Research Article

The Tutorial Educational Program (TEP): A Structured Model for Student Engagement in Higher Education

Claudio D. G. Linhares[*,1]

[1] Department of Computer Science and Media Technology, Linnaeus University, Växjö, Sweden

*Corresponding author. E-mail: claudio.linhares@lnu.se

Abstract: This paper presents the Tutorial Educational Program (TEP), an initiative designed to enhance academic engagement through integrated experiences in teaching, research, and community outreach. Inspired by the Brazilian Programa de Educação Tutorial (PET) and adapted to a Swedish higher education context, TEP offers undergraduate and master's students structured opportunities to participate in departmental activities while developing critical, collaborative, and leadership skills. The program addresses challenges such as low retention in technology-related fields and employs a selective admissions process that emphasizes academic performance, motivation, and gender balance. Students work as part-time assistants under faculty supervision across three interconnected pillars. TEP follows a cyclical operational methodology of recruitment, participation, evaluation, and transition. This study evaluates TEP using multi-stakeholder survey and interview data, showing that participants perceive gains in pedagogical competence, academic identity, research understanding, and time-management skills. Teachers and administrators report increased reliability, continuity, and reduced coordination workload, while broader benefits for departmental teaching and outreach are identified. Early experiences indicate other benefits, including reduced administrative workload, continuous teaching and outreach support, and development of transferable skills. These findings highlight

DOI: https://doi.org/10.5324/njsteme.v10i1.6485

the potential of structured mentorship programs to support student development, research readiness, and institutional collaboration in higher education.

Keywords: Tutorial Educational Program, Student Engagement, Mentorship, Teaching Assistantship, Research-Based Learning, Community Outreach

1 Introduction

Higher education across Europe increasingly emphasizes integrating students into authentic academic practices beyond traditional coursework. Active participation in research, teaching, and outreach has been shown to improve student motivation, deepen learning, and strengthen academic identity (Pilkington, 2010; Brew, 2013; Leong & Ma, 2019). Yet, many programs, particularly in STEM fields, still offer limited opportunities for students to engage in such practices before graduation. This lack of early academic exposure can lead to lower retention rates and a weaker connection between formal learning and professional or research-oriented careers (Rosenzweig et al., 2024; Wong et al., 2022; Belser et al., 2018).

In response to these challenges, several studies have explored structured models that integrate students into teaching, research, or learning-support roles. However, much of the existing literature focuses on course-level learning assistants or discipline-specific pedagogical interventions (Barrasso & Spilios, 2021; Vihavainen et al., 2011), often addressing a single dimension of academic engagement. As a result, integrated models that combine teaching, research, and outreach within a unified program remain underexplored, particularly regarding how they are experienced by different stakeholders within a department (Odden et al., 2023).

In Sweden, universities have long promoted equality, collaboration, and reflection as key elements of education. However, even within this strong pedagogical culture, smaller and mid-sized institutions often face difficulties in recruiting and retaining students for advanced research and teaching roles. These challenges are particularly visible in technology-related disciplines, where industry positions are often perceived as more attractive and secure than academic careers (Li et al., 2025; Kallo & Välimaa, 2025). Consequently, there is a growing need for structured initiatives that cultivate early academic engagement and introduce students to teaching, research, and community involvement within the university environment.

One long-standing example of such a structured initiative is the Brazilian Programa de Educação Tutorial (PET). PET is a Brazilian program that, for over four decades, has combined mentorship, research, teaching, and civic engagement in higher education (Dieb, 2023; Lima & Menezes, 2025). Although PET was designed for the Brazilian context, its pedagogical foundations, experiential learning, structured mentorship, and social responsibility align closely with Nordic educational values (Kallo & Välimaa, 2025). PET demonstrates how sustained, program-level engagement can foster academic identity while simultaneously supporting institutional and societal goals.

This paper introduces and evaluates the Tutorial Educational Program (TEP), inspired by the Brazilian PET model and developed at Linnaeus University in Sweden. TEP provides

undergraduate and master's students with structured, part-time opportunities to contribute to teaching, research, and community outreach within their department. While drawing on PET's core principles, the program adapts them to the Swedish higher education context by integrating dimensions of teaching assistantship, research assistantship, and outreach into a cohesive, sustained model. Through this integration, TEP aims to prepare students for future academic or professional roles while also supporting institutional needs, including course support, research continuity, and public engagement. Students participate as paid assistants, receiving mentorship and supervision while developing transferable skills in communication, teamwork, and leadership.

Building on this program description, the paper presents an exploratory, multi-perspective evaluation of TEP based on survey data from TEP student participants, complemented by qualitative input from teaching and administrative staff. The novelty of the study lies in its holistic focus: rather than examining student engagement or assistant roles in isolation, it captures how an integrated assistantship model operates across individual, pedagogical, and institutional levels. By foregrounding lived experiences, workload balance, and perceived value across stakeholder groups, the paper contributes empirical insight into students-as-partners initiatives and structured assistantship models, highlighting their potential to support student development while addressing broader departmental and institutional needs in higher education.

2 Conceptual and Theoretical Background

2.1 Related Student Assistant Models in Higher Education

Related initiatives in higher education have explored the use of advanced students as teaching or learning assistants to enhance student engagement and learning outcomes. One prominent example is the Learning Assistant (LA) model, which has been widely implemented and studied across STEM disciplines. Research on LAs has shown positive effects on course participants' learning, increased use of active learning practices, and professional development for the assistants themselves (Barrasso & Spilios, 2021). Nordic implementations of the LA model further demonstrate its potential to support instructional quality and contribute to institutional change when embedded within departmental structures (Odden et al., 2023).

Closely related approaches have emerged under different terminologies and pedagogical traditions. In many higher education contexts, students who support teaching and learning activities are commonly referred to as Teaching Assistants (TAs), or in some pedagogical frameworks, Learning Assistants (LAs). In mathematics and computer science education, for example, the extreme apprenticeship method emphasizes intensive guidance by more experienced peers and instructors, with a strong focus on improving learning outcomes for course participants (Vihavainen et al., 2011; Rämö et al., 2021). While these models vary in scope and terminology, they share a common emphasis on peer-supported learning, situated practice, and gradual progression toward independence.

TEP aligns with these established models in its use of experienced students as assistants and mentors, but differs in its broader, more integrated design. Rather than

focusing primarily on course-level learning outcomes, TEP explicitly combines teaching assistantship, research involvement, and community outreach within a single, structured program. This integration extends the role of student assistants beyond individual courses, positioning them as contributors to multiple academic functions and as partners in departmental activities. As a result, TEP shifts the analytical focus from isolated teaching interventions toward a department-level model of student engagement, raising questions not only about student learning but also about impacts on teaching staff, institutional practices, and academic culture.

TEP is grounded in student-centered and experiential learning, emphasizing active participation, reflection, and collaboration. These approaches view students as co-creators of knowledge, developing understanding through social interaction and engagement with real-world experiences (Biggs & Tang, 2011; Kolb, 2014; Leong & Ma, 2019). Experiential learning within TEP involves a cycle of practice, reflection, and feedback, allowing students to integrate theory and practice while building academic identity and transferable skills (Prince, 2004; Brew, 2003).

Mentorship is central to TEP and operates at multiple levels. Faculty mentors guide students in teaching and research tasks, peer mentors support newcomers, and institutional coordination ensures alignment with departmental and personal goals (Haeger & Fresquez, 2016; Berinšterová, 2020; Radlick & Mevatne, 2023). This layered support system balances autonomy and guidance, helping students transition to independent inquiry while creating equity, inclusion, and a sense of belonging (Tight, 2020).

2.2 The Brazilian Programa de Educação Tutorial (PET)

TEP draws its main inspiration from the Brazilian Programa de Educação Tutorial (PET), a federal higher education initiative that organizes small groups of undergraduate students under the long-term supervision of a faculty tutor. PET aims to integrate research, academic development, and community outreach beyond the traditional curriculum, fostering excellence, social responsibility, and student autonomy (Lima & Menezes, 2025). Each tutorial group typically consists of up to 12 scholarship holders or volunteers who work collaboratively over multiple years, gradually developing technical, scientific, and leadership competencies. The program emphasizes the close connection between research and outreach, offering students sustained opportunities to contribute meaningfully to both their academic field and society. While PET does not formally include teaching as a core pillar, since course monitoring and tutoring are organized through separate institutional contracts, students engage in related educational activities, such as peer mentoring, developing didactic materials, and organizing seminars and workshops.

