). Overall, the DBR contributed to the theoretical and practical foundation of the Co!Coach framework.
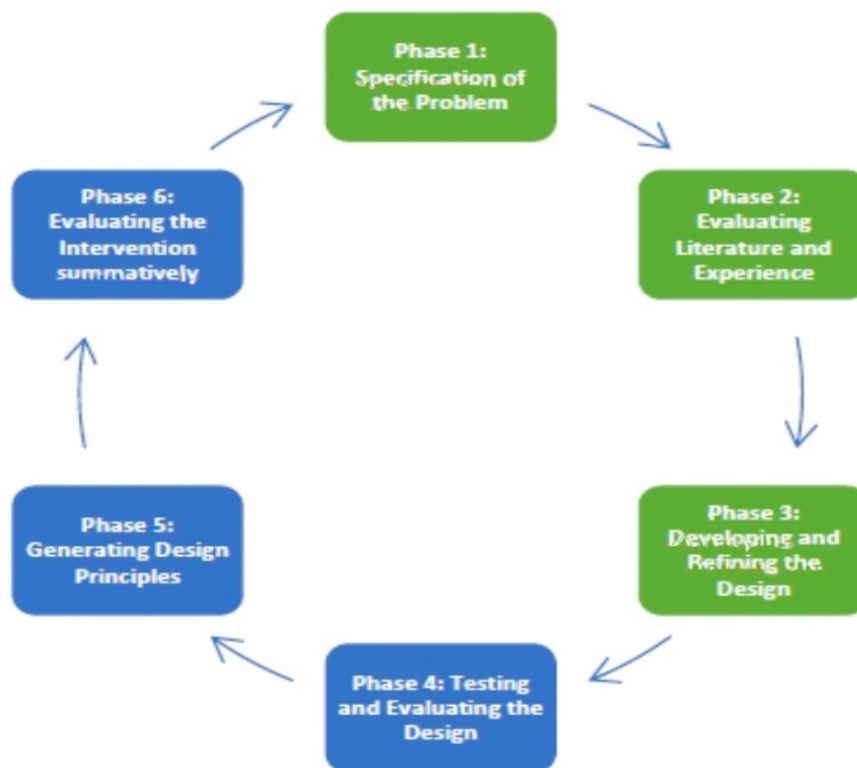

Figure 1: Design-based research based on Euler (Euler, 2014, p. 20) (authors' simplified visualization).

FINDINGS ALONG THE DBR CYCLE

Phase 1: Specification of the Problem

The process began with the initial step involved to identify the need of a structured coaching framework to support higher education students in their teamwork projects. A problem analysis was done through a comprehensive literature review and observations of project-based teamwork. The review focused on 1) the application of agile methodologies in education, 2) the required professional competencies in modern work environment,

3.) the usage of digital and AI-enhanced tools in collaborative learning, and 4) coaching approaches applicable to educational contexts. Surveys and feedback from students highlighted persistent challenges in team projects, such as poor communication, unequal workload distribution, and a general lack of planning and motivation of team members (Tudor et al., 2024). These findings presented the gap between students' team experiences and the required demands of professional competencies, such as critical thinking, collaborative and communication skills, as well as the limited use of agile practices and coaching techniques in a university setting.

Phase 2: Evaluating Literature and Experience

Based on insights from the literature review and prior team coaching sessions, a conceptual framework was developed that integrates agile elements such as retrospectives, the use of weeklies, work tracking in online task boards and coaching interventions into students' teamwork projects.

In several coaching sessions, held both remotely and in person, student teams were supported in dealing with self-identified, yet broadly occurring challenges such as lack of workload management, communication, and planning. One team, for example, struggled to meet a milestone deadline due to a late start and poor distribution of work. In response, the coach introduced agile tools such as a Kanban board to help visualize the workflow, define due dates for individual tasks, and assign responsibilities more transparently. Weekly check-ins ("weeklies") were introduced in the spirit of daily standups to introduce essential sharing, yet better-fit students' schedules than daily meetings. These regular sessions helped the team reflect on their progress and identify what was still missing. By visualizing their tasks, the team gained a better understanding of their workload and improved their time management.

