

EXPLORING TEACHER PERCEPTIONS OF INTEGRATING STEAM AND HOME ECONOMICS THROUGH THE STEAMKITCHEN HANDBOOK

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Abstract

The integration of Science, Technology, Engineering, Arts and Mathematics (STEAM) across school subjects supports meaningful learning and 21st-century competencies. Home Economics offers a natural context for STEAM because it links scientific, technological, mathematical and creative knowledge to everyday practices. The STEAMKitchen project (Erasmus+ KA220-HED) produced a teacher handbook of practical, food-based learning activities that connect STEAM concepts with Home Economics. This study used a descriptive, mixed-methods design to examine in-service teachers' perceptions following a one-day STEAMKitchen professional development seminar introducing the handbook. Post-event feedback from 28 teachers was collected via an anonymous online survey comprising Likert-type items and open questions addressing clarity, curricular integration, pedagogical relevance, 21st-century skills, motivation and inclusivity. Quantitative responses were summarised with descriptive statistics (means, SDs); qualitative responses were analysed thematically. Results show uniformly positive reception: teachers rated the handbook highly for practical applicability and interdisciplinary integration (e.g., STEAM integration $M = 4.71$), and described experienced food-based tasks (chocolate, pH and temperature experiments) as effective bridges between Home Economics and STEAM. Teachers also reported perceived gains in confidence and ideas for classroom adaptation. The seminar format, combining short theoretical framing with hands-on practice, supported teachers' readiness to adapt interdisciplinary tasks.

Keywords: *Home economics, STEAM education, interdisciplinary teaching.*

1. Introduction

STEAM education (Science, Technology, Engineering, Arts and Mathematics) has become a globally visible and influential educational approach over the past decade, promoted as a response to complex societal challenges that require interdisciplinary thinking, creativity, and problem-solving skills (Perignat & Katz-Buonincontro, 2019). Rather than focusing on isolated disciplinary knowledge, STEAM emphasizes the meaningful integration of scientific, technological, artistic, and ethical perspectives in authentic, real-life contexts, supporting the development of key 21st-century competencies such as critical and creative thinking, collaboration, and sustainability-oriented problem solving. In this sense, STEAM has been described not only as an interdisciplinary framework but also as a broader educational shift toward a more humanistic and socially responsive conception of schooling (Perales & Aróstegui, 2024). Recent frameworks further highlight STEAM's potential to address real-world and so-called "wicked problems" through practice-oriented approaches that combine thinking, making, and doing in meaningful contexts (Chappell, Hetherington, Juillard, Aguirre, & Duca, 2025). Home economics education offers a particularly suitable context for implementing STEAM principles, as it inherently connects theory and practice through everyday activities such as food preparation, consumption, material use, and household decision-making. By linking scientific and technological knowledge with daily life practices, home economics supports students' ability to apply knowledge meaningfully and to develop responsible and sustainable ways of living. Previous research has shown that home economics contributes to students' holistic development and the acquisition of 21st-century skills, particularly in relation to sustainability and everyday life competence (Taar & Palojoki, 2022).

In recent years, the integration of home economics within STEAM education has gained increasing international attention. The International Federation for Home Economics (IFHE) emphasizes that home economics provides a unique bridge between science- and technology-based knowledge and learners' everyday lives, enabling students to actively shape sustainable lifestyles (IFHE, 2025). This view is

supported by recent research synthesizing international studies, which demonstrates strong conceptual and pedagogical connections between home economics and STEAM, particularly in fostering problem-solving skills, creativity, and real-world application of knowledge (Heinmäe, Callaghan, & Taar, 2025). Despite this growing recognition, systematic integration of STEAM and home economics remains limited in educational practice, especially in terms of practical teaching materials and structured professional development opportunities for teachers.

