Integrated evaluation report. D4.2. Accelerating Digital Innovation in Schools through Regional Innovation Hubs and a Whole-School Mentoring Model (iHub4Schools) project, Horizon 2020, European Union.

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2023

http://hdl.handle.net/10138/573071

Tammets, K, Coelho, R, Khulbe, M, Ley, T, Cukurova, M, Lakkala, M, Ilomäki, L, Požogina, K, Dagienė, V, Juškeviien, A, Nakashidze-Makharadze, T & Mikeladze, M 2023, Integrated evaluation report. D4.2. Accelerating Digital Innovation in Schools through Regional Innovation Hubs and a Whole-School Mentoring Model (iHub4Schools) project, Horizon 2020, European Union. European Union. https://doi.org/10.3030/101004676

Accelerating Digital Innovation in Schools through Regional Innovation Hubs and a Whole-School Mentoring Model

WP4/ D4.2
INTEGRATED EVALUATION REPORT

WP5 Leader: TLU

I-HUB4SCHOOLS

iHub4Schools - Accelerating Digital Innovation in Schools through Regional Innovation Hubs and a Whole-School Mentoring Model

D4.2: Integrated Evaluation Report

Project Acronym	iHub4Schools
Project Full Title	Accelerating Digital Innovation in Schools through Regional Innovation Hubs and a Whole-School Mentoring Model
Project Number	Grant Agreement:101004676
Type of Action	Coordination and support action (CSA)
Topic	DT-TRANSFORMATIONS-21-2020
Project Coordinator	Tallinn University (TLU)
Project start date / duration	01.01.2021/30 months
WP/ Result	WP4 / D4.2
Title	Integrated Evaluation Report
Result Type	Report
Lead partner	TLU
Due date	M30
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Dissemination level	Public

Revision History			
Revision	Date	Comments	Author
v01	30.04.2022	Initial draft	TLU
v02	31.05.2022	Improved report	TLU, UCL, Harno, UH
v1.0	30.06.2022	1st version of evaluation report	TLU, UCL, Harno, UH
v1.2	31.01.2023	Updated version of the report	TLU, UCL
v1.5	31.05.2023	Improved report	TLU, UCL, UiB, UH, Harno, VU, BSU, EPFL, StePs
v1.8	15.06.2023	Internal review	UH
v2.0	30.06.2023	Final version	TLU, UCL

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Extended abstract

The main aim of the iHub4Schools project was to develop and validate a new approach for promoting peer-learning settings and reinforcing the evidence-informed adoption of digital innovation in schools. Within the context of iHub4Schools, this approach is referred to as the "School Mentoring Model." An additional goal of the project was to establish five Regional Innovation Hubs across Europe. These hubs were designed to support the project's various activities and were expected to make a significant impact on individuals - like teachers and students - and organisations, ranging from schools and associations to networks and local policy bodies.

The project's execution was organised in three distinct phases. Initially, a shared knowledge base was developed, encapsulating mentoring models, individual methods, pedagogical approaches, and evaluation approaches. Concurrently, cooperation with national stakeholder networks was initiated. In the second phase, pre-piloting was conducted to assess the initial version of the School Mentoring Model and gather insights for Support Mechanisms. Finally, in the last phase, the pilot program was implemented and subsequently evaluated in four partner countries.

Deliverable D4.2 reports on the final evaluation of the project, encapsulating the two rounds of implementation of the proposed School Mentoring Model. Our evaluation is underpinned by a series of core questions:

- To what degree do teachers express an intention to adopt the practices they have learned through their involvement in activities related to, or inspired by, the mentoring efforts?
- How do teachers perceive the practices of knowledge appropriation, maturation and scaffolding in relation to the new teaching and learning methods introduced, or emanating from their engagement in the mentoring activities?
- What perceived changes have participating teachers and school leadership identified as a result of their involvement in activities related to the mentoring efforts?
- How do mentors evaluate the effectiveness and utility of the mentoring model and methods in facilitating digital innovation?

To ensure a comprehensive evaluation of the project's final outcomes, a mixed-method approach was used integrating quantitative and qualitative data collection and analysis methods. Our primary stakeholders, mainly teachers and, in some cases, school leadership - were at the heart of this evaluation. The evaluation strategies included surveys and semi-structured interviews for teachers participating in the study, and reflective questionnaires for mentors.

The main conclusions of our evaluation are:

Innovation adoption in education is diverse, as demonstrated in our analysis. This diversity is evident in the spread of pedagogical practices, improvements at the school-level, learning of tools, and the development of digital competence. Challenges arose due to differing mentoring approaches, time constraints, and limited resources in participating schools. The practices of knowledge appropriation varied across countries due to diverse innovations and structures used, rendering direct comparisons challenging. Despite these challenges and limitations, the evaluation process upheld rigorous research standards and best practices

aligned with the requirements of the specific contexts. Substantial insights were derived from the evaluation of the mentoring model and methods in participating countries.

Teachers reported learning new methods during the mentoring process and expressed a willingness to implement these in the future. Collaboration and co-creation were essential components, supported by peers, mentors, and guidelines. However, readiness to support colleagues was less developed due to the limited duration of mentoring, suggesting a need for follow-up activities.

There was a significant shift in the diversified use of learning technologies among teachers, which promoted peer collaboration and mentor engagement. The successful implementation of pedagogical methods resulted in perceived improvements in student learning.

School-level changes were especially notable in schools where leadership training was part of the mentoring process, leading to the recognition of new roles, like educational technologists, and meetings focused on digital innovation.

Balancing professional development and everyday teaching duties was challenging, requiring attention from leaders and mentors. The improvement of digital infrastructure during the mentoring period enhanced the conditions for digital innovation.

The knowledge appropriation model is effective in examining social learning practices in multi-stakeholder networks, and understanding the knowledge transfer process at the collective level. The adoption of innovation is time-intensive, and all changes may not be observable within a short mentoring period, such as six months. Sustained progress necessitates ongoing collaboration, for instance, through Regional Innovation Hubs. Regular evaluations of the model contribute to its validity and create guidelines for wider use. Both formative and summative evaluations of local initiatives are essential to validate the School Mentoring Model developed and evaluated in this project.

These findings hold value for a range of stakeholders. For those aiming to develop mentoring programmes to support teachers and schools, this report provides a valuable overview of the evaluation approach and the lessons learned. It also provides input for those involved in planning actions to support teachers and school leaders.

1. Introduction and background

1.1 Needs addressed in the project

Initiatives are underway across numerous countries aimed at promoting the incorporation of digital technologies within educational settings. These initiatives span both individual and nationwide training programs, targeting two main focus areas: the integration of digital technologies into the teaching processes and the personal development of teachers' digital competence (Top et al., 2021). However, as also reviewed and highlighted in detail in D4.1, it is well-recognised that effective integration of technology into education depends on a number of factors. These can include **teachers' attitudes and beliefs** towards digital technologies in teaching (Tondeur et al., 2017), the availability of **technical support** (Khanlari et al., 2016), **teachers' digital competence** (Top et al., 2021), **professional development opportunities such as**

mentoring (Kopcha, 2012), and **school level support and leadership** (Inan & Lowther, 2010). This indicates that, despite significant efforts to accelerate digital innovation, the degree of digital technology integration varies among teachers and schools. Factors influencing this variance can include individual teacher expertise, beliefs, self-confidence, and the prevailing school culture (Ertmer & Ottenbreit-Leftwich, 2010). Previous research (e.g., Mathur et al., 2013) has shown that **mentoring educators** can be an effective approach in facilitating teachers' use of digital technologies in instruction. Additionally, **promoting collaboration** between teachers at the school level, using a mentoring approach, can lead to more efficient integration of digital technologies in teaching and learning processes (Liu et al., 2015).

The iHub4Schools project proactively addresses some of these issues by establishing Regional Innovation Hubs and by developing and implementing a School Mentoring Model to aid schools in adopting digital innovation. This model encourages both intra-school and inter-school collaboration and cultivates partnerships that bridge research and practice.

The School Mentoring Model, coupled with individual methods integrated within the iHub4School framework, serves as pivotal tools for effectively introducing, deploying, and scaling up digital innovation in schools, enabling transformative educational experiences.

1.2 Theoretical background

Our project is grounded in socio-cultural theories that emphasise the significance of social and situated approaches to professional learning. At the heart of our project lies the assumption that fostering social learning practices, such as the co-creation of new practices, cultivating a shared understanding, validating and reflecting upon new ideas through mentoring can contribute to the adoption of innovative practices in educational settings. A key approach to support school teams in the adoption of innovative methods is through a mentoring process. Mentoring serves as a valuable tool to support professionals in the field of education to critically reflect on their knowledge and skills, thereby enhancing their ability to perform their roles effectively (Hobson & Malderez, 2013). As part of the mentoring process for integrating digital technologies into teaching, professionals enter into reciprocal relationships that foster an environment conducive to collaborative learning, the sharing of knowledge, and the exchange of expertise (Kopcha, 2012). Definitions of mentoring and related approaches, as well as previous studies about mentoring in the educational contexts and especially related to mentoring teachers and schools in digital practices are reviewed in the mentoring guidelines as part of D.3.3.