Typical PET activities are primarily focused on research and outreach. In research, students participate in faculty-led projects, contribute to data collection and analysis, support publications, and explore innovative methodologies. Outreach activities include organizing community events, public lectures, educational workshops, and programs targeting underserved groups, such as courses for the elderly or school-based science initiatives. PET groups also commonly support academic competitions and challenges, such as programming hackathons, and organize conferences, seminars, and poster

sessions to disseminate work. Empirical studies indicate that participation in PET supports the development of a wide range of transferable skills, including communication, teamwork, leadership, creativity, and reflective practice (Morel et al., 2020).

The program is financially supported by the country's government through scholarships for both students and tutors, enabling sustained engagement without compromising academic performance. By combining structured mentorship with active participation in research and outreach, PET promotes holistic academic development and professional preparation. Research has shown that PET participation contributes to students' academic literacy and writing practices across disciplines, strengthening their relationship with knowledge production and communication (Dieb, 2023). The program's long-term design further encourages progressive responsibility, as senior students mentor newcomers and take part in planning and coordination activities, reinforcing collaborative learning and leadership.

PET's impact extends beyond individual participants. Tutorial groups frequently collaborate with local schools, community organizations, and industry partners, strengthening ties between universities and society while fostering civic engagement and critical thinking. The program has been widely recognized for reinforcing academic identity, supporting student retention, and preparing graduates for complex professional and societal challenges (Lima & Menezes, 2025; Morel et al., 2020). For these reasons, PET provides a robust and well-documented reference point for initiatives such as TEP, which adapts its core principles to new institutional contexts while extending the model to formally include teaching assistantship in response to specific departmental needs.

While PET emphasizes research and outreach, TEP adapts its principles to the Swedish context and formally incorporates teaching assistantship. This addition addresses institutional needs while enhancing students' pedagogical and communication skills, supporting early academic engagement and professional development. The integration of experiential learning with structured mentorship aligns with evidence suggesting that guided participation improves retention, engagement, and career readiness in STEM disciplines (Belser et al., 2018; Li et al., 2025).

TEP is particularly relevant to Nordic STEM education, where universities face challenges in recruiting and retaining students in academic pathways (Thunborg & Bron, 2012). By providing structured, compensated opportunities to engage in teaching, research, and outreach, the program strengthens students' professional identity, curiosity, and skills while supporting institutional capacity. TEP thus bridges learning, career development, and societal engagement in higher education, reflecting broader trends in Nordic higher education policy that emphasize experiential learning and student participation as key instruments for educational quality (Kallo & Välimaa, 2025).

3 The Tutorial Educational Program (TEP)

TEP was developed as a structured model for integrating students into academic activities through a coordinated framework that combines teaching assistantship, research assistantship, and community outreach. Its primary goal is to enhance student learning and engagement while also supporting the department's operational and pedagogical needs. This section describes how the program is organized and

implemented in practice, providing an overview that can serve as a guide for replication in other Nordic higher education contexts. More detailed information about the program at Linnaeus University is available on the TEP webpage: https://lnu.se/en/tep.

3.1 Program Structure and Pillars

TEP is built upon three interconnected pillars: teaching assistantship, research assistantship, and community outreach. Teaching assistantship involves supervising laboratory sessions, mentoring peers, assisting with grading, and supporting instructors. Research assistantships engage students in active projects, including data collection, analysis, software prototyping, or documentation. Community outreach includes public-facing activities such as workshops for school students, open-house events, or digital literacy initiatives.

Each pillar reinforces the others, ensuring participants experience knowledge creation, knowledge sharing, and social engagement. Students often move between roles, gaining confidence in teaching, research, and outreach. This integration promotes reflection, adaptability, and the development of both technical and transferable skills, including communication, teamwork, and leadership. By engaging in all three areas, students are exposed to the full spectrum of academic work and learn to navigate complex university environments.

3.2 Recruitment, Participation, and Academic Balance

Student recruitment occurs once per academic term (every six months) and follows transparent selection criteria that prioritize academic performance, motivation, communication skills, and diversity. Candidates must have completed at least one year of undergraduate study to ensure sufficient disciplinary knowledge. Interviews assess initiative, collaboration, and interest in extending learning beyond coursework, while gender balance and representation in underrepresented technology fields are also considered.

Participants are employed on part-time contracts, typically 25% for limited engagement focused on teaching assistance and community outreach, or 50% for full involvement across the three pillars (teaching, research, and outreach). This allows students to engage meaningfully without compromising their studies. Undergraduates usually support teaching and peer mentoring, while master's students may take on more advanced research or leading roles. Workload is monitored and adjusted during high-demand academic periods to maintain a balance between program involvement and coursework. This flexible structure encourages students to integrate program activities into their academic experience rather than treating them as extracurricular work.

3.3 Supervision, Coordination, and Mentorship

TEP is coordinated by a faculty supervisor who manages contracts, assigns responsibilities according to skills and interests, and ensures alignment with departmental priorities. The supervisor provides direct mentorship and acts as a bridge

between students and faculty. Experienced participants can also take on student leader roles, facilitating communication, organizing schedules, mentoring peers, and ensuring smooth task distribution.

This layered approach creates a support network that balances autonomy and guidance, creating peer mentorship, and strengthens program sustainability. Monthly meetings follow a structured agenda to support transparency, accountability, and shared learning. Each participant reports on their activities within the three pillars and reflects on outcomes, challenges, and lessons learned. Participants present summaries of any research progress, teaching support experiences, or outreach initiatives they were involved in during the month. The group also discusses coordination issues, resource needs, and upcoming priorities, raising problems as they emerge so solutions can be collaboratively developed and implemented on time.

Biweekly meetings are smaller and more operational, led by student leaders, and focus on short-term planning, task distribution, and peer support. Participants use this time to clarify upcoming responsibilities, adjust schedules, and exchange practical advice, providing early feedback before the monthly meeting. If needed, individual meetings with the coordinator can occur between scheduled sessions, usually in response to specific demands or personal development needs. These one-on-one meetings support personalized mentoring, allowing participants to discuss performance, career goals, and challenges in a confidential setting, thereby strengthening academic persistence, equity, and confidence for students exploring advanced studies or academic careers.

3.4 Operational Cycle and Institutional Integration

TEP operates through a four-phase cyclical model: recruitment and selection, participation, evaluation and renewal, and transition (see Figure 1). Students are assessed on academic progress, collaboration, and initiative rather than rigid output metrics. Those performing well can take on additional responsibilities such as mentoring or coordination, while those struggling academically may pause participation to prioritize coursework.

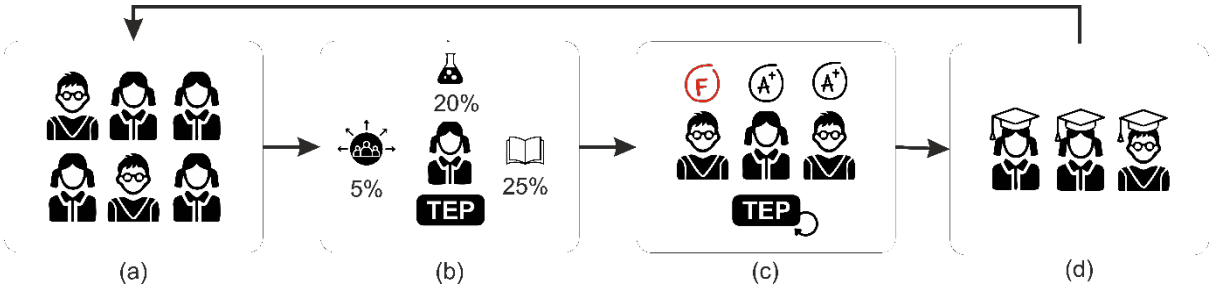

Figure 1. *The cyclical operational model of TEP: (a) recruitment, (b) participation, (c) evaluation, and (d) transition. This structure ensures sustainability, reflection, and continuous learning.*

At six-month intervals, corresponding to the standard contract periods, participants undergo a formal review focused on academic progress, engagement, and overall compatibility with the program's demands. This evaluation informs decisions regarding

continuity, role adjustment, or temporary withdrawal, ensuring that participation remains aligned with students' academic priorities. Transitions naturally occur as students graduate, complete their studies, move to other projects, or choose not to continue in TEP, as well as in cases of insufficient academic progress or limited engagement with assigned responsibilities, where continued participation may no longer be beneficial for the student or the program. Following these transitions, the recruitment phase is reactivated. New candidates are identified through an open call and interviews, with particular attention to motivation, reliability, and alignment with the program's values. Current and former TEP participants often recommend peers who are not yet involved but demonstrate strong potential and ambition; while such recommendations do not guarantee selection, they are considered as part of the interview process to support continuity and peer-informed recruitment.