To address this gap, the international STEAMKitchen project was initiated to demonstrate, through concrete examples, how STEAM education and home economics can be meaningfully combined in everyday teaching practice. STEAMKitchen is a two-year ERASMUS+ KA220-HED project (2024–2026) involving partner institutions from Estonia, Finland, Austria, and Norway, bringing together complementary expertise in home economics and STEAM teacher education. The project aims to support teachers, teacher educators, and other educational stakeholders by providing research-informed yet practice-oriented solutions developed through international collaboration (Paas & Taar, 2025).

Within the project, Work Package 2 focused on strengthening interaction between practice, research, and policy through the development of guidelines illustrating how STEAM principles can be integrated with home economics (Paas et al., 2025a). Work Package 3 built on this foundation by developing a teacher handbook containing 20 practice-oriented learning task ideas that integrate STEAM and home economics across different age groups and educational contexts (Paas et al., 2025b).

The present article focuses on the STEAMKitchen teacher handbook developed within Work Package 3 and on its introduction during a one-day professional seminar for in-service teachers. The study is grounded in the understanding that teachers play a key role in creating meaningful learning environments and implementing interdisciplinary approaches in school practice. Research on teacher professional development identifies active learning, such as hands-on engagement, reflection, and collaborative meaning-making, as a core feature of effective professional development that supports the transfer of new ideas into classroom practice (Desimone & Garet, 2015). This focus is further supported by international evidence from the OECD Teaching and Learning International Survey (TALIS), which highlights teachers as intrinsically motivated professionals who value practice-oriented and collaborative professional learning opportunities (OECD, 2019).

The aim of this study was to evaluate the effectiveness of the STEAMKitchen professional development seminar in supporting teachers' understanding, confidence, and readiness to implement interdisciplinary home economics–STEAM activities. Specifically, the study explored teachers' perceptions of the handbook's clarity, pedagogical relevance, practical applicability, and its potential to support 21st-century skills and inclusive learning.

2. Methods

This study employed a descriptive research (Creswell, 2009) to examine in-service teachers' perceptions of a one-day STEAMKitchen professional development seminar and the accompanying Teacher Handbook following their introduction to practice. The aim was to document teachers' experiences, perceived relevance, and usability of the materials as part of their dissemination to educational practice. The seminar was designed as a hands-on professional development event introducing teachers to selected activities from the STEAMKitchen handbook through a short project introduction and a rotating workshop format. Participants engaged in three hands-on activity stations representing different integrations of STEAM and home economics, as well as one facilitated reflection workshop focusing on sustainability-related dimensions. The aim of the seminar was to enable teachers to experience the activities as learners and to reflect on their pedagogical value and applicability in school practice.

The seminar took place at Tallinn University, Estonia, and was organised by the local project team. Although similar seminars were conducted by project partners in other countries, the present article focuses exclusively on the Estonian case to allow for a contextualised description of the seminar format and a coherent analysis of teacher feedback.

Data were collected using an online questionnaire administered via Google Forms. The questionnaire included both Likert-type items and open-ended questions addressing teachers' perceptions of the seminar structure, pedagogical relevance, interdisciplinarity, sustainability, motivation, collaboration, and inclusivity. The Likert-type items used a five-point response scale ranging from 1 ("not at all") to 5 ("absolutely"). Participation in the questionnaire was voluntary, and ethical principles as well as General Data Protection Regulation (GDPR) requirements guided the data collection process. All participants provided informed consent for the anonymised use of their responses in scientific publications.

The seminar was open, free of charge, and limited to 40 registered participants. On the seminar day, 33 teachers attended, of whom 29 completed the questionnaire. One respondent did not consent to the

scientific use of their data and was therefore excluded from the analysis. The final data set consisted of 28 valid responses.

Quantitative data from the Likert-type items were analysed using descriptive statistics, including frequencies, mean values, and standard deviations, to summarise overall trends in teachers' perceptions of the seminar and the STEAMKitchen Handbook. Although Likert-type items are ordinal in nature, the use of mean values for descriptive purposes is widely accepted in educational research when the aim is to describe general tendencies rather than to make inferential claims (Joshi, Kale, Chandel, & Pal, 2015). Qualitative data from open-ended questions were analysed using thematic content analysis (Braun & Clarke, 2006). Responses were read iteratively, recurring themes were identified and coded, and illustrative excerpts were selected and translated into English for reporting. Given the formative and context-specific nature of the study and the relatively small sample size, the analysis emphasised descriptive interpretation and actionable feedback rather than statistical generalisation.