Doering et al. (2014) suggested that successful integration of new technologies into teaching and learning requires more than just individual attitudes and skills. Darling-Hammon et al. (2017) proposed the following characteristics of effective teacher professional development: **content** focused; incorporates **active learning** strategies and engaging teachers into the design and implementation of new practices to make connections between professional learning and classroom situations; enhances **collaboration** in job-embedded contexts; implements **modelling** of instruction to provide teachers with a clear vision of good practices; integrates **mentoring**, **coaching** and expert support; fosters **feedback** and **reflection**; and is of **sustained duration.** Also, the European Commission (2022) (EC) has pointed out that there are various approaches to enhance teachers' digital competence, such as mentoring, online training or formal continuing professional development, with different opportunities. Mentoring enables a personalised approach to support the development of teachers and schools, and its benefits are bidirectional: mentors

and mentees both develop professionally (EC, 2022). Earlier research has also shown that situated professional development, such as mentoring, presents a promising approach to equipping teachers with the skills needed to overcome common obstacles to integrate technology into instruction (Kopcha, 2012).

We have incorporated the recommended components of successful professional learning, as proposed by Darling-Hammon et al. (2017), into our mentoring framework by leveraging the socio-cultural context and fostering collaboration among multi-stakeholder networks. Qvortrup (2016) emphasises the need for close research-practice relationships to drive meaningful change and improvement in pedagogical practices. The details of the mentoring model can be seen in D3.3 and the regional innovation hubs are discussed in detail in D2.2 and D2.3. As also discussed there, collaborative partnerships between researchers and practitioners allow for synthesis of research-based knowledge on effective educational practices with the practical insights and expertise of educators. By working together, researchers and practitioners can address challenges, identify innovative solutions, and enhance teaching methodologies to bring about positive transformations in educational settings.

Learning in social and situational contexts, with different actors working together to support the adoption of innovations, has been explored by Ley (2020) and Ley et al. (2020; 2022). Their Knowledge Appropriation Model (KAM) helps to explain how people create knowledge at the individual level, contribute to collective knowledge, and how they apply, adapt and validate it in concrete professional situations (see Figure 1).

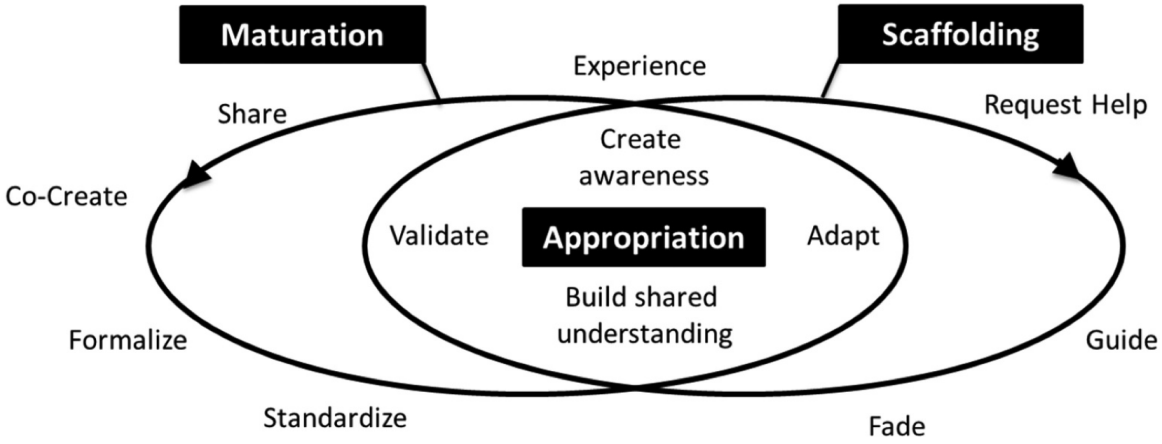

Figure 1. Knowledge Appropriation Model (Ley et al. 2020).

In the context of our project, we looked at mentoring interventions as a context in which different actors create, apply and validate shared knowledge through three areas of learning and knowledge practices:

- **Knowledge maturation** (the left section in Figure 1): practices of knowledge creation, namely how an individual experience becomes shared knowledge in the community and how it becomes more mature knowledge that is available for formal organisational processes (e.g. schools' curriculum development processes). Specifically, this part describes how knowledge is created,

shared and refined; for example, pedagogical scenarios in teachers' classroom practice or school development projects in the school development process.

- **Knowledge scaffolding** (the right section of Figure 1) explains how professionals learn and are supported (through mentoring in our case) to apply the newly created knowledge in real-life settings.
- **Knowledge appropriation** (the middle section of Figure 1) brings these two perspectives together and explains how knowledge is applied and validated in concrete work settings. Consequently, its primary objective should be to ensure the successful, sustainable, and widespread adoption of innovation.

The combination of scaffolding, maturation and appropriation practices in the context of mentoring shapes the interaction between knowledge creation and individual learning.

1.3 Logic model

Figure 2 presents a visual representation that outlines the logical connections between the various components of the iHub4Schools project's evaluation process. It presents a conceptual framework that shows how inputs, activities, outputs, outcomes, and impacts are interconnected, providing a coherent explanation of how the project is expected to work and achieve its intended outcomes. It also allows opportunities for reflections on the assumptions built into the connections so that these can be taken into account in the interpretations of the evaluation results.

The **challenge** we address in iHub4Schools is supported by earlier research, which stipulates that the implementation of digital innovation in education is a rather complex task which integrates individual and organisational level aspects. Therefore, there is a need to work together with different stakeholders and the **primary users** of our project outcomes are school leadership members, teachers and mentors. Through the seven steps of the **mentoring process**, we have brought together research and practice and promoted social dynamics and co-creation as also emphasised in the Knowledge Appropriation Model. Additionally, given that the educational settings and needs of individual schools differ, several other research-based individual methods that have shown success in supporting teachers and school teams can be adopted. These methods range from long-term development programmes targeting school teams or individual teachers to a greater focus on leadership or evidence-informed and inquiry practices, etc. Therefore, the **determinants** of successfully implementing digital innovation can be different depending on the case.

The **short-term outcomes** of the mentoring process are numerous, including individual and collective creation and acquisition of knowledge, classroom use of the digital innovations supported by mentor and peer scaffolding, and bolstering of teachers' intentions to adopt the new teaching and learning methods. The expected **long-term outcomes** are also many. First, we anticipate the emergence of a culture of sharing and collaboration between teachers themselves, teachers and school leadership, and depending on the context, between schools. Second, schools should be able to develop the infrastructure needed for implementing digital innovations. This includes opportunities for relevant teacher training and access to adequate technical support. Third, teachers should adapt and adopt the new teaching methods and materials they encountered during the project pilot into their everyday classroom practice. Finally, all of these changes should culminate in improved student outcomes.