Institutional integration ensures TEP is embedded in departmental operations and supported by the operating budget, contributing to long-term sustainability. The program benefits faculty by providing trained assistants familiar with departmental methods, while students gain professional skills, confidence, and a sense of belonging. Graduating or departing students leave with a portfolio of experience and often continue into master's or doctoral studies. By linking teaching, research, and outreach within a structured, cyclical framework, TEP strengthens both individual development and institutional capacity.

4 Research Design and Evaluation Methodology

4.1 Detailed Research Questions

This study adopts a multi-stakeholder perspective to evaluate the implementation and early outcomes of the Tutorial Educational Program (TEP). The research questions focus on participants' experiences, perceived impacts, the program's institutional effects, and its distinction from more traditional student assistant models. Together, these questions guide the design of the evaluation instruments and the analysis presented in the following sections.

RQ1. *How do participating students perceive the impact of TEP on their learning, academic identity, and workload balance?*

This question examines students' self-reported learning outcomes, skill development, time management, and academic motivation associated with participation in TEP. **RQ1** is addressed through the student survey instrument, which comprises a set of Likert-scale questions (Q1-Q23 shown in Section 5.2 on Figure 2 and Table 2, as well as additional survey questions reported in Supplemental File 1). These data were collected from current and former TEP participants.

RQ2. *How do teaching staff perceive the role and contribution of TEP students in comparison to traditional teaching or learning assistants?*

This question explores teachers' perspectives on reliability, pedagogical contribution, coordination, and perceived effects on course delivery and student learning. **RQ2** is addressed through qualitative questions posed to teaching staff, reported in Section 5.3 and Supplemental File 2 under the category "Teachers". The data is based on written responses and semi-structured interviews with faculty members who worked with TEP participants.

RQ3. *What institutional and administrative effects are associated with the implementation of TEP?*

This question focuses on coordination, administrative workload, sustainability, and alignment with departmental goals. **RQ3** is addressed through qualitative questions directed at departmental leadership and administrative staff, reported in Section 5.4 and Supplemental File 2 under the categories "Representative of Leadership" and "Representative of Student Administration".

RQ4. *To what extent are perceived benefits of TEP understood to extend beyond program participants to course students and departmental practices?*

This question responds directly to concerns about whether structured student engagement initiatives generate broader educational value. **RQ4** is examined from both student and staff perspectives, combining selected student survey items on teaching quality and peer learning (Section 5.2 and Supplemental File 1) with qualitative reflections from teachers and administrative staff (Sections 5.3, 5.4, and Supplemental File 2).

4.2 Study Context and Participants

This study was conducted at the Department of Computer Science and Media Technology at Linnaeus University, Sweden, where the Tutorial Educational Program (TEP) was implemented as a department-level initiative. The program was designed to address recurring challenges related to the recruitment and coordination of student assistants, the sustainability of teaching and research support, and the early engagement of students in academic practices beyond formal coursework. TEP was implemented over one entire academic year and organized into two consecutive phases, with a third phase initiated at the time of data collection.

The study involved multiple participant groups corresponding to the program's core stakeholders. Student participants consisted of undergraduate and master's students employed part-time (25% or 50%) within TEP. These students were selected based on academic performance, motivation, and communication skills, and were engaged in activities spanning teaching support, research assistance, and community outreach. All current and recent TEP participants during the study period were invited to contribute to the evaluation through survey questionnaires.

In addition to students, teaching staff who had worked directly with TEP participants in course-related activities, supervision, or collaborative tasks were invited to participate in the study. Their contributions primarily aimed to capture perspectives on teaching quality, coordination, and the integration of student assistants into academic work.

Insights from individuals involved in program coordination and administrative support were also included to provide contextual understanding of institutional and organizational aspects of TEP.

Participation in the study was voluntary for all groups. All participants were informed about the purpose of the study and the intended use of the collected data and provided informed consent prior to participation. Responses were anonymized before analysis, and participation or non-participation had no impact on academic evaluation, employment conditions, or professional responsibilities. The study followed institutional guidelines for ethical research in higher education settings.

4.3 Data Collection Methods

To address the research questions and capture perspectives from multiple stakeholder groups, this study employed a mixed-methods data collection approach combining questionnaires and semi-structured interviews. The choice of methods was guided by the size, availability, and roles of the participant groups, as well as by the need to balance breadth of responses with depth of insight.

Student data were collected through online survey questionnaires. This approach enabled the parallel collection of responses from a large and diverse group of current and former TEP participants while minimizing time demands on students. The questionnaire combined closed-ended items using a 5-point Likert scale with open-ended questions that allowed respondents to elaborate on their experiences. Likert-scale items were used to assess perceptions related to learning outcomes, skill development, and academic engagement, as well as workload balance, while open-ended questions invited reflection on motivations, perceived benefits, challenges, and suggestions for improvement (**RQ1, RQ4**). This design allowed quantitative trends to be complemented by qualitative explanations and examples. Additionally, the online format facilitated reaching former TEP members, enabling the collection of retrospective feedback on their long-term experiences with the program. The full set of survey questions and the corresponding summarized responses are provided in the Supplementary Material (Supplemental File 1). The complete anonymized raw survey dataset is not included as a supplementary file but is available from the author upon reasonable request.

Teachers, staff, and institutional perspectives were collected through in-person semi-structured interviews. Interviewees included teaching staff who collaborated with TEP students, as well as representatives of student administration and leadership. The interview questions focused on how TEP students were integrated into teaching activities, how their roles and contributions compared with those of traditional teaching or learning assistants, and whether the benefits extended to students who were not directly involved in the program (**RQ2**, **RQ4**). Additional questions addressed students' preparedness, reliability, and continuity in outreach activities, as well as organizational strengths and challenges observed from an administrative perspective (**RQ3**, **RQ4**). At the institutional level, questions explored the motivations for introducing TEP, the perceived departmental benefits, and the program's sustainability or scalability beyond its initial implementation (**RQ3**, **RQ4**).

All interviews followed a common structure: four thematic questions on the perceived role, benefits, and challenges of TEP, followed by a final open-ended question inviting

additional comments or reflections. The questions were slightly adapted for each group (representative of leadership, student administration, and teachers) to ensure they were appropriate to the participants' perspectives and evaluation area. This structure ensured consistency across interviews while allowing participants to raise issues they considered relevant. Interviews were audio-recorded solely for transcription purposes. After transcription, the audio recordings were deleted, and only anonymized text transcripts were retained for analysis. Full interview questions and anonymized answers are also provided in the Supplementary Material (Supplemental File 2).

4.4 Data Analysis

Quantitative data from the student questionnaires were analyzed using descriptive statistics to identify patterns in perceptions of learning outcomes, workload balance, skill development, and future orientation. Likert-scale responses were summarized using frequency distributions, and results were visualized through divergent stacked bar charts to emphasize the distribution of positive, neutral, and negative responses. These visualizations supported the identification of prominent trends and areas where responses were more varied or negative, guiding further qualitative interpretation. For the open-ended questions, responses were first reviewed to identify recurring themes and notable insights related to the students' experiences across the three TEP pillars, workload management, and perceived program impact. These qualitative reflections were used to contextualize and explain patterns observed in the quantitative data.

Data from in-person interviews with teachers, leadership representatives, and student administration were analyzed using thematic coding. Anonymized transcripts were systematically reviewed to identify key insights related to the effectiveness of TEP, institutional benefits, challenges in program implementation, and the perceived impact on students. Differences in perspective between participant groups were highlighted to reflect the program's multi-stakeholder nature. Finally, findings from quantitative and qualitative analyses were integrated to provide a discussion of TEP outcomes and to answer the research questions presented in Section 4.1.

4.5 Ethical Considerations

The study was conducted in accordance with standard ethical guidelines for research involving human participants. All participants, including current and former TEP students, faculty, and administrative staff, provided informed consent before participating in the survey or interviews. For the online student survey, participants were presented with an initial consent form and could proceed with the questionnaire only after explicitly agreeing to participate. For in-person interviews with teachers, leadership representatives, and student administration, verbal consent was obtained at the start of each session. Participation was voluntary, and respondents were informed of their right to withdraw at any time without consequence.