3. Results

The participating teachers represented a highly experienced professional group. Of the respondents, 22 teachers reported more than nine years of teaching experience, five teachers had between three and eight years of experience, and one teacher reported less than three years of experience. Teachers came from different regions across Estonia, reflecting a geographically diverse sample of in-service teachers. The participating teachers represented a range of subject backgrounds, with the majority teaching home economics and handicraft, either as a main subject or in combination with related fields. Several teachers also taught technology education and art, reflecting strong links between practical, creative, and design-oriented subjects. In addition, a smaller number of participants represented STEAM-related subjects, including chemistry, biology, natural sciences and mathematics. This diversity highlights the interdisciplinary relevance of the STEAMKitchen seminar for teachers across both home economics and STEAM subject areas.

Overall, teachers' responses to the Likert-scale items indicate very positive perceptions of the STEAMKitchen activities and supporting materials. On a five-point scale, teachers evaluated the structure of the activities as clear and easy to follow ($M = 4.75$, $SD = 0.44$). The handouts and accompanying information were also rated highly in terms of supporting implementation in practice ($M = 4.68$, $SD = 0.55$). When asked to position the activities on a practical–theoretical continuum, teachers' responses indicated a clear emphasis on practical orientation ($M = 2.57$, $SD = 1.26$), where lower values represented a more practice-oriented approach. This suggests that teachers perceived the activities primarily as hands-on and applicable to classroom practice rather than predominantly theoretical.

Teachers assessed the integration of subject content very positively. The integration of home economics topics, such as nutrition, food, and household-related themes, was rated as valuable ($M = 4.57$, $SD = 0.69$). Similarly, teachers reported strong integration of multiple STEAM subjects within the activities ($M = 4.71$, $SD = 0.46$). Sustainability was consistently rated as a clearly embedded and meaningful component of the activities. Teachers evaluated both the communication of the importance of sustainability ($M = 4.50$, $SD = 0.51$) and the extent to which sustainability was present in the activities ($M = 4.50$, $SD = 0.58$) at a high level.

Teachers also reported that the activities properly represented their subject content, whether related to home economics (e.g., health and everyday life) or STEAM-related scientific and socio-scientific topics ($M = 4.57$, $SD = 0.57$). In addition, teachers indicated that the activities supported going beyond the existing curriculum by addressing additional topics relevant to everyday life ($M = 4.86$, $SD = 0.36$), which received the highest mean score among all items.

The development of 21st-century skills—specifically creativity, collaboration, cooperation, and critical thinking—was rated highly by teachers ($M = 4.71$, $SD = 0.53$). Teachers also reported increased motivation and ideas for collaboration with colleagues following the seminar ($M = 4.64$, $SD = 0.49$), and evaluated the goals of the STEAMKitchen project as motivating ($M = 4.61$, $SD = 0.63$).

Teachers perceived the activities as motivating for students ($M = 4.54$, $SD = 0.74$) and inclusive for a wide range of learners ($M = 4.46$, $SD = 0.69$). Inclusivity was also rated highly from the teachers' perspective, with respondents indicating that the activities were suitable for teachers of different levels, subjects, ages, genders, and cultural backgrounds ($M = 4.68$, $SD = 0.48$).

Teachers' open-ended responses largely supported the high quantitative ratings across all evaluated dimensions. In particular, teachers provided concrete examples of how interdisciplinary integration was realized through food-based activities involving chocolate, pH measurement, and temperature, which were frequently mentioned as effective bridges between home economics and STEAM subjects. One teacher noted, "From one simple everyday product, it is possible to design a highly versatile and integrated lesson."