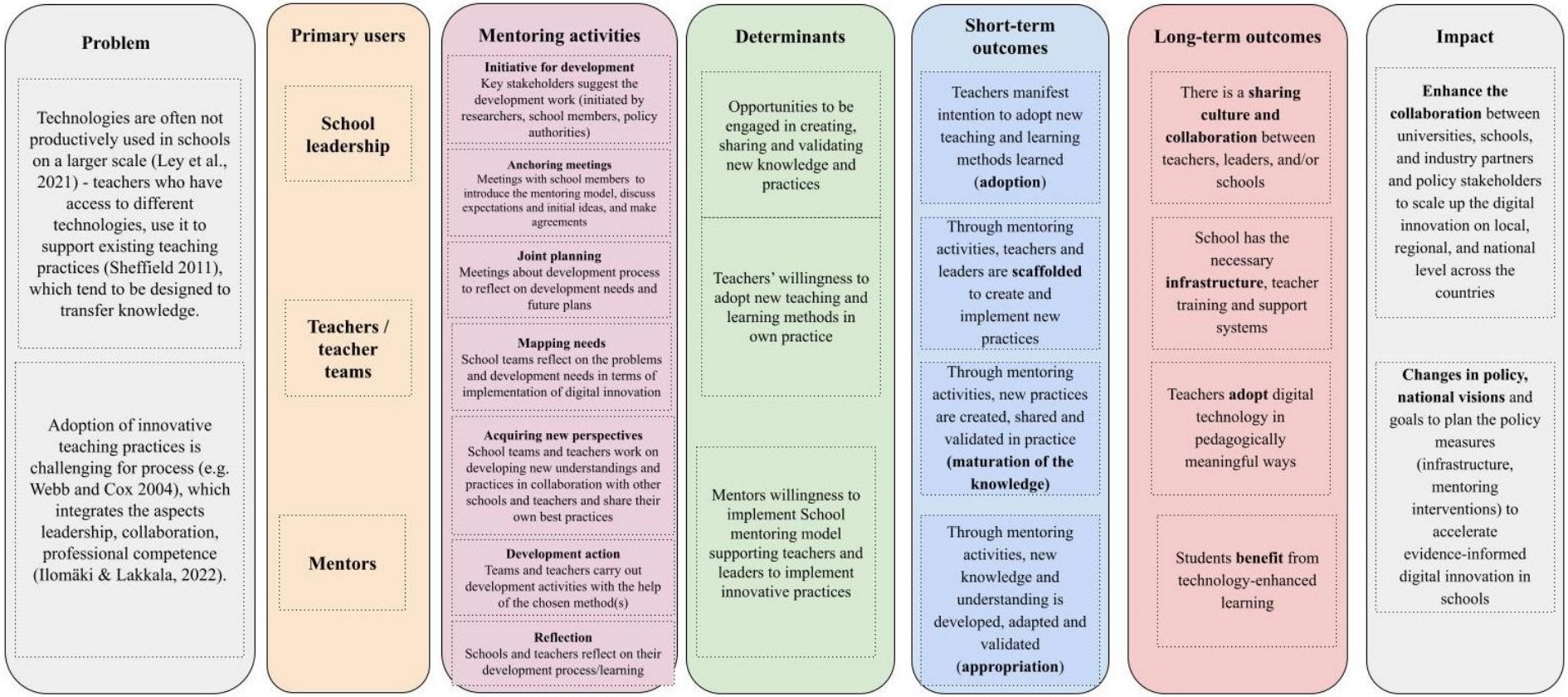

Figure 2: Logic model of iHub4Schools' evaluation process

1.4 Stakeholders and their information needs

The iHub4Schools project has engaged and worked with a variety of stakeholders, each with unique information needs that our evaluation report and proposed toolkit are designed to address.

This deliverable is particularly relevant to various actors involved in the project, **mentors**, **teacher trainers**, and **school leaders.** It provides insights into how teachers and leaders experience the implementation of the School Mentoring Model. Further, it explores the extent to which this model encourages the appropriation of innovative practices. This takes into account the variations across different educational contexts and the implications of resource-intensive interventions.

Policymakers, who are strategizing initiatives to enhance the digital maturity of schools and to accelerate digital innovation through inter-school collaboration and leadership involvement, will also find this deliverable informative. The report is particularly useful for schools that are lagging in the implementation of digital innovation.

Finally, this deliverable bears significance for **researchers** in the fields of educational sciences and technology-enhanced learning. It provides an opportunity to delve into the evaluation process and the instruments used for assessing the implementation of the School Mentoring Model.

1.5 iHub4Schools objectives and project activities

The primary goal of the iHub4Schools project was to develop and validate a new approach for promoting peer-learning settings and reinforcing the evidence-informed adoption of digital innovation in schools. Within the context of iHub4Schools, this approach is referred to as the "School Mentoring Model." An additional goal of the project was to establish five Regional Innovation Hubs across Europe. These hubs were designed to support the project's various activities and were expected to make a significant impact on individuals - like teachers and students - and organisations, ranging from schools and associations to networks and local policy bodies.

WP4 aimed to evaluate the effectiveness of the developed School Mentoring Model and to understand the impact of the Regional Innovation Hubs on scaling of digital innovation in partner countries. Specifically, D4.2 was designed to document the two rounds of local implementation of the proposed evidence-informed whole School Mentoring Model. This report was produced using an evaluation toolkit, initially in D4.1, which was significantly further developed in collaboration with partners based on insights gained from the pilot stages. Additionally, this deliverable will contribute to the T3.3, focusing on guidance and evaluation of the School Mentoring Model and establishing the model's validity and suitability across several diverse contexts.

The project's execution was organised in three distinct phases. Initially, a shared knowledge base was developed, encapsulating mentoring models, individual methods, pedagogical approaches, and evaluation approaches. Concurrently, cooperation with national stakeholder networks was initiated. In the second phase, pre-piloting was conducted to assess the initial version of the School Mentoring Model (D3.3) and gather insights for Support Mechanisms (D2.2). Finally, in the last phase, the pilot program was implemented and subsequently evaluated in four partner countries (see next section for case descriptions).

1.6 Projects' piloting cases

The iHub4Schools project applied the School Mentoring Model in two iterations (refer to Section 3 for more details). Although it was initially envisaged that only the second-round piloting cases would serve for the project's evaluation, some cases spanned the entire duration of the project, providing valuable feedback and insights.

In this section we will present an overview of all the cases evaluated within the collective framework established by the project evaluation guidelines. We will describe these cases in the following tables, aiming to identify shared characteristics while highlighting their contextual differences.

Table 1: Estonia

Name of the case:	**School improvement program: Digital Accelerator (EE)**
Stakeholders involved	One mentor of the mentors Ten mentors and educators Six schools (20 management members & 205 teachers)
Focus	The goal of the Digital Accelerator in Estonia was to support the enhancement of digital capabilities within school teams' and bolster their overall readiness for implementing digital technology. This was to be achieved through intensive training and educational technology mentoring. The Digital Accelerator sought to mentor schools that required a more systematic approach to implementing digital technology into their learning processes. Additionally, a key objective of the case was to encourage and promote cross-school collaboration among leaders.
Individual method applied	Digital acceleration: A development program aimed at school leaders and teachers to accelerate digital innovation in schools.
Success indicators	● Schools demonstrating evidence-informed awareness of their development needs. ● Teachers' readiness to integrate new practices into their instructional process. ● School-to-school engagements events. ● Documented, published, and shared good practices of adopting digital innovations in schools.
Characteristics that potentially lead to change	A tailored development program addressing the specific needs of schools. A previously established method aligning with the content of the program, indicating its maturity. A significant emphasis was placed on engaging both management and teachers concurrently, with special consideration for schools and teachers who typically are not involved in initiatives promoting digital innovation. Each participating school was assigned its own educational technologist as a mentor, and a development programme was customised to cater to each e school's needs, making this a resource-intensive intervention. The case primarily aimed to enhance basic digital competence and cultivate a digital culture within the school. The focus was less on embedding innovative practices , but rather on preparing the school to undertake initial,

	systematic steps towards implementing innovation. Cross-school cooperation was encouraged and facilitated through leadership training.

Table 2: Finland

Name of the case:	**Cross-school collaboration to implement DigiPath (FI)**
Stakeholders involved:	Finland implemented two cases, with each involving collaboration between two schools (approximately 30 teachers and 2 leaders in each instance). In total, there were four schools, about 60 teachers, and four leaders. Additionally, two university researchers mentored both cases, and two city-level digi-pedagogical experts participated in the activities. The first case started earlier in the pre-piloting phase, but both cases continued until the end of the piloting phase and contributed to the data collection reported in this deliverable.
Focus	The goal was to support two schools to collaborate with each other, to develop the schools' digital practices in general (in the first case) and to implement the city's DigiPath, which defines digital competences that students should develop at each grade level.
Individual method applied	In the first case, *a workshop was first organised to assess the school's current digital practices and development needs* (*Workshop for evaluating school's digital practices* - link). This workshop allowed teachers to identify good digital practices and points for improvements in teacher teams. A separate workshop *Generating ideas for promoting students' digital competence* (link) was conducted once in the first case and two times in the second case for all teachers of the two schools, combined with pre-tasks to get familiarised with the DigiPath framework as well as create and/or improve their own written pedagogical tips in a shared document. Each teacher was asked to choose two topics from the DigiPath that they specifically want to concentrate on. The best pedagogical tips were afterwards collected by the mentors to be shared and published as a package between all four schools as well as in the DigiPath platform of the city. Two city-level digi-pedagogical experts participated in the workshops and in supporting the schools. We also promoted the sharing of expertise inside schools by encouraging some teachers to give a presentation of their best case pedagogical examples in implementing DigiPath. One key method was that from the participating schools, two teachers with digital responsibilities formed a development team and led the work in their own school; teams from two schools formed a joint coordination team together. Also the principals participated often in the meetings. The mentors worked mainly with the coordination teams.
Success indicator	• Development aims recognized • Pedagogical tips created for implementing the DigiPath of the city by all teachers and shared between the two schools • Increased and sustainable collaboration between schools

Characteristics that potentially lead to change	Launched a year prior to the second case, the first case offered the mentors an invaluable opportunity to leverage their acquired experiences when providing support to schools in the subsequent case. Given the non-availability of the city's DigiPath framework at the inception of the project, the first case necessitated a substantial amount of time to outline the schools' individual goals. When the second case started, the implementation of DigiPath became a mandatory objective for the participating schools, with all parties keen to streamline the process and avert any potential wastage of time. In the second case, the process was quite straightforward and smooth. The schools expressed gratitude for the practical support they received from the mentors, particularly valuing the relevance to their specific circumstances. All coordination team meetings were for both schools together and the events for teachers in the mentoring process (workshops) were organised for both schools. In addition, the city contributed to the initiative by organising informative events and providing resources on DigiPath to support teachers. The mentors liaised with the city-level DigiPath development experts, thereby facilitating the network of various stakeholders and promoting the integration of city-level plans and development work into the schools. The mentors worked mainly with the coordination teams, whose members were tasked with managing school-level activities. This approach supported their role within the school effectively.. Given that the responsibility was at the school level, the development actions were more aptly suited to address the needs of the school and had a higher probability of yielding permanent changes.