For student surveys, anonymity was maintained, no personal questions were asked, and responses were collected through a secure online platform (Google Forms). For interviews with teachers, leadership representatives, and student administration, audio recordings were made solely for transcription. These recordings were deleted after

anonymized transcripts were created. Any identifying information, such as names of students or staff mentioned during interviews, was anonymized prior to analysis.

5 Results

5.1 Participant Overview (TEP Students and Program Phases)

Table 1 presents an overview of TEP students' participation across three consecutive periods, including contract levels, gender distribution, renewal patterns, and the presence of master's students. The table reports participation per period and therefore includes overlap, as several students continued across multiple periods. When considering unique individuals, TEP has involved 17 distinct participants so far, comprising 9 male and 8 female students. Period-based participation increased from eight students in H1 2025 to fifteen in H2 2025, followed by eleven ongoing participants in H1 2026. The initial cohort consisted exclusively of students on 50% contracts, while subsequent periods introduced a combination of 25% and 50% positions, reflecting a deliberate move toward greater flexibility in engagement. Gender distribution remained relatively balanced across periods, and renewal rates were consistently high, with departures occurring primarily between periods and on a limited scale. Notably, while no master's students participated in H1 2025, three master's students were included in H2 2025 and extended to H1 2026, indicating a diversification of academic levels within the program.

Table 1: *Describing the TEP participants' profiles divided into three phases.*

Period	#Particip.	25%	50%	#Master	#Male	#Female	#Renewed
H1 2025	8	0	8	0	3	5	6
H2 2025	15	3	12	3	9	6	11
H1 2026	11	2	9	3	5	6	-

The renewal patterns shown in Table 1 must be interpreted in light of the program's phased development and evolving organizational constraints. TEP was initially launched with eight participants as a pilot to test the program format, supervision model, and integration of teaching, research, and outreach activities. Following the success of this initial phase, the program was deliberately expanded in H2 2025 to include a larger cohort, with the aim of strengthening teaching assistant coverage across the department, supporting more courses, and increasing capacity for outreach activities. While this expansion achieved these goals, it also introduced new challenges, particularly regarding the research pillar, which did not scale at the same pace as teaching and outreach since research supervision remained largely centralized under a single coordinating faculty member. In addition, the increased number of participants led to higher overall program costs, prompting a strategic decision to reduce cohort size in the next period to regain a more centralized, sustainable, and well-coordinated structure.

From H1 2026, the program is being reorganized to address these challenges, potentially including PhD students as supporting coordinators. This adjustment is

intended to reduce supervisory workload and improve the program's operational balance. Non-renewals across periods were therefore shaped by a combination of academic, structural, and contextual factors rather than by disengagement. In H1 2025, one non-renewal was due to insufficient academic performance, which conflicted with the program's emphasis on academic priorities, while the other reflected a successful transition of a participant to a more research-focused project. In H2 2025, of the four participants not renewed for H1 2026, one was an exchange student who completed their studies and returned to their home country, one transitioned to a research-intensive project, and only two non-renewals were directly attributable to budgetary constraints imposed at the departmental level.

Beyond these descriptive patterns, the participant data reflect the program's maturation and increased attractiveness to students at more advanced stages of their academic trajectories. TEP initially focused on recruiting advanced undergraduate students based on academic performance, motivation, and communication skills to address challenges associated with decentralized hiring of student assistants, such as short-term contracts, inconsistent quality, and administrative overhead. Centralizing recruitment and coordination under a single supervisory structure enabled more effective matching between students and tasks related to teaching, research, and community outreach, improving continuity and reducing the coordination burden on individual teachers.

Overall, the participant overview illustrates a program that evolved through intentional experimentation, expansion, and subsequent consolidation. Rather than prioritizing retention as an end in itself, TEP emphasized academic quality, sustainability, and alignment with departmental capacities. This dynamic yet stable development provides a robust empirical foundation for analyzing student experiences, organizational learning, and program outcomes in the following sections.

5.2 TEP Student Survey Results

This section presents the results of the survey administered to current and former TEP participants, addressing students' experiences, perceived learning outcomes, skill development, workload management, and reflections on the program's overall impact. The questionnaire was designed to capture both quantitative and qualitative data through a combination of 5-point Likert-scale items, yes/no items, and open-ended questions. Students first provided background information, including level of study, periods of participation, contractual workload, and any changes over time, along with explanations of these changes. They then reflected on their engagement with the three pillars of TEP (teaching, research, and community outreach), estimating the distribution of effort, identifying the most meaningful activities, evaluating the balance among areas, and suggesting potential improvements.

Of the 17 unique students who participated in TEP throughout its existence, 11 volunteered to complete the survey, for a participation rate of approximately 65%. The full questionnaire comprised 39 questions (Supplemental File 1), including closed-ended items (5-point Likert scales and yes/no items) and open-ended questions, and was expected to take 15–20 minutes to complete. From the total of 39 survey questions, 23 correspond to Likert-scale items (Q1–Q23, listed in Table 2). These questions, shown in Figure 2, solicit students' perceptions of learning outcomes, skill development, and

workload balance. The survey also explored perceived learning outcomes, including the development of academic, pedagogical, and research skills, as well as communication, teamwork, leadership, and confidence. Students reflected on their awareness of research and interest in academic careers before and after participating in TEP, allowing an assessment of the program's influence on future study and career plans. Finally, questions addressed workload, time management, satisfaction, and overall reflections on the program, including whether students would continue participating, recommend TEP to peers, or offer additional remarks. Together, these four thematic sections provide a comprehensive view of students' experiences, combining quantitative trends with qualitative explanations, and form the basis for interpreting the impact of TEP on individual participants and on broader academic engagement.

Overall, the Likert-scale responses indicate a consistently positive perception of TEP across its core dimensions, particularly regarding pedagogical development, academic confidence, and departmental integration (Figure 2). All respondents agreed or strongly agreed that teaching activities supported the development of academic or pedagogical skills (Q1), and a strong majority reported positive effects on academic development (Q4), theory–practice integration (Q5), confidence in academic or professional settings (Q7), and sense of belonging within the department (Q22). Similarly, students overwhelmingly perceived improvements in time management (Q18), found the workload appropriate (Q19), and expressed satisfaction with the balance between TEP responsibilities and their studies (Q20). These results suggest that, for most participants, TEP successfully combines meaningful engagement with manageable academic demands, reinforcing the program's central pedagogical objectives.

Some variation emerges in areas where participation levels or prior experience differ, particularly in research- and outreach-related items. While research activities were perceived as beneficial by most students (Q2), a small proportion reported neutral or negative responses, which aligns with qualitative comments indicating uneven exposure to research tasks across participants. A similar pattern appears for community outreach (Q3) and leadership or mentoring skills (Q8), where neutral responses are likely to reflect differences in role allocation rather than dissatisfaction. These findings point to structural heterogeneity within the program: not all students engage equally in all pillars, and neutral responses may therefore indicate limited opportunity rather than negative evaluation. Importantly, communication and teamwork (Q6) still show a strong positive trend overall, suggesting that even partial participation yields transferable skill development.

The divergent stacked bars are particularly informative for questions designed as retrospective or comparative measures. For example, Q9 and Q10 together demonstrate a clear shift in students' understanding of academic research. Before joining TEP, a majority of respondents reported a limited or unclear understanding of what academic research entails (Q9). After participation, this pattern reverses, with nearly all students agreeing that they now have a clear understanding (Q10). Rather than indicating a weakness, the negative responses in Q9 provide evidence that TEP reaches students who initially lack research awareness and that it contributes to measurable conceptual change. A similar dynamic is observed for academic career interest: while many students reported low or uncertain interest in academia before joining TEP (Q11), a strong majority agreed that TEP positively influenced their interest in pursuing further studies (Q12). This contrast reinforces the interpretation of TEP as an exploratory and formative intervention

rather than a program designed only for students already committed to academic careers.