Another team independently decided to implement two fixed days per week for internal progress reviews, demonstrating increasing self-organization and responsibility. These interventions not only supported the teams in managing their projects more effectively but also provided valuable insights into how coaching and agile methods can be tailored to fit the needs of student teams. Building on these empirical observations, reflective practices, and experiences, a structured coaching framework, named Co!Coach (collaboration Coach) was developed.

Figure 2 gives an overview of the Co!Coach framework, which comprises four core components: agile practices, person-centered coaching, visualization and management tools, and generative Artificial Intelligence tools. Each component includes a set of elements, such as tools, techniques, and practices, that are adjusted to boost students' teamwork, communication, and professional competency development.

Phase 3: Developing and Refining the Design

Core elements of each component of the Co!Coach framework were put into practice and evaluated with student teams over the course of three semesters, helping to respond to the first research question.
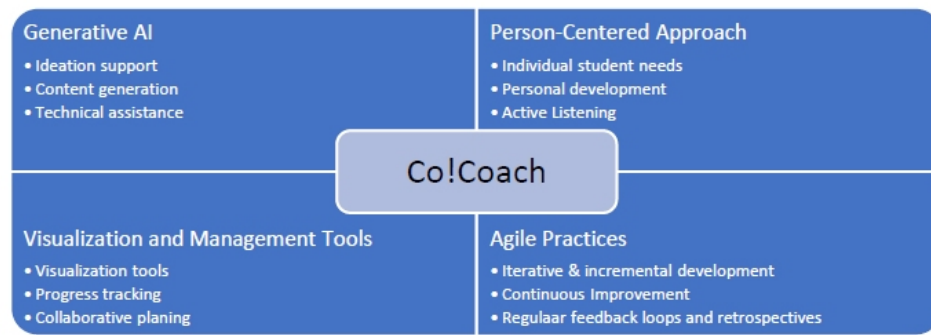
Figure 2: Components of the coaching framework.

Agile practices were represented by the usage of kanban boards, which were used by student teams to visualize tasks and track the project's progress. This helped work to be distributed equally and created transparency of what is still to be done. Students reported that they learned new tools and techniques through this process and found them helpful for organizing their teamwork more effectively.

In particular, the retrospective sessions stood out as a valuable tool for reflection. These sessions enabled teams to better understand the challenges they faced, explore root causes, and collaboratively develop strategies for improvement. Students highlighted that retrospectives contributed to building a more supportive team environment and helped them develop skills for giving and receiving constructive feedback.

Person-centered coaching was demonstrated by the coach's emphasis on openness, active listening (Rogers & Farson, 1987), and communication at eye-level during coaching interventions. By creating a space of acceptance, respect and non-judgement students felt empowered to reflect on their teamwork and to identify obstacles, areas for improvement and to define actionable steps. This created a sense of ownership and helped resolve team conflicts or misunderstandings. Students reported that communication within their teams improved significantly as a result of the structured and empathic moderation provided during the coaching sessions. The guided conversations supported better alignment and contributed to a stronger team spirit over time. However, some students expressed a desire for more in-person coaching sessions, suggesting that face-to-face interaction could further strengthen team cohesion and trust.

In addition, several students had initially expected more topic-specific support, particularly related to project management. While this was not an explicit goal of the coaching role, it highlights the importance of clearly communicating the focus of coaching versus mentoring or technical advising. Going forward, one possible enhancement could be that coaches encourage students to use genAI tools to independently explore project management methods or domain-specific knowledge, thereby maintaining the coaching stance while still guiding students toward useful resources.

Visualization and management tools such as Miro, facilitated collaboration in remote sessions as well as in person. Students noted that learning to use tools like Miro helped them make their work progress more visible and supported them in planning the tasks required for each milestone. This led to greater transparency and improved efficiency in task management across the team. One example was the incorporation of online whiteboards during retrospectives. Student feedback highlighted the positive impact of the retrospective sessions, which helped student teams to reflect on what went well and what didn't go well to identify areas for improvement and to define concrete action items for the upcoming milestone. The implementation of such tools increased the collaborative environment in a remote session.