Table 3: Georgia

Name of the case:	**Collaboration between Georgian schools in developing digital practices**
Stakeholders involved:	One case was implemented in Georgia. Within this case two phases were carried out applying individual methods. The pilot involved a total of five schools in two separate phases. Key stakeholders included five school leaders, five ICT development personnel (who are also teachers), approximately 100 teachers, and seven staff members from BSU. All the schools and teachers participated in both phases of the pilot.
Focus:	The primary goal of the case in Georgia was to foster collaboration both within and across schools, with a concentrated focus on enhancing teachers' digital competences. To achieve this, coordination teams were established in each participating school. These teams were responsible for nurturing collaboration among teachers across different subjects and grade levels. The overarching goal was to foster an environment conducive to sharing experiences, thereby assisting each other in effectively integrating digital technologies into the teaching process.
Individual method applied:	Measuring Teachers' Digital Competences Combined Training and Peer Learning

Success indicator	● Establishment of a collaborative culture among schools and teachers ● Enhancement of the quality of digital technology usage in teaching, leading to improved digital competencies for teachers
Characteristics that potentially lead to change	A pronounced emphasis on school-to-school collaboration and a whole-school approach towards incorporating digital practices. Integration of schools with different experiences in digital innovation. The inter-school collaboration among the five schools served as a foundation for creating the Georgian Regional Innovation Hub. The models and methods developed within the project were introduced to school principals, so that they could plan their school improvement activities based on the same methods. The schools were given significant autonomy in adapting the methods to their specific needs. The case prioritised improving the digital competence of participating teachers.

Table 4: Lithuania

Name of the case:	**Teachers' digital competence in the field of artificial intelligence and computational thinking**
Stakeholders involved:	Two separate cases were implemented in Lithuania, involving 12 schools and approximately 200 teachers along with three mentors. Although the first case started during the pre-piloting phase, both cases continued until the end of the second piloting phase and were included in the data collection reported in this deliverable.
Focus:	The goal was to cultivate collaboration among Lithuanian schools to enhance teachers' digital competence, particularly in artificial intelligence and computational thinking. New pedagogical practices were co-created through collaborative efforts using ViLLE/Eduten and Bebras tasks.
Individual method applied:	School-university collaboration for deepening teachers' digital competencies
Success indicator	● Increased teachers' enthusiasm for incorporating digital tools into their lessons ● Heightened student interest in mathematics and computer science ● Tailored teacher training that assisted teachers in integrating new practices ● Development and successful implementation of various digital resources and guidelines ● Application of computational thinking in pedagogical practice ● Enhanced inter-school collaboration
Characteristics that potentially lead to change	The mentors played a crucial role in preparing a plethora of educational resources, enabling teachers to incorporate them into their lessons effortlessly. All the exercises and didactic materials were conveniently uploaded to a virtual learning environment (ViLLE), making it easier for teachers to utilise them in classrooms and cater to different groups of students. This streamlined approach contributed to a straightforward and smooth process. The schools greatly appreciated the practical

	support provided by mentors, as it was directly relevant to their specific goals and needs: introducing students to artificial intelligence and problem-solving through computational thinking approaches. Furthermore, the mentors maintained regular communication with national curricula development experts (one of the mentors was involved in curricula development team last year), facilitating networking among various stakeholders and promoting the integration of computational thinking and development work within the schools. Collaboration primarily occurred with the coordination team, which comprised individuals responsible for school-level activities. This collaboration proved highly beneficial, as it further enhanced the mentors' role within the schools. By entrusting the responsibility for development to the schools themselves, the implemented actions were better aligned with their unique needs and goals.

As evidenced above, there are significant differences among the iHub4schools cases, and this diversity is intentional. Our goal was to study a variety of educational contexts and, more importantly, to endorse the autonomy of school leaders and teachers in determining what constitutes digital innovation in their unique settings. This variation naturally imposes limitations on collective evaluations, making direct comparisons of cases less meaningful. However, it simultaneously presents an opportunity to understand the reasons behind the differing perceptions and experiences of teachers and mentors in various circumstances.

2. Evaluation study questions

2.1 Questions addressed in the iHub4Schools' evaluation

The iHub4Schools project is a comprehensive initiative that deals with various dimensions of introducing, implementing and scaling digital innovation in schools. At the heart of this project is the implementation of the School Mentoring Model. Applied across a variety of educational contexts, the model aims to encourage and streamline digital innovation. The evaluation of the iHub4Schools is focused on answering the following key questions:

- To what degree do teachers express an intention to adopt the practices they have learned through their involvement in activities related to, or inspired by, the mentoring efforts?
- How do teachers perceive the practices of knowledge appropriation, maturation and scaffolding in relation to the new teaching and learning methods introduced, or emanating from their engagement in the mentoring activities?
- What perceived changes have participating teachers and school leadership identified as a result of their involvement in activities related to the mentoring efforts?
- How do mentors evaluate the effectiveness and utility of the mentoring model and methods in facilitating digital innovation?

3. Evaluation design

The project evaluation took place in two stages: pre-pilot phase (M12 to M18) and pilot phase (M20 to M30). The pre-pilot phase focused on the evaluation of the mentoring model and piloting of evaluation tools to investigate the teachers' experiences during the mentoring process. More specifically, in pre-pilot phase, 9 mentors from the five partner countries and teachers from the two Estonian cases (n=117) were

involved in piloting the survey instruments (for instance knowledge appropriation survey), on the basis of which common instruments for all partners were developed for the piloting phase.

To ensure a comprehensive evaluation of the project's final outcomes, a mixed-method approach was used in the pilot phase integrating both quantitative and qualitative data collection and analysis methods. Primary stakeholders, mainly teachers and, in some cases, school leadership - were the focal point of this evaluation. The following methods were applied:

- **A *survey*** for teachers was used in all four countries to gather quantitative data, enabling the identification of general trends and patterns. In total, 294 teachers across the four countries were surveyed.
- Semi-structured ***interviews*** were conducted with teachers and/or school leaders to supplement the numerical data, thereby providing a deeper understanding of stakeholders' experiences. These interviews offered participants an opportunity to share their unique experiences and viewpoints, not only in relation to the survey results but also beyond them. 37 stakeholders, including teachers, IT specialists, principals, and vice-principals, were interviewed across the four countries.
- ***Reflective questionnaires*** were used with the mentors who implemented the School Mentoring Model during both the pre-pilot and piloting phases, to gauge mentors' perceptions of the mentoring experience, both for themselves and as a potential experience for teachers and school leaders. All mentors (N=24) involved in the project were invited to respond to the reflective questionnaire.
- ***Case reports for evaluation of mentoring models and methods*** In each mentoring case, the key mentors prepared case reports (N = 6) documenting their key activities and phases of their mentoring process while implementing the School Mentoring Model. After the mentoring process was finished, mentors were asked to evaluate the applicability of the various elements of the mentoring model (Conceptual model, Process model, Individual methods used) within the conclusion of the case report (refer to questions in Annex 4). In addition, some educational experts offered feedback on the draft descriptions of the models and methods within the mentoring guidelines prepared for D3.3.

3.1 Participants

In this chapter, we present an overview of the participants who were engaged in the pilot phase of the study.

Survey

Table 5 summarises the demographic characteristics of the survey responders. A total of 294 teachers across the four countries completed the survey. The distribution of participants across countries was as follows: Estonia (N=112), Finland (N=46), Georgia (N=31), and Lithuania (N=105). In terms of gender distribution, the majority of participants identified as female. The percentage of female participants in each country was as follows: Estonia (91%), Finland (78%), Georgia (94%), and Lithuania (93%).

The age distribution of participants ranged from 20 to over 60. The highest percentage of participants were between 51-60 years old in Estonia (34%) and Lithuania (40%). Finland had a more evenly distributed age group, with the highest percentage of participants within the 31-40 (34%) and 41-50 (32%) age groups. For Georgia, the majority of the participants were evenly spread across the 31-40 (32%) and 41-50 (32%) age

groups. Participants aged over 60 made up a minority in each country, with the most significant representation in Estonia (16%) and Lithuania (12%).