Table 2: *Survey questions for TEP students corresponding to the Likert-scale items.*

Question	Description
	Areas of Involvement
Q1	Teaching activities helped me develop academic or pedagogical skills.
Q2	Research activities helped me develop analytical or research-related skills.
Q3	Community outreach activities helped me develop communication or societal engagement skills.
	Learning Outcomes and Skill Development
Q4	Participation in TEP contributed positively to my academic development.
Q5	TEP helped me connect theoretical knowledge with practical application.
Q6	My communication and teamwork skills improved through TEP.
Q7	TEP increased my confidence in academic or professional settings.
Q8	TEP contributed to my leadership or mentoring skills.
Q9	Awareness of research before TEP (retrospective). Before joining TEP, I had a clear understanding of what academic research involves.
Q10	Awareness of research after TEP. After participating in TEP, I have a clear understanding of what academic research involves.
Q11	Interest in an academic career before TEP (retrospective). Before joining TEP, I was interested in pursuing an academic career (e.g., Master's, PhD, research-focused roles).
Q12	Contribution of TEP to this change: TEP supported or influenced my interest in pursuing further studies (e.g., Master's, PhD).
Q13	Participation in TEP influenced my career aspirations (academic or industrial).
	Workload and Academic Balance
Q14	I was able to balance TEP responsibilities with my academic coursework.
Q15	TEP activities negatively affected my academic performance.
Q16	TEP activities positively affected my academic performance.
Q17	TEP responsibilities caused stress or challenges in managing my studies.
Q18	Participation in TEP helped me improve my time management skills.
Q19	I felt the workload in TEP was appropriate for my available time.
Q20	Overall, how satisfied were you with the balance between TEP responsibilities and your studies?
	Perceived Impact and Value
Q21	TEP differs positively from traditional teaching assistant roles or student jobs.
Q22	TEP increased my sense of belonging within the department.
Q23	TEP contributed positively to the quality of teaching or learning in the courses I supported.

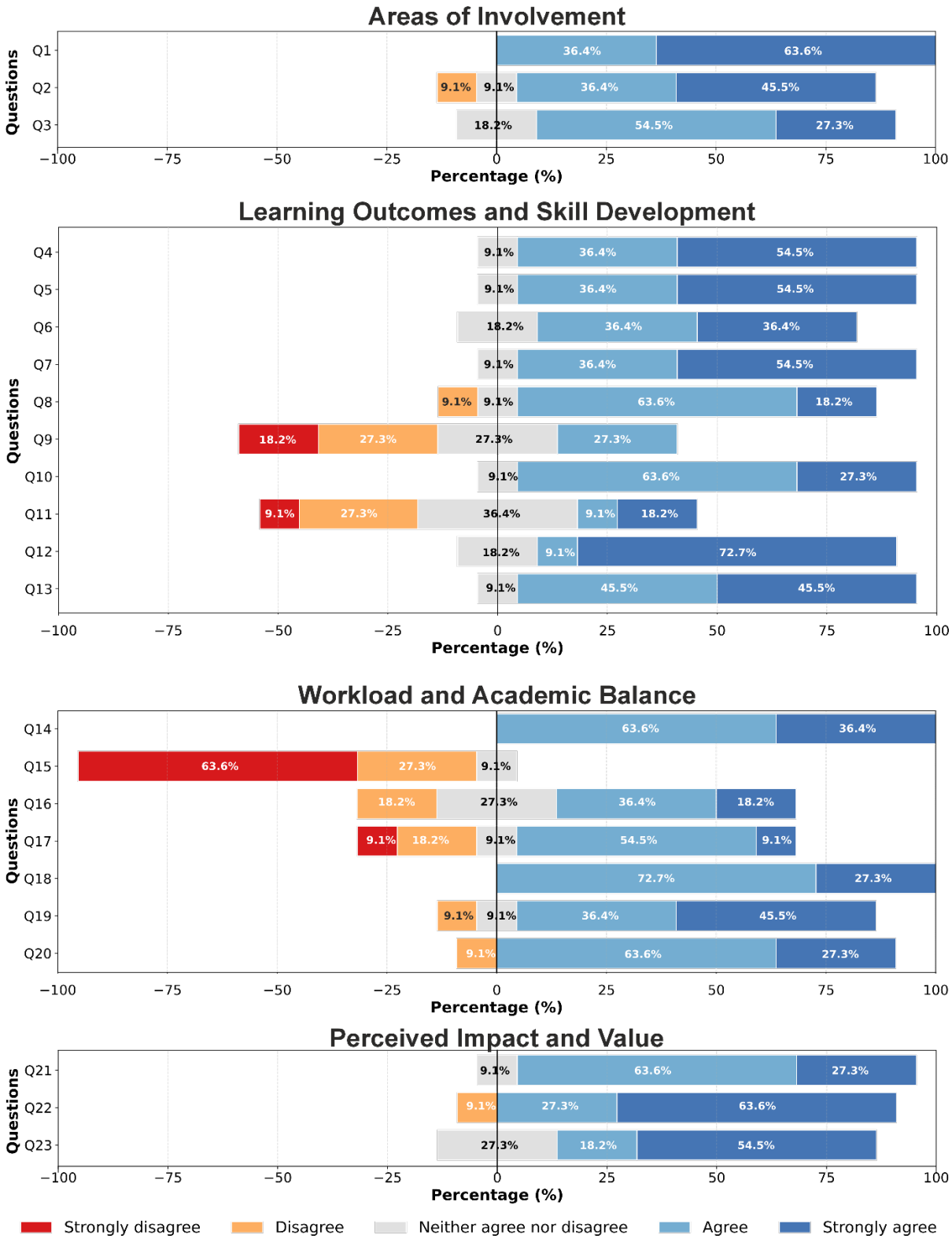

Figure 2. *Questions on a survey with current and former TEP students, regarding four different aspects: Areas of Involvement, Learning Outcomes and Skill Development, Workload and Academic Balance, and Perceived Impact and Value. The complete description of the questions is available in Table 2.*

Workload and Academic Balance: Questions about academic performance, stress, and workload require careful, transparent interpretation. Two items address academic performance from opposite perspectives: Q15 asks whether TEP activities negatively affected academic performance, while Q16 asks whether TEP activities positively affected academic performance. Responses to Q15 show strong disagreement, indicating a clear consensus among participants that involvement in TEP was not perceived as academically harmful. This result establishes that participation in the program is broadly viewed as non-detrimental to students' studies. Responses to Q16 present a more nuanced picture. While many students reported that TEP had a positive influence on their academic performance, others expressed neutral views, and a smaller group did not perceive such benefits. Read together, Q15 and Q16 suggest that TEP is widely perceived as academically safe, with positive academic effects observed for a substantial portion of participants but not uniformly across cases. This variation points to the influence of individual circumstances, such as workload balance and level of engagement, rather than to any systematic academic risk associated with the program.

At the same time, responses related to workload and stress reveal a more nuanced picture. Most students agreed they could balance TEP responsibilities with their coursework (Q14) and that the workload was appropriate for their available time (Q19), yet a majority also reported that TEP responsibilities caused stress or challenges in managing their studies (Q17). Importantly, this stress was often described in constructive terms. One student characterized the experience as *"challenging, but in a positive way*," suggesting that increased responsibility encouraged greater awareness of time use rather than disengagement. This interpretation is reinforced by strong agreement on improved time-management skills (Q18) and high overall satisfaction with the balance between TEP and studies (Q20), indicating that increased demands and skill development frequently co-occurred.

Students' accounts of managing the balance between TEP and their studies emphasize the central role of structured planning and routine. Calendars, time-blocking, and consistent daily schedules were repeatedly mentioned as key strategies. For instance, one student explained, *"I time-blocked my week so fixed TEP commitments went into the calendar first, then I scheduled study around those,"* while another highlighted short-term planning, noting that *"focusing on the next 24 hours... has been working very well for me."* Although evenings and weekends were sometimes used to compensate for busy weeks, these adjustments were generally described as deliberate and manageable, supported by the flexibility and predictability of TEP commitments.

Periods of heightened workload were primarily associated with temporal overlaps rather than the intrinsic demands of TEP. Exam periods, assignment deadlines, and grading responsibilities were the most commonly cited stressors, with one respondent observing that *"courses are never consistent about needing the same amount of hours, and TEP makes them intertwined."* Several students emphasized that workload pressure was driven more by academic structures or personal standards than by program expectations, describing the effort as demanding yet *"rewarding and productive."* In some cases, sustained workload prompted reflection on personal priorities, with one student noting that the experience offered *"a very valuable lesson"* about the importance of free time and balance. Taken together, these reflections suggest that workload challenges were situational and developmental, reinforcing TEP's role as a context for

cultivating planning skills and self-awareness rather than as a source of enduring academic strain.