Similarly, sustainability, highly rated in the quantitative results, was described as being embedded naturally across activities through discussions of energy use, food choices, waste, and everyday household practices. Teachers also highlighted hands-on experimentation and real-life relevance as key motivational factors for students, reinforcing the strong ratings related to practicality and student engagement. Finally, inclusivity was reflected in teachers' descriptions of multiple entry points, adaptability, and the possibility to address diverse learners and perspectives within the same activities.

4. Discussion

The findings of this study indicate a highly positive reception of the STEAMKitchen teacher seminar and the accompanying handbook, highlighting the value of experiential and practice-oriented professional development for supporting interdisciplinary teaching. Teachers' open-ended responses complemented the quantitative results by illustrating how food-based activities (particularly those they experienced), related to chocolate exploration, pH measurement using natural indicators, and temperature experiments, functioned as effective focal points for integrating home economics with chemistry, physics, and biology. These activities provided concrete, sensory-rich contexts that made interdisciplinary connections visible and accessible. The findings also reinforce research identifying home economics as a natural and pedagogically meaningful context for STEAM integration. Teachers' experiences with food-based activities illustrate how scientific, technological, mathematical, and creative elements converge in everyday home economics practices, supporting recent review findings that highlight strong conceptual and pedagogical overlap between home economics and STEAM (Heinmæe et al., 2025).

Sustainability emerged as a meaningful and integrated dimension of the activities rather than an isolated topic. Teachers described how issues such as food production chains, energy use, everyday consumption choices, and material reuse were naturally embedded in practical tasks and discussions. This embedded approach aligns with teachers' high quantitative ratings for sustainability and supports the idea that sustainability education is most effective when linked to everyday practices and real-life decision-making.

Beyond specific content knowledge gains, many teachers reported broader professional learning outcomes, including a shift toward more holistic and interdisciplinary thinking. Several participants described increased awareness of STEAM connections across subjects and greater confidence in designing integrated lessons. Practical, hands-on engagement was consistently identified as a key motivational factor for students, alongside real-life relevance, collaboration, and the use of familiar materials. Teachers also noted that the activities offered flexibility and multiple entry points, supporting inclusivity through differentiated approaches, cultural connections, and varied learner needs.

Importantly, teachers emphasised adaptation rather than direct replication of the activities. Experiencing the tasks as learners during the seminar enabled them to envision how similar principles could be transferred and modified for their own classroom contexts. This finding suggests that experiential professional development supports sustainable pedagogical change by encouraging teachers to internalise underlying ideas and apply them flexibly rather than follow fixed lesson scripts.

These findings reinforce the central role of teachers as key agents in implementing interdisciplinary and innovative educational approaches such as the integration of home economics and STEAM. Teachers' feedback indicates that hands-on, practice-oriented professional development can strengthen their understanding of interdisciplinary concepts and increase confidence in applying them in everyday teaching practice. This aligns with international evidence from TALIS (OECD, 2019), which highlights teachers as intrinsically motivated professionals who value professional development that is relevant, collaborative, and closely connected to classroom practice.

The seminar format used in the STEAMKitchen project reflects several features identified in the literature as characteristic of effective teacher professional development. Teachers' opportunities for active engagement, reflection, and collective participation correspond with research emphasising active learning as a critical condition for meaningful professional learning (Desimone & Garet, 2015). By situating STEAM principles within familiar and meaningful everyday contexts, such as those provided by home economics, the STEAMKitchen Teacher Handbook appears to lower barriers to interdisciplinary teaching and support teachers in envisioning implementation across subject boundaries and age levels. This finding is consistent with earlier research indicating that professional development is most effective when closely aligned with teachers' curricular responsibilities and classroom realities.

5. Conclusion

The results suggest that the STEAMKitchen professional development seminar effectively supports teachers in adopting interdisciplinary Home Economics and STEAM practices. Providing both conceptual grounding and experiential learning opportunities enhanced teachers' confidence and perceived readiness to implement the handbook in their own teaching.

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