Regarding teaching experience, most participants from each country had significant experience. Over half of the participants from Estonia (51%) and Lithuania (71%) reported having more than 20 years of teaching experience. In Finland, the majority of participants had between 11-20 years (32%) and more than 20 years (32%) of teaching experience. Similarly, in Georgia, the most common teaching experience bracket was between 11-20 years (39%) and more than 20 years (45%). Less experienced teachers, with 0-5 years of experience, were in the minority in each country, with the highest representation in Estonia (17%) and Finland (21%).

Table 5. Participant Demographics

	Estonia (N = 112)		Finland (N = 47)		Georgia (N =31)		Lithuania (N = 105)	
Gender								
Female	102	91%	36	78%	29	94%	98	93%
Male	10	9%	10	20%	2	6%	7	7%
Prefer not to answer	0	0%	1	2%	0	0%	0	0%
Age								
20-30	7	6%	6	13%	4	13%	7	7%
31-40	20	18%	16	34%	10	32%	17	16%
41-50	29	26%	15	32%	10	32%	26	25%
51-60	38	34%	9	19%	7	23%	42	40%
More than 60	18	16%	1	2%	0	0%	13	12%
Teaching experience								
0-5	19	17%	10	21%	2	6%	7	7%
6-10	14	13%	7	15%	3	10%	5	5%
11-20	22	19%	15	32%	12	39%	18	17%
More than 20	57	51%	15	32%	14	45%	75	71%
Experience teaching with technology*								
0-5	30	27%	14	30%	13	42%	17	17%

6-10	34	31%	17	36%	13	42%	22	21%
11-20	32	29%	13	28%	5	16%	44	43%
More than 20	14	13%	3	6%	0	0%	19	19%

*Note: *Data missing for two Estonian teachers and three Lithuanian teachers*

Interviews

Table 6 provides a concise overview of the interviews in which the participants were involved for the qualitative part of the evaluation. In all, there were 37 participants. In Estonia, six individuals were interviewed, including five teachers and one IT specialist who also had teaching responsibilities. In Finland, there were ten participants, consisting of six teachers who were all actively involved in providing Information and Communications Technology (ICT) support in their respective schools, as well as four administrative staff (three principals and one vice principal). Georgia had five participants, all of whom were teachers, with one participant also serving as a deputy director. Lastly, Lithuania had the highest number of participants, with a total of 16, which included 15 teachers and one vice principal.

Table 6. Participation in interviews

	Estonia (N = 6)	Finland (N = 10)	Georgia (N = 5)	Lithuania (N = 16)
Position				
Teacher	5	6*	5**	15
IT specialist	1*			
Principal		3		
Vice principal		1		1

N*ote: *Also a teacher; ** One teacher is also deputy director; ***All accumulate ICT support in schools*

Reflective questionnaire for the mentors

Table 7 provides an overview of the mentors involved in the 1st and 2nd phase of the project. These mentors completed reflective questionnaires, providing insights into their experiences with implementing the School Mentoring Model and their perceptions of the overall mentoring process.

Table 7. Mentors involved in the evaluation process

	Estonia	**Finland**	**Georgia**	**Lithuania**	**Norway**
1st phase (M18)	3 mentors	2 mentors	1 mentor	2 mentors	2 mentors
2nd phase (M30)	10 mentors	1 mentor	1 mentor	2 mentors	-

Case reports for evaluation of the School Mentoring Model and methods

A total of six mentoring cases were documented in the case reports, with one each from Estonia and Georgia, and two each from Finland and Lithuania. The key mentors organising each case jointly assumed the responsibility for evaluating the mentoring models and methods, an analysis which formed the concluding part of the case report. Feedback on the descriptions of the models and methods in the draft version of D3.3 was sought from three educational experts from Estonia, Italy, and Finland. These experts were chosen based on convenience sampling by the members of the consortium using their existing professional networks. Notably, the experts were seasoned practitioners who routinely worked with schools and teachers and had experience in teacher training and mentoring.

3.2 Data collection process

The data collection process comprised a survey, interviews for school participants, and evaluative and reflective questionnaires for mentors, ensuring a thorough understanding of the project's outcomes. The survey and the interview were initially developed in English and subsequently translated into the native language of each country. Further, the questions were localised in consultation with the project partners to capture the contextual differences and variations in the implementation of the iHub4School's project across the four countries. The outcomes, data collection tools, and target group are summarised in Table 8.

Table 8: Outcomes, instruments and target groups

Outcomes	Data collection tools	Target group
Intended adoption of new practice	Survey, individual interviews	Teachers
Knowledge appropriation practices	Survey, individual interviews	Teachers
Knowledge maturation practices	Survey, individual interviews	Teachers
Scaffolding practices	Survey, individual interviews	Teachers
Perceived changes	Individual or focus groups interviews	Teachers
Mentoring experiences	Self-reflection questionnaire	Mentors
Model and method usefulness	Evaluation answers in the mentoring case reports and expert feedback on the mentoring guidelines	Mentors, external experts

Survey

The survey (see Annex 1) was structured into three distinct sections. The first section centred on teachers' intention to adopt the novel teaching and learning methods they were familiarised with during their participation in the project activities. Responses were measured on a Likert scale, ranging from 'strongly disagree' to 'strongly agree'. One such item stated, "I am frequently using the new ways of teaching and learning with digital technologies in my teaching practice." Although the items were adapted to align with each country's specific context, these modifications were minor (refer to Annex 1 for details). The second section delved into practices related to knowledge appropriation, using a Likert-type scale for responses. The conceptual basis for these two first sections was derived from the work of Ley et al. (2022). The final section gathered demographic information about the participants, including their gender, age, teaching experience, and experience teaching with technology. Certain sections, though initially included, pertaining to individual motivation, leadership practices, structural changes, and inter-school collaboration were eventually excluded from this evaluation. The decision to exclude these items resulted from several factors. Firstly, some of these items were not universally relevant across all cases. Secondly, some partners accidentally omitted one or two of these sections when administering the survey. Finally, there was a collective agreement among partners that qualitative data could more effectively address these topics.

Country-specific survey distribution:

Estonia: In the six Estonian schools, an online survey was sent after the end of the mentoring program using LimeSurvey. The survey was translated to Estonian and distributed through school leaders to all the teachers participating in the program.

Finland: In four Finnish schools, mentors coordinated with each school's development team to distribute the survey during their regular weekly teacher meeting. The teachers present at the meeting completed the survey at the start of the meeting. The survey was translated from English to Finnish and Swedish and implemented using the e-Form application of the University of Helsinki.

Georgia: In the five Georgian schools, an online survey was sent after the pilot ended. The questionnaire was translated to Georgian and was sent to teachers via Google Forms.

Lithuania: The Vilnius university team responsible for the iHub4schools project sent the online survey directly to schools which used ViLLE or Eduten platforms. The survey was shared via Google Forms with school leaders who were requested to forward to relevant teachers. The survey was translated to Lithuanian.

Interviews/focus groups

A semi-structured interview protocol (see Annex 2) was developed to serve multiple purposes, including providing nuanced understanding of survey findings, exploring unanticipated outcomes from the project, understanding the perceived changes resulting from participants' engagement in the mentoring activities, and identifying potential areas for project improvement. The interviews were conducted either in-person or online and recorded to ensure the accurate capture of participants' responses. Sample questions included inquiries such as: "Can you provide specific instances of changes that have occurred in your school since the beginning of the [training/development project]?" and "When reflecting on your experience participating in this [training/development project], what was it like for you?" In the cases of Finland and

Lithuania, focus groups were organised in different schools, bringing together both teachers and school leaders. It is important to note that, to maintain a comfortable atmosphere for the teachers, one question was omitted from the interview protocol. The excluded question aimed to explore potential areas for improvement by asking, "If your school had to do it over again, what could the principal/leaders have done differently?" This decision was made to ensure that teachers were not put in an uncomfortable position during the interview process.

Country-specific interview procedures:

Estonia: Interviews were conducted individually with teachers from all six participating Estonian schools. The questions were adapted to suit the Estonian context, based on the guidelines in Annex 2. The interviews were conducted online and recorded using Zoom and transcribed.

Finland: In the two Finnish cases comprising four schools collaborating with each other, the mentoring mainly focussed on collaborating with the coordination team that consisted of the development teams of both participating schools in each case. The interview was conducted as a group interview separately for each schools' development team. The questions from the interview protocol (Annex 2) were somewhat revised to be suitable for the school-level development team. The development teams consisted of the principal or vice principal and one or two teachers who had a special role as digital support teacher in their school. The interviews were conducted online and recorded using Teams or Zoom and transcribed.

Georgia: The BSU university team selected teachers from five mentoring schools, visited schools and conducted interviews according to the guidelines. Five teachers were interviewed and sessions were transcribed.

Lithuania: The Vilnius university team visited participating schools and conducted interviews, following the guidelines in Annex 2. Usually, five to seven teachers participated individually in interviews to share their experiences during the mentoring. The interviews were recorded and transcribed.