Areas of Involvement: Students consistently distinguished TEP from traditional teaching assistant roles (Q21) and perceived a positive contribution to teaching and learning quality (Q23), even while expressing neutrality about their individual impact. This pattern suggests that students may assess teaching quality conservatively, especially in large courses, while still recognizing the program's structural and organizational advantages. Taken together, the questionnaire results indicate that visible negative or neutral responses often reflect intentional design choices (e.g., workload realism, role diversity, retrospective framing) rather than programmatic shortcomings. When interpreted in context and alongside qualitative comments, the Likert-scale data support the conclusion that TEP delivers broad educational benefits while maintaining an acceptable and pedagogically productive level of challenge.

Students' self-assessed distributions of effort across teaching, research, and community outreach provide an important complementary perspective on how the TEP pillars were enacted in practice. After standardizing responses to account for different contractual workloads (25% or 50%), the average allocation was approximately 26.6% to teaching, 15.9% to research, and 5.2% to community outreach. This pattern aligns closely with the intended structure of the program, in which teaching constitutes the core activity, research engagement is substantial but variable, and outreach plays a smaller yet clearly defined role. While most students reported similar allocations, some emphasized research more strongly, while others focused primarily on teaching, reflecting both individual interests and the department's specific needs at different times.

Importantly, the consistency of outreach contributions, typically around 5%, with one student reporting a slightly higher share, suggests that outreach was perceived as a bounded and manageable component rather than an open-ended obligation. This is consistent with earlier findings from the Likert-scale responses (Q14, Q19), where students largely agreed that workload was appropriate and that TEP responsibilities could be balanced with academic studies. Taken together, these results indicate that students experienced the three-pillar model not as an abstract program design but as a concrete, intelligible division of labor, reinforcing TEP's goal of offering structured, diversified academic engagement without disproportionately burdening participants.

Reflections on balance and structure indicate that flexibility was central to students' positive experiences, even when workloads fluctuated. Several students emphasized that the relative emphasis of each pillar varied across the semester, particularly when teaching demands peaked in large or assessment-heavy courses. This variability was generally accepted as an inherent feature of academic work rather than a flaw of the program. A small number of respondents pointed to potential areas for refinement, including clearer boundaries between research and outreach activities and more explicit definitions of what constitutes each pillar. Others suggested increasing the visibility of outreach activities or strengthening their role within the program, especially given their perceived societal impact. Overall, however, students largely viewed the existing structure as well-balanced and supportive, reinforcing the interpretation that TEP's three-pillar model functioned as a flexible framework rather than a rigid prescription.

Students' own words illustrate the diversity of experiences and the complementary nature of the pillars. One participant emphasized the formative role of research, noting

that *"research was easily the most meaningful in growing useful skills relevant to my studies…while also giving me a gentle entrance into the research world."* Others highlighted teaching as both academically and socially valuable, for example: *"explaining algorithms and debugging strategies to peers forced me to clarify my own understanding,"* and *"having worked as a TA throughout all the time also gave me the chance to get to know some students more"*. Outreach, while sometimes described as secondary, could be deeply impactful for some students, as reflected in comments such as *"seeing the children and their guardians proud and happy with their progress was very rewarding"*. Together, these reflections underscore that the three pillars did not contribute uniformly to all students, but instead offered multiple pathways for development, allowing participants to derive meaning in ways aligned with their interests, motivations, and stages of study.

The remaining closed questions (not Likert scale-based) provide a clear and consistent picture of how students perceived TEP in relation to their academic and professional trajectories. A strong majority of respondents were still participating in the program at the time of the survey, indicating sustained engagement. Among those who had exited TEP, the reasons were primarily positive and expected, such as moving on to other research projects or completing their degree programs, rather than dissatisfaction with the program itself. This pattern suggests that participation in TEP often functions as a transitional stage that supports progression to subsequent academic or professional opportunities.

Looking ahead, students expressed strong support for the program. All respondents who reflected on TEP's overall impact described it as having a very strong influence on their academic or professional path, and nearly all indicated that they would like to continue working with TEP if given the opportunity. Moreover, every respondent stated that they would recommend TEP to other students. Participants highlighted a range of motivations for this endorsement, including the program's ability to provide meaningful teaching experience, research involvement, and financial stability. As one student noted, TEP is "*a great opportunity for someone to be way more involved in the studies of their own and others*," while another emphasized that it is "*a far more beneficial part-time employment situation compared to any other part-time job typically available to students*." Several students also pointed to the program's support for international students, with one respondent explaining that TEP provides "*a chance to improve in their field and earn income, which is really hard to obtain in Sweden*." Taken together, these findings highlight high levels of satisfaction, perceived long-term value, and willingness to advocate for the program, reinforcing TEP's role as a meaningful and developmental experience rather than a temporary or purely instrumental student position.

5.3 Teacher Perspectives

To capture the experiences and observations of teaching staff working with TEP participants, in-person semi-structured interviews were conducted. The interview questions focused on teachers' interactions with TEP students, differences from traditional teaching assistants, the impact of TEP students on course delivery and the learning environment, and whether non-participating students benefited from their presence. Teachers were also asked to assess the preparedness and autonomy of TEP participants and were invited to provide any additional reflections or comments on the

program. These questions provided insight into the pedagogical contributions of TEP students, the perceived effects on student learning, and the broader implications for teaching practices.

To gather the perspectives of teaching staff who worked closely with TEP participants, the study employed short, semi-structured interviews. The interview protocol consisted of five questions, designed to be answered in approximately 5 minutes, allowing teachers to share concise, focused reflections on their experiences. A total of three teachers were interviewed. These teachers have several years of experience in the department and have worked with a range of teaching assistants across multiple disciplines, before and after TEP was implemented. Importantly, all three teachers interacted with almost all TEP students during 2025, as they taught both introductory and advanced undergraduate courses with large enrolments. In some courses, the number of students exceeded 200, and it was common to employ 5 to 10 teaching assistants, with TEP students being highly involved whenever possible. The complete interview questions and the three teachers' anonymized answers are provided in Supplemental File 2. Follows the five questions, answers, and a summary of the three teachers' answers:

Question 1 – Teaching Practices and Differences Compared to Traditional TAs**:** Teachers reported that TEP introduced a more structured and predictable system for integrating student assistants. In particular, the program provided a stable pool of students with clear expectations, reducing the time and effort spent on recruitment and onboarding. One teacher explained that TEP "*eliminated the annual effort required to find teaching assistants*," allowing them to focus directly on teaching-related work rather than administrative tasks. Another teacher described how TEP students were treated similarly to other assistants in formal terms, but in practice, they often became the "*backbone*" of the teaching team due to prior experience, especially when they had previously supported the same course.

In smaller courses, experienced TEP students required minimal supervision and could independently manage practical course activities, handle student questions effectively, and escalate issues only when necessary. This allowed teaching staff to focus on higher-level course development. One teacher stated that after the initial preparation, TEP students "*could manage most practical aspects of the course independently*," which improved teaching efficiency. However, one teacher noted that performance did not differ substantially between TEP and non-TEP assistants, suggesting that the program's main value lies in organizational stability and continuity rather than individual teaching performance.

Question 2 – Impact on Learning Environment and Teaching Practice: TEP students were perceived as having a more integrated role within the department, which positively influenced the teaching environment. One teacher noted that TEP students seemed to understand "*how things work at the departmental level*" and were able to contribute more independently. This deeper sense of belonging and engagement appeared to increase proactivity and support for course activities, in contrast to traditional teaching assistants, who are often focused only on assigned tasks and lack broader departmental awareness. This stronger community attachment was seen as a clear advantage for course coordination and student support.

Another key impact reported was the increased reliability and motivation of TEP students. Teachers observed that the selection process ensured a more committed

group, reducing the presence of assistants who might be less interested in supporting students. One teacher emphasized that with TEP, "*students who seek assistance tend to receive higher-quality support*," and that there were simply more engaged assistants available. Additionally, experienced TEP students demonstrated strong communication skills and familiarity with the course structure, which contributed to smoother course delivery and reduced friction in the learning process. Overall, TEP students were seen as enhancing the quality of student support and strengthening the course learning environment.

Question 3 – Benefits for Non-TEP Students: Overall, teachers agreed that non-TEP students (both students taking courses or other teaching assistants) benefited from the presence of TEP students, particularly through improved quality and consistency of teaching support. One teacher noted that TEP students served as "*informal mentors*" to less experienced assistants, helping establish good practices and improve coordination within the teaching team. In larger courses, TEP students were intentionally distributed across groups so that each group had at least one experienced assistant, resulting in more consistent guidance. Course students also benefited from interacting with assistants who were confident, experienced, and effective communicators, thereby improving the overall student experience even when performance varied across individuals.