Generative AI tools were used by students for a variety of learning purposes, including clarifying terms and concepts, generating ideas, and improving their writing. They particularly appreciated the interactive nature of the tool, the immediacy of the feedback, and the innovative application of AI as a learning companion. Many highlighted how quickly and easily they could gain an initial understanding of new domains. At the same time, students noted concerns regarding the reliability of the responses and the risk of misinterpretation of their input, emphasizing the need for critical reflection.

Throughout the coaching period, qualitative and quantitative data was collected through student feedback, observations, focus groups, and surveys (Tudor et al., 2024). Students were invited to share their experience with the coaching process and the learned techniques as well as the usefulness of tools and practices and their perceived development of team-related competencies. Interview results indicated that students increasingly took ownership of task planning and appreciated having dedicated time for structured reflection and alignment.

Summarizing, the coaching succeeded in fostering self-organization, reflection, collaboration within student teams, and a constructive feedback culture. While RQ1 asking for the benefits, and potentials for improvement of Co!Coach's components has been answered above, the response to RQ2 addressing the coach' perceptions follow below.

The initial Co!Coach framework also provided valuable insights from the coach's perspective. The coach (first author) observed that some team members naturally took on the roles of facilitator and moderator during remote and in-person meetings. Additionally, students who were initially shy at the beginning of the coaching interventions became more open after some time. There was also a noticeable shift towards more proactive behavior in terms of self-organization and shared ownership of tasks. The coach observed improvements in team dynamics, with team members identifying challenges or issues earlier in the project. They also reported needing support more regularly and proactively. Moreover, the coach noted the high level of productivity during a more structured session, where students were encouraged to use different creative tools and techniques. The teams generated ideas quickly and collaborated effectively throughout the process.

One challenge that emerged was coordinating shared timeslots among team members. Additionally, students reported limited availability for coaching sessions due to the high volume of other commitments.

The next three phases of the DBR approach are going to be applied in upcoming semesters to systematically evaluate the effectiveness, usability and adaptability of the Co!Coach framework.

DISCUSSION

The initial application of the Co!Coach framework suggests that the integration of agile methods, person-centered coaching, digital visualization, and management tools, and genAI can significantly enhance students' teamwork and self-organization in higher education project settings. Students reported improvements in communication, task planning, and reflection, while also developing soft skills such as leadership and a better feedback culture. These insights support prior research on the effectiveness of agile and coaching practices in education, while also contributing a novel integration of genAI in the coaching process while calling for critical reflection of this innovation.

From the coach's perspective, the evolving group dynamics and increased proactivity of student teams indicate the potential for Co!Coach to support professional competency development in student projects.

However, several limitations emerged. First, some students expected more topic-specific guidance, such as project management support, which was outside the scope of the coaching role. This suggests the importance of clearly communicating the distinction between coaching, mentoring, and advising at the start. Second, the mix of in-person and remote sessions was well received, but students expressed a preference for more face-to-face interaction, highlighting the role of physical presence in building team trust and cohesion. Third, while generative AI tools were valued, concerns about reliability and misinterpretation indicate the need to further support critical digital literacy among students.

The study's limitations include a relatively small sample size and its setting within a large European university, which may affect the generalizability of the findings to other cultural or institutional contexts. Additionally, the research focused only on the first three phases of the proposed cycle, leaving the later stages unexamined. These factors highlight the need for further studies with more diverse samples and a complete implementation of the framework.

CONCLUSION

This paper introduced Co!Coach, a coaching framework that integrates agile practices, visualization and management tools, AI-enhanced tools, and person-centered coaching to support undergraduate students' team collaboration.

Iterative, formative evaluation of the concept following DBR showed several benefits, including improved team communication, better workload

distribution, increased motivation, and the development of leadership skills. The use of digital tools including genAI fostered, in particular, transparency and proactive collaboration leading to students' increased satisfaction and superior project outcome.

The coach also observed better team dynamics and an increase in students' leadership skills. The structured sessions helped students tackle challenges early and engage proactively in their personal development. Further work is underway to overcome current limitations by exploring broader applications and refining the framework based on feedback, theory, and experience. The authors warmly welcome interested colleagues to join our endeavors in applying, refining, and evaluating the initial Co!Coach framewok and supporting students' team projects, their qualification for professional work. as well as staff in maturing in their role as coaches.

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