Reflective questionnaires

A reflective questionnaire for mentors was developed to understand the perspectives of the mentors about the mentoring process. We aimed to understand how mentors perceived the mentoring activities, especially in relation to motivational aspects and challenges. We also wanted to explore mentors' impressions of the benefits reaped and challenges faced by the teachers and leaders they mentored. The questionnaire was translated to local languages and shared via Google Forms with mentors.

Case reports for evaluation of the School Mentoring Model and individual methods

Case reports were organised in two ways. First, in each mentoring case (in the pilot phase) the key mentors were responsible for filling out a case report, in which they documented the main phases and activities of their mentoring process while employing the School Mentoring Model. Upon the conclusion of the mentoring process, the mentors were tasked with evaluating the applicability of the different elements of the mentoring model - namely, the Conceptual model, Process model, and Individual methods used. This evaluation was included at the end of the case report (see the questions in Annex 4). Second, the draft version of the mentoring guidelines detailed in D3.3 was shared with three chosen educational experts via

a Google document. These experts were invited to add their comments and suggestions directly into the document. The experts were able to see each others' comments.

3.3 Approach to data analysis

Quantitative data analysis

The quantitative data collected was entered and analysed using JASP (version 0.17.1). The raw data was checked for accuracy and completeness. For the analyses described in this document, no data was missing. Descriptive statistics were computed to summarise the quantitative data.

Qualitative data analysis

The analysis approach for the **qualitative data collected from teachers** comprised a blend of deductive and inductive strategies. Initially, the codebook included codes inspired by the knowledge appropriation model, and new codes emerged during the analysis were also incorporated. The analysis process integrated coding and memoing techniques, with initial themes being recorded in analytic memos. These preliminary themes were then polished through several cycles of revision. For the purposes of this evaluation, a single researcher associated with the project undertook the data coding. This coded data was then shared with collaborators for verification and additional modifications as necessary.

The **analysis of the mentors' experiences** leveraged inductive strategies. Main themes were created around questions concerning mentoring activities, the importance of mentoring for teachers and leaders, the motivation and challenges encountered by mentors in the mentoring process, and factors hindering the mentoring process. Subthemes were derived from the analysis of the teachers' reflections. The coded data was subsequently shared with collaborators for verification and additional modifications as necessary.

As for the **analysis of the evaluation of the mentoring models and methods** presented in the case reports and mentoring guidelines feedback, this was carried out by making a descriptive summary of the responses.

4. Findings and Discussion

In this section, we begin by outlining the results from the survey, providing a broad perspective on the experiences and perceptions of teachers. We then proceed to detail findings from the interviews and mentors' evaluation of the models and methods as well as self-reflections. These qualitative sources offer rich, nuanced insights, deepening our comprehension of the project's outcomes and implications. Notably, whenever our data allows, we supplement and contextualise survey results with pertinent insights from the interviews. In addition, we analyse mentors' experiences of both the mentoring itself and the model created.

4.1 Teacher intention to adopt methods and practices learned from mentoring-influenced activities

Section 4.1 delves into teachers' perceptions regarding their intention to adopt new learning methods and practices learned from mentoring-influenced activities. Overall, the findings suggest that the majority of teachers intend to adopt new teaching and learning practices in their classrooms. Figure 3 provides **a combined score reflecting the teachers' intention to adopt new teaching and learning methods** across all cases, offering a comprehensive view of the findings. It is critical, however, to recognize that each case is unique, with its own specific context and nuances that shape teachers' perceptions and intentions. As

such, we will dissect each individual case, providing an in-depth analysis and discussion of the teachers' perceived intention to adopt new methods.

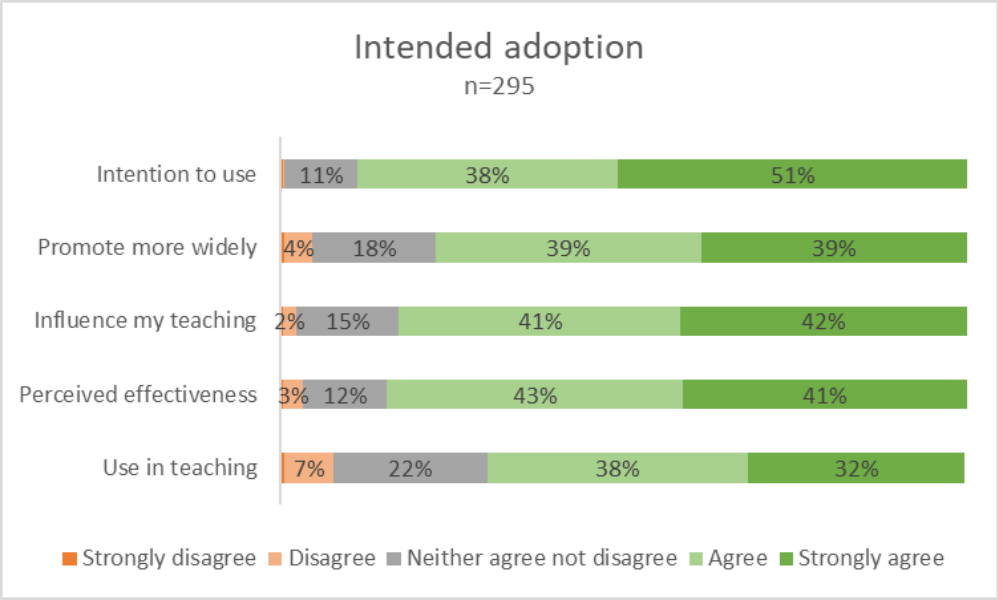

Figure 3: Teachers' perceptions of intended adoption of new teaching and learning methods

As the figure shows, a significant proportion of participants (89%) - with 51% of teachers strongly agreeing and 38% agreeing - expressed firm agreement with the statement regarding their **intention to use the new teaching methods and learning practices post-mentoring period.** Similarly, the majority of teachers **expressed willingness to promote the new methods** within their broader school community, with 78% in agreement - equally split between those who agree and strongly disagree. Furthermore, 83% of the teachers agreed that the **new methods will influence their teaching and** 84% acknowledged the **effectiveness of the novel methods.** Notably, more than two thirds of the teachers (70%), with a slight lean toward agreement, reported that they **were already incorporating the new methods in their practice**.

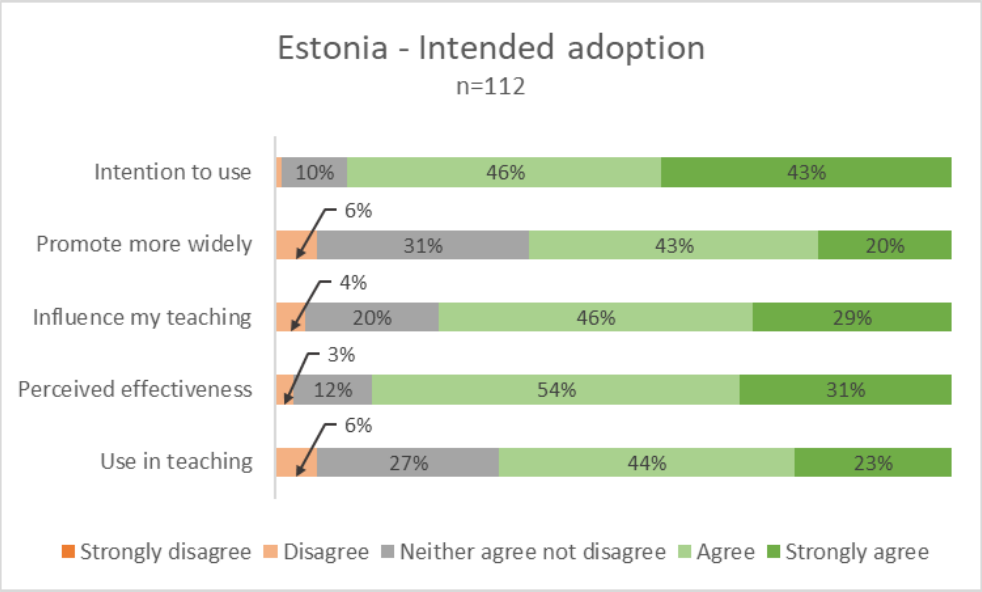

Figure 4: Estonian Teachers' perceptions of intended adoption of new teaching and learning methods