However, the impact on non-TEP students was not always easy to measure directly. One teacher noted that while the engagement and motivation of TEP students might influence others, this effect was difficult to observe consistently, especially when assistants work across different campuses or remotely. Another teacher stated that while TEP students sometimes took on leadership roles within the assistant team, non-TEP assistants have also demonstrated similar initiative in the past. Thus, while there is evidence of indirect benefits, the overall impact appears to be mixed and context-dependent. Still, all teachers agreed that having motivated, capable assistants contributes positively to student support, regardless of whether the benefits are easily measurable.

Question 4 – Preparedness and Autonomy: Teachers generally agreed that TEP students demonstrated greater preparedness and autonomy than traditional teaching assistants. One teacher observed that TEP students appeared "*more confident and autonomous*" within the department and were more comfortable navigating routines and expectations, although there was no significant difference in subject knowledge compared to other assistants. Another teacher emphasized that the key advantage of TEP students is continuity, since many students assist across multiple courses and return to the same course in later years. This continuity increases preparedness, as returning students already understand the course structure and expectations, reducing the need for extensive training.

In addition, one teacher ranked TEP students as more prepared and autonomous than typical teaching assistants, placing them just below PhD students in terms of experience. The presence of a ready pool of qualified students also reduced the instructor's workload, as there was no need to independently recruit assistants. Overall, TEP students were viewed as more engaged and better prepared, requiring less initial guidance and contributing to a more efficient teaching process. The main benefits were their consistent involvement and higher level of independence, which allowed instructors to focus on teaching design rather than administrative and training tasks.

Question 5 – Additional Comments on TEP: Teachers expressed strong support for TEP and highlighted its positive impact on both students and the department. One teacher emphasized that TEP creates a stronger sense of belonging and integration for students, making them more proactive and connected to departmental life. They highlighted that TEP also supports the department's ability to identify promising candidates for future advanced studies, noting that several participants are considering or preparing for master's or doctoral education. This teacher also pointed out that students are involved in research activities and have contributed to early-stage publications, describing them as functioning similarly to "junior doctoral trainees." In this sense, TEP provides an early pipeline for recruiting students into research and academic careers, which is strategically valuable for the department.

Other teachers focused on practical aspects of program implementation. One described the availability of a pool of prepared, motivated students as a major relief that improved working conditions, stating that the program should "*definitely continue*." However, they stressed the need to monitor workload to avoid overutilization, since students may feel reluctant to refuse extra tasks. Another teacher noted that TEP creates a more structured and supportive environment for students, but raised concerns about the high number of allocated working hours and unclear monitoring. They emphasized that workload balance is essential to prevent negative impacts on students' academic progress. Overall, the teachers' comments reinforce TEP as a valuable initiative while highlighting the importance of carefully managing workload, expectations, and program growth.

5.4 Administrative Perspectives

To explore the institutional and organizational impacts of TEP, in-person interviews were conducted with one representative from student administration and one from leadership. Questions for student administration focused on the contributions of TEP students to community activities, improvements in preparedness and reliability, specific examples of meaningful involvement, and reflections on strengths and areas for improvement. Questions for the leadership representative addressed the program's purpose, distinctions from traditional student-assistant models, perceived benefits for the broader department, and the sustainability and scalability of TEP. Both sets of questions concluded with an invitation to provide additional comments or reflections. The complete interview questions, anonymized responses, and summaries of the administrative answers are provided in Supplemental File 2. These interviews provided insight into the administrative, coordination, and strategic dimensions of TEP, helping to evaluate its institutional value beyond the participating students.

Before TEP, outreach coordination required the representative to recruit students individually, which was time-consuming and often unsuccessful. With TEP, students arrived prepared and interested in outreach, especially in activities involving children and youth. The representative of student administration noted that "*the coordination became much easier*" because they could choose the most suitable students for each activity and rely on their prior readiness. In practice, TEP students acted as ambassadors and facilitators in public events, improving the consistency and quality of outreach. The program also enabled the representative to plan activities more efficiently, as TEP

students work for six months to a year and understand their responsibilities in advance, eliminating the need to repeatedly "*hunt for participants*".

The representative of student administration highlighted the reliability and continuity of TEP students as a major improvement compared to previous arrangements. Clear contracts and defined working hours meant students were more committed and less likely to cancel at the last minute. This stability improved administrative planning and reduced the workload of coordinating outreach activities. Examples of meaningful participation included a national digitalization event for children, where six to seven TEP students ran coding and programming stations, and a children's programming course, where three students successfully managed challenging groups. The representative described these activities as strong demonstrations of TEP students' capability and persistence. The overall evaluation was highly positive, with the representative expressing hope that the program continues and suggesting expanding it to the faculty level so outreach efforts can be more fairly supported across departments. It was also emphasized that research publications about TEP would strengthen the case for expanding the model beyond a single department.

The leadership representative confirmed that TEP was introduced to address significant departmental needs for teaching and outreach resources. The department previously relied on short-term hourly contracts, which were not sustainable and required constant recruitment. The leadership representative described TEP as a "*good way forward*" because it provided a stable pool of teaching and outreach support. In contrast to traditional course-based hiring, TEP creates a sense of community and group identity among students rather than assigning isolated assistants to specific courses. TEP students are also involved in research and outreach, creating a more diversified academic portfolio and deeper integration within the department. This group structure supports more consistent teaching practices and strengthens the department's internal ecosystem.

From the leadership representative's perspective, TEP benefits multiple stakeholders beyond the participating students. It is a "*win-win-win*" model: students gain academic and pedagogical experience, the department gains more engaged students who may pursue advanced studies, and the program coordinator develops leadership and mentoring skills. This long-term investment is seen as a strategic advantage, helping the department cultivate future academic leaders. The leadership representative also considered TEP sustainable and potentially scalable depending on economic constraints, suggesting that maintaining a pool of 8–10 part-time students each semester would provide reliable support for teaching, research, and outreach. Additionally, the program contributes positively to departmental culture by increasing students' sense of ownership and belonging, and by improving the social and collaborative dynamics of the workplace. The leadership representative noted that TEP students' eagerness to work and strong engagement have had a visible impact on the department's atmosphere and teamwork.

6 Discussion

Regarding **RQ1**, which investigates how students perceive the impact of TEP on their learning, academic identity, and workload balance, the findings provide strong support

for the claim that TEP positively influences students' learning, academic identity, and workload management, while also revealing important boundary conditions. Students consistently reported gains in pedagogical competence, academic confidence, and understanding of research, suggesting that TEP functions as a formative environment that strengthens academic identity rather than merely offering employment. Importantly, the data do not indicate that TEP harms academic performance; instead, students largely rejected this notion. At the same time, experiences of stress and workload pressure were acknowledged, particularly during peak academic periods. Rather than contradicting the program's objectives, these challenges appear to reflect realistic exposure to academic work rhythms and responsibility. The combination of increased pressure and improved time-management skills suggests that TEP supports adaptive skill development, even if it does not eliminate workload tensions entirely. Thus, **RQ1** is largely supported, with the caveat that positive outcomes are closely tied to students' planning capacity and the program's flexibility.

Regarding **RQ2**, which examines staff perceptions of TEP students compared to traditional teaching or learning assistants, staff perceptions indicate that TEP changes the nature of student assistance rather than the content of teaching itself. Instructors described TEP students as more integrated into departmental practices, with stronger continuity across courses and better familiarity with the curriculum. This continuity allowed TEP participants to provide consistent support to students and to respond more proactively to course needs, such as grading planning, lab coordination, and tutoring. The key difference compared to traditional teaching or learning assistants was not greater academic expertise but greater reliability, commitment, and contextual understanding of the department's teaching structure. Teachers also noted that TEP students often contribute to teaching quality by enhancing communication skills and sustained involvement, thereby improving the student experience in lab sessions and office hours. Therefore, **RQ2** is supported through evidence that TEP creates a more cohesive and predictable assistantship model, strengthening operational efficiency and student support without changing the role of instructors.