Figure 4 shows the data from Estonia, which aimed to implement whole-school level adoption of digital innovation, specifically targeting schools with limited prior exposure to digital innovation training. A majority of the teachers (89%) reported that they **intended to use the newly learned approaches in the future** (89%), and a significant portion (85%) perceived the new **methods as effective.** About (75%) of the teachers reported that the **methods will influence their teaching** in the future while a slightly smaller group (63%) reported confidence in **advocating the method** in their school. Though quantitative data highlights Estonian teachers' positive attitudes towards the training, interview responses reveal reasons for actual implementation lagging behind teachers' reported intentions. Balancing their current roles with the training programs demands proved challenging, as noted by Participant 2E, "*The whole of September seems to be spent purely on settling into school… it all seemed to come a little too much at once. We weren't quite ready for that.*" Similarly, Participant 4E commented on the overwhelming workload, which made it difficult to manage all tasks in the given time. Moreover, the endeavour of assimilating digital tools into everyday teaching procedures presented additional obstacles, particularly concerning digital literacy. Participant 3E's experience highlighted these issues as they grappled with digital collaboration: "*One moment we had such a confusion where we needed to share a joint document. Then I got the feeling that help, I don't understand anything.*" This could be due **to the lack of basic digital competence** and **difficulties in managing intensive communication,** as the school teams reported to the mentors that they experienced heavy information overload. For most teacher training in Estonia, teachers are not required to complete practical individual tasks, but classroom implementation and reporting on the same was necessary to obtain a completion certificate in this case. This could explain why the training was overwhelming for the teachers. Nevertheless, the positive influence of **external mentorship and support was unequivocally apparent,** as participants found these elements to be of immense value. This external guidance greatly facilitated the successful implementation of novel teaching methods and digital tools. Participant 2E stressed the importance of these meetings: "*For me personally, the meetings there in the management room with the mentor and the digital accelerator team had some interesting examples to offer.*" The commitment of the mentor to continue providing support beyond the program's scope, as Participant 4E detailed, was deemed vital for their progress. Considering these factors in conjunction with the participants' explicit

enthusiasm for the program and the perceived opportunities for professional growth suggests that with enhanced planning and sustained support, the prospect of these innovative teaching methods gaining wider acceptance and use may become increasingly feasible.

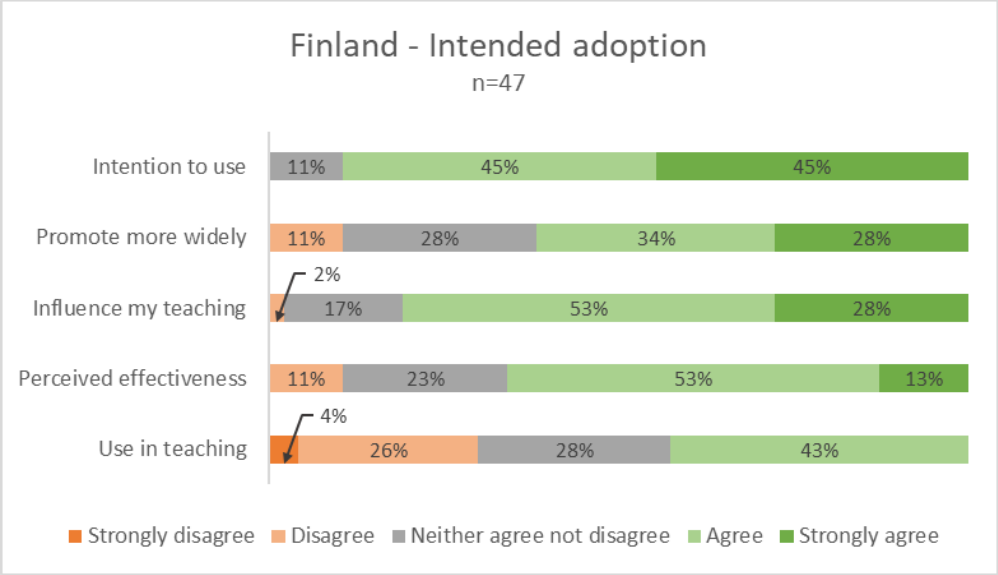

Figure 5: Finnish teachers' perceptions of intended adoption of new teaching and learning methods

As depicted in Figure 5, participants from the **Finnish cases** conveyed **a strong intention** to employ the newly introduced teaching and learning methods following their mentoring experiences. With 90% indicating they **intend to use them in the future** and 81% believing that these methods would exert a long-term **influence on their teaching**, the data underscores the participants' confidence in the value and longevity of these innovative practices.. However, the responses regarding **encouraging the use of these methods** within their broader school community and the **frequency of using these methods in everyday teaching** practice was less enthusiastic, with only 64% and 43% respectively expressing agreement or strong agreement. Moreover, while 63% of participants agreed that **the new teaching methods were effective** for teaching their subjects, the context may have influenced this perception. Since all respondents were elementary school teachers teaching various subjects and the development goal was to implement a framework for supporting students' digital competence, this particular question may not have resonated fully in their context. These results, while positive overall, suggest some hesitation or potential barriers when it comes to advocating these innovative methods more broadly within their school, and integrating them more frequently into their teaching routines. Significantly, the Finnish case revolved around the implementation of a digital skills curriculum for elementary school students, with principals and teachers from two different schools collaborating to create teaching and learning material based on the locally administered "DigiPath" curriculum. It is plausible that teachers' hesitance in certain areas could be attributed to the timing of this evaluation. Participants might have needed more time to fully implement and evaluate the effectiveness of the new teaching methods developed during the project. Therefore, while participants perceived a high degree of personal commitment to these new methods and their long-term influence on their teaching, the findings suggest that further support and perhaps more time might be

necessary to encourage broader and more frequent adoption of these methods within their school environment.

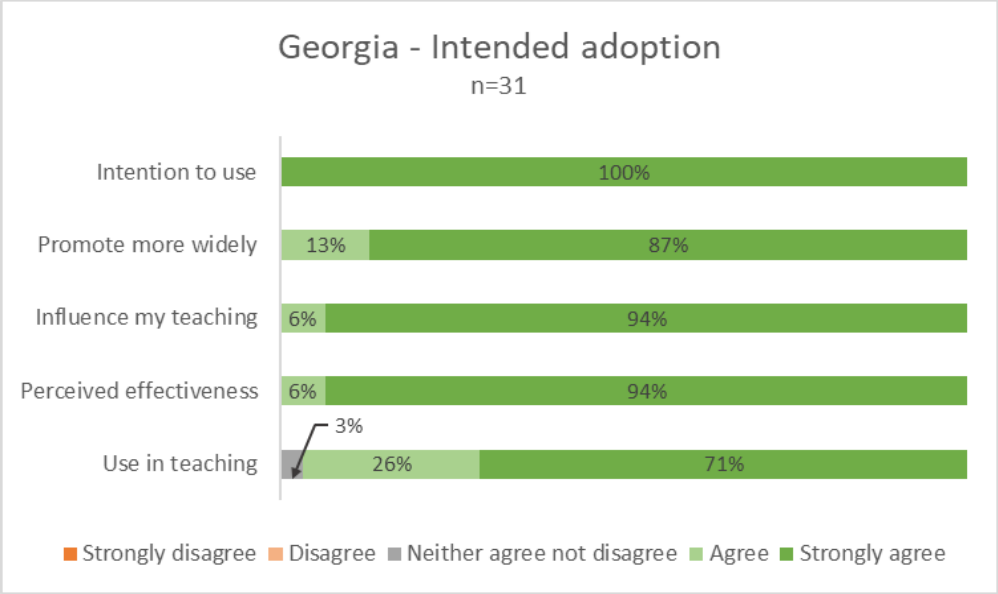

Figure 6: Georgian Teachers' perceptions of intended adoption of new teaching and learning methods

In the **Georgian context** (see Figure 6), all participants confidently expressed **their commitment to applying the new teaching and learning methods,** with **87% of participants strongly agreeing that they would promote these methods** more widely in their schools. An overwhelming 94% of participants strongly agreed on the **long-lasting influence these methods will have on their teaching practices.** This high degree of certainty signals a strong personal commitment to these new methods,, an anticipation of their sustained impact, and a readiness to act as advocates for these methods within their broader school environment. Furthermore, all participants either agreed or strongly agreed that these **new methods were effective in teaching** their subject, indicating their appreciation for these new methods and their perceived efficacy. Finally, a considerable 97% of the teachers reported implementing **these new methods in their day-to-day teaching practice.** This indicates that nearly all participants are not only embracing the methods at a conceptual level but are also actively incorporating them into their routine teaching practices. Taken together, these results from the Georgian case suggest that the participants have strong positive perceptions regarding the new teaching and learning methods, both in terms of their personal use and their potential for wider adoption within the school environment. The high respondent agreement across all categories reflects an overall positive receptivity towards these innovative practices. However, these consistent responses across all survey indicators point to a need to interpret these results with some caution. The nature of the mentoring program might have influenced the participants to portray their experiences and future intentions in an exceptionally positive light. Hence, while the results clearly indicate a positive outlook on the adoption and propagation of these teaching methods, further scrutiny may be required to fully understand the complexities of implementing these methods in the Georgian context.

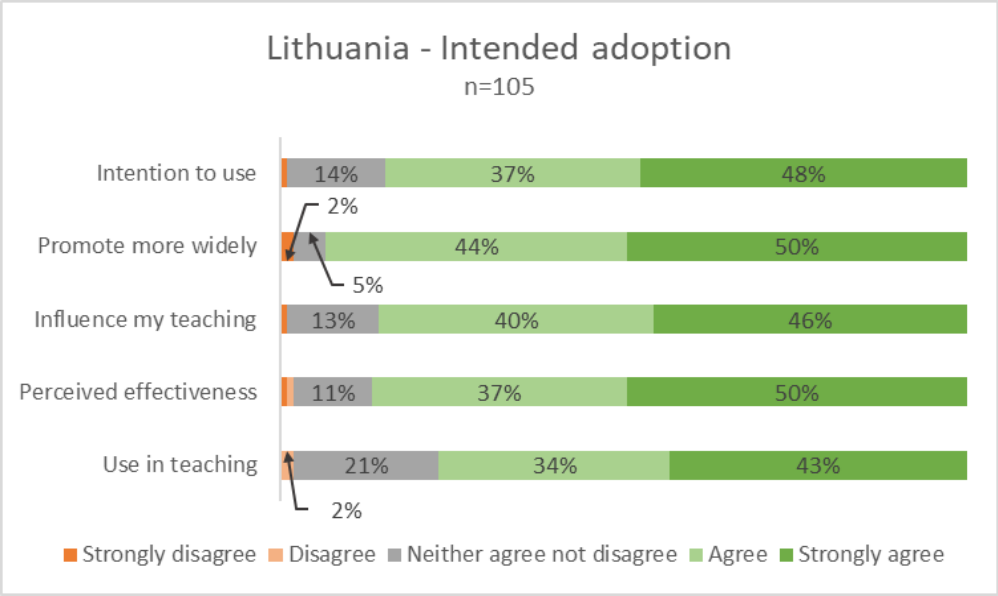

Figure 7: Lithuanian Teachers' perceptions of intended adoption of new teaching and learning methods

In the **Lithuanian case** (see Figure 7), a large number of participants expressed strong certainty in employing and promoting the newly introduced teaching and learning methods following their training. This certainty is evidenced by 85% of the teachers **expressing the intention to use new methods in their teaching,** and 94% reporting **that they intend to promote these new methods more widely in their school.** Moreover, most teachers (87%) perceived these **innovative methods to be effective** for teaching their subject. This was closely matched by the percentage of teachers who perceived that these **methods would influence their teaching** for a long time (86%). These results indicate a strong belief among most participants in the efficacy and longevity of these teaching and learning innovations. However, when it came to the **frequency of already implementing these new methods** in their teaching practice, 77% of the teachers reported doing so. While this is still a large number of teachers, it is the lowest among the areas evaluated, suggesting that there may be room for increased regular use of these new methods in their daily teaching activities. Overall, these results suggest a positive perception of the new teaching and learning methods among a large majority of the Lithuanian participants. Most of them not only express the intentions of using and advocating for these new methods, but also perceive them as effective and influential in their teaching practice. Despite this, there may be room for improving the frequency of these methods' application in daily teaching. The qualitative feedback gathered from Lithuanian participants substantiates the high survey scores, underscoring the successful integration of new teaching methodologies, increased usage of digital tools, and a noteworthy positive shift in students' attitudes towards learning (additional details can be found in Section 4.3). Yet, alongside these perceived positive impacts, several participants identified challenges, such as the transition to digital methods extending their working hours (Participant 2L), a tight project schedule (Participant 12L), a lack of methodological support (Participants 12L and 13L), and difficulties in merging digital tasks with traditional pedagogical practices (Participants 14L and 3L). For example, Participant 2L revealed how the transition from traditional to digital methods **extended their working hours**: "*The shift from paper to screen meant that some activities had to be extended beyond school hours, making our working day longer.*" Additionally, Participant 12L illuminated the stress brought on by a **tight timeline**, expressing, "*The project itself was very tight, we needed to do many things in a short period of time.*" A third challenge was found in the **lack of methodological support**, as explained by

Participants 12L and 13L. Participant 13L, for instance, commented on the significant lack of guidance during the digital transition, saying, "*There was a great lack of methodological support and a lot of distraction.*" Lastly, issues with integrating digital exercises into existing traditional pedagogical methods were flagged by several participants. Specifically, Participant 3L reported difficulties in reconciling exercises on the Eduten/ViLLE platform with the current maths curriculum, stating, "*It was quite a challenge to combine exercises in Eduten/ViLLE platform with the acting maths curriculum*." These challenges underscore the need for additional support and resources tailored to aid teachers in their adoption of innovative teaching and learning methods. By addressing these areas, it is likely to further enhance the overall positive response and integration of these new methodologies into everyday teaching practices in the Lithuanian context.

The evaluation across the Estonia, Finland, Georgia, and Lithuania cases underscores a collective affirmation for the newly-introduced teaching methods and digital tools through mentoring experiences. Across all cases, participants' intention to adopt and advocate for these innovative strategies, their perceived effectiveness, and anticipated long-term impacts recorded consistently high scores. This suggests a generally positive outlook towards these progressive teaching and learning methods. However, despite the successful integration of these innovations, there are noteworthy challenges. A common issue across all cases was the frequency of employing these new methods in daily teaching activities, indicating a potential area for improvement. The qualitative responses further delve into the intricate nuances of incorporating new teaching methodologies and digital tools. The challenges reported ranged from the complexity of balancing existing teaching responsibilities with mentoring activities, the timing of these activities, improving data literacy, the additional workload stemming from the transition to digital methods, and managing tight project timelines, and lack of methodological support, underscoring the need for sustained assistance and resources to successfully employ these teaching innovations. Despite these obstacles, the overwhelming sentiment conveyed by participants across all cases was one of excitement and dedication to these novel approaches. This highlights the potential of these innovative strategies to substantially enrich teaching and learning experiences across diverse educational environments, despite the encountered challenges.

4.2 Teacher Perceptions of Knowledge Appropriation, Maturation, and Scaffolding Practices during the Mentoring Process

4.2.1 Knowledge Maturation Practices

Knowledge maturation practices consider **how knowledge is created through sharing, co-creation, formalisation and standardisation** in a systematic manner. In our project, we expected that through the mentoring and School Mentoring Model phases, we would create opportunities to create, share and validate new knowledge (e.g. in the phase of acquiring new perspectives or developmental activities). At the same time, it is important to bear in mind that both the methods used and the knowledge shared were different in each case, which is why we need to carefully examine the dynamics within each case.

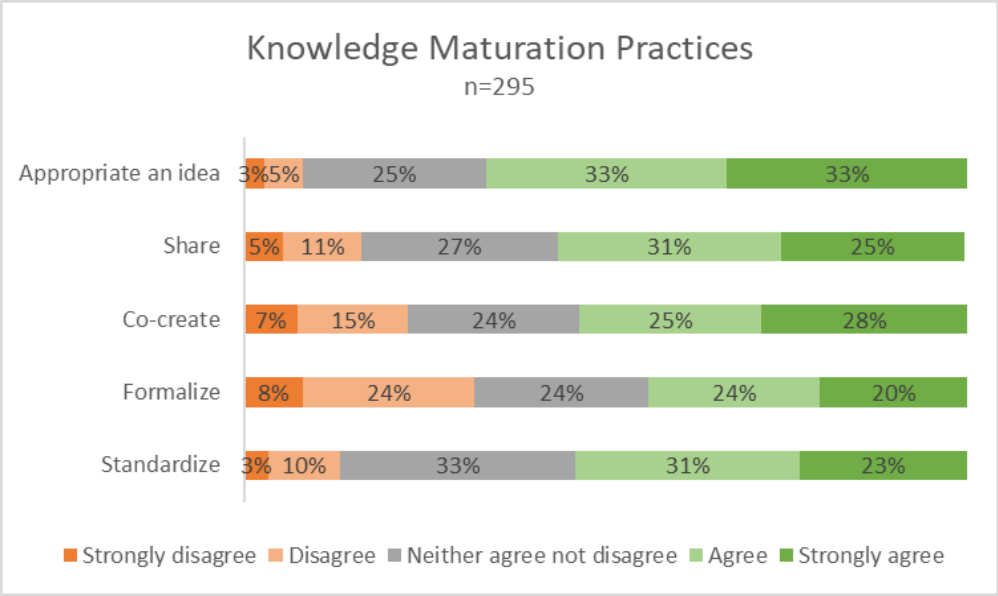

Figure 8: Teachers' perceptions on knowledge maturation practices during the mentoring activities

Figure 8 examines the specific components encompassed within the construct of knowledge maturation practices. Across the cases we can assume that teachers involved in mentoring perceived that **their ideas and experiences were considered** when new teaching and learning methods were developed and introduced during the training - all cases rated these practices the highest. However, formalisation practices (**documentation of materials and practices** in a way that others outside of our school would be able to use) received the lowest scores from all four cases.