Regarding **RQ3**, which explores the institutional and administrative effects of implementing TEP, the evidence highlights clear effects, particularly in coordination, sustainability, and strategic alignment. From both administrative and leadership perspectives, TEP addressed longstanding challenges associated with decentralized hiring, short-term contracts, and unreliable availability of student assistants. Centralizing recruitment and supervision reduced administrative overhead, improved planning horizons, and increased reliability in both teaching and outreach contexts. At the same time, the results underscore that institutional benefits are contingent on careful scaling and supervision; the temporary strain observed during program expansion illustrates that such models require ongoing adjustment to remain sustainable. Overall, **RQ3** is well supported by the data, demonstrating that TEP produces tangible organizational value beyond individual student outcomes and highlights governance and workload monitoring as critical factors for long-term viability.

Regarding **RQ4**, which assesses whether benefits extend beyond program participants to course students and departmental practices, it is partially supported: benefits do extend beyond TEP participants in meaningful ways, though not always easily measurable. Teachers and administrators consistently perceived improvements in teaching support quality, continuity, and team coordination, which indirectly benefit

course students and departmental practices. TEP students often functioned as informal mentors and stabilizing agents within teaching teams, contributing to more consistent student support. However, the broader educational impact on non-TEP students was described as context-dependent and difficult to isolate, especially in large or distributed courses. Rather than undermining the program's value, this finding reflects the diffuse nature of pedagogical benefits in complex teaching environments. Consequently, while **RQ4** cannot be validated in a narrow causal sense, the data supports a broader interpretation in which TEP contributes to improved departmental practices and learning environments through structural and cultural mechanisms rather than direct, individually observable effects.

7 Conclusion

The Tutorial Educational Program (TEP) demonstrates how a structured, student-centered framework can effectively integrate teaching, research, and outreach in STEM higher education. By embedding students in authentic academic activities through paid, mentored participation, the program transforms them from passive learners into active contributors. This approach not only enhances individual learning and motivation but also creates a more collaborative departmental culture in which students, teachers, and administrators share responsibility for educational development.

In the Nordic context, TEP addresses a persistent challenge: engaging and retaining students in STEM academic pathways. Early exposure to research, teaching, and outreach activities has encouraged participants to consider postgraduate studies, while the paid employment model promotes inclusivity by allowing students from diverse socioeconomic backgrounds to participate. The program's emphasis on civic engagement and holistic learning aligns with Nordic educational values, bridging the gap between university and society through practical, community-oriented experiences.

After one year of implementation, TEP has proven to be both pedagogically effective and institutionally sustainable. It improves teaching quality, reduces administrative burden, and cultivates academic identity among students. Challenges such as workload management and scalability remain, but the model's adaptability and success suggest strong potential for replication across Nordic institutions. Ultimately, TEP exemplifies how experiential learning can be institutionalized to strengthen equity, engagement, and excellence in STEM education while preparing students to become the next generation of researchers, educators, and community leaders.

References

Barrasso, A.P., Spilios, K.E. A scoping review of literature assessing the impact of the learning assistant model. *IJ STEM Ed* **8**, 12 (2021). https://doi.org/10.1186/s40594-020-00267-8

Belser, C. T., Shillingford, M. A., Daire, A. P., Prescod, D. J., & Dagley, M. A. (2018). Factors influencing undergraduate student retention in STEM majors: Career development, math ability, and demographics. *The Professional Counselor, 8*(3), 262–276. https://doi.org/10.15241/ctb.8.3.262

Berinšterová, M. (2020). Mentoring of university students: Functions and important characteristics. *Individual and Society [Človek a spoločnosť], 23*(4). https://doi.org/10.31577/cas.2020.04.577

Biggs, J., & Tang, C. (2011). Teaching for Quality Learning at University (4th ed.). Maidenhead, UK: Open University Press / McGraw-Hill Education.

Brew, A. (2003). Teaching and research: New relationships and their implications for inquiry-based teaching and learning in higher education. *Higher Education Research & Development, 22*(1), 3–18. https://doi.org/10.1080/0729436032000056571

Brew, A. (2013). Understanding the scope of undergraduate research: A framework for curricular and pedagogical decision-making. *Higher Education, 66*(5), 603–618. https://doi.org/10.1007/s10734-013-9624-x

Dieb, M. (2023). The Tutorial Education Program (PET) and the relationship of students with knowledge toward academic writing. *Educar em Revista*, *39*. https://doi.org/10.1590/1984-0411.83560-T

Haeger, H., & Fresquez, C. (2016). Mentoring for inclusion: The impact of mentoring on undergraduate researchers in the sciences. *CBE—Life Sciences Education, 15*(3), ar36. https://doi.org/10.1187/cbe.16-01-0016

Kallo, J., & Välimaa, J. (2025). Higher education in Nordic countries: Analyzing the construction of policy futures. *Higher Education, 89*(2), 275–292. https://doi.org/10.1007/s10734-024-01280-4

Kolb, D. A. (2014). Experiential Learning: Experience as the Source of Learning and Development (2nd ed.). Upper Saddle River, NJ: Pearson Education.

Leong, J., & Ma, N. (2019). Using experiential learning theory to improve teaching and learning in higher education. European Journal of Social Science Education and Research, 6(1), 123–132. https://doi.org/10.26417/ejser.v6i1.p123-132

Li, T., Kirk, C., & Oseguera, L. (2025). STEM career as a pathway: Stability and dynamics of students' STEM occupational intention after high school. *The Journal of Higher Education, 96*(5), 804–829. https://doi.org/10.1080/00221546.2024.2406734

Lima, L. A. de O., & Menezes, S. J. M. da C. de. (2025). Programa de Educação Tutorial (PET): Perspectivas históricas, fundamentos e as contribuições para a minimização da evasão estudantil no nível superior. *Cadernos Cajuína, 10*(3), e1088. https://doi.org/10.52641/cadcajv10i3.1088

Morel, L. L., Ferreira, N. B., Altmam, J. G., Silva, H. G., Chaves, E. T., & Martos, J. (2020). Evaluation of graduates of the Tutorial Education Program (PET) of the Dentistry Course at the Federal University of Pelotas. *Revista Da ABENO*, *20*(2), 119–130. https://doi.org/10.30979/rev.abeno.v20i2.1108

Odden, T. O. B., Lauvland, A., Bøe, M. V., & Henriksen, E. K. (2023). Implementing the learning assistant model in European higher education. *European Journal of Physics, 44*(3), 035701. https://doi.org/10.1088/1361-6404/acb39e

Pilkington, R. (2010). Developing undergraduate research and inquiry. *Innovations in Education and Teaching International, 47*(2), 247–248. https://doi.org/10.1080/14703291003718976

Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education, 93*(3), 223–231. https://doi.org/10.1002/j.2168-9830.2004.tb00809.x

Radlick, R. L., & Mevatne, M. (2023). Mentoring for inclusion: A scoping review of the literature. *Nordisk välfärdsforskning | Nordic Welfare Research, 8*(1), 65–79. https://doi.org/10.18261/nwr.8.1.6

Rämö, J., Lahdenperä, J., & Häsä, J. (2021). The Extreme Apprenticeship Method. *PRIMUS*, *31*(10), 1106–1120. https://doi.org/10.1080/10511970.2020.1818332

Rosenzweig, E. Q., Chen, X. Y., Song, Y., Baldwin, A., Barger, M. M., Cotterell, M. E., Dees, J., Injaian, A. S., Weliweriya, N., Walker, J. R., Wiegert, C. C., & Lemons, P. P. (2024). Beyond STEM attrition: Changing career plans within STEM fields in college is associated with lower motivation, certainty, and satisfaction about one's career. *International Journal of STEM Education, 11*(1), 15. https://doi.org/10.1186/s40594-024-00475-6

Thunborg, C., & Bron, A. (2012). Sweden: Higher education and lifelong learning in Sweden. In *Global perspectives on higher education and lifelong learners* (pp. 97–111). Routledge. https://doi.org/10.4324/9780203122495

Tight, M. (2020). Student retention and engagement in higher education. *Journal of Further and Higher Education, 44*(5), 689–704. https://doi.org/10.1080/0309877X.2019.1576860

Vihavainen, A., Paksula, M., & Luukkainen, M. (2011, March). Extreme apprenticeship method in teaching programming for beginners. In *Proceedings of the 42nd ACM technical symposium on Computer science education* (pp. 93-98). https://doi.org/10.1145/1953163.1953196

Wong, B., Chiu, Y. L. T., Murray, Ó. M., & Horsburgh, J. (2022). End of the road? The career intentions of under-represented STEM students in higher education. *International Journal of STEM Education, 9*(1), 51. https://doi.org/10.1186/s40594-022-00366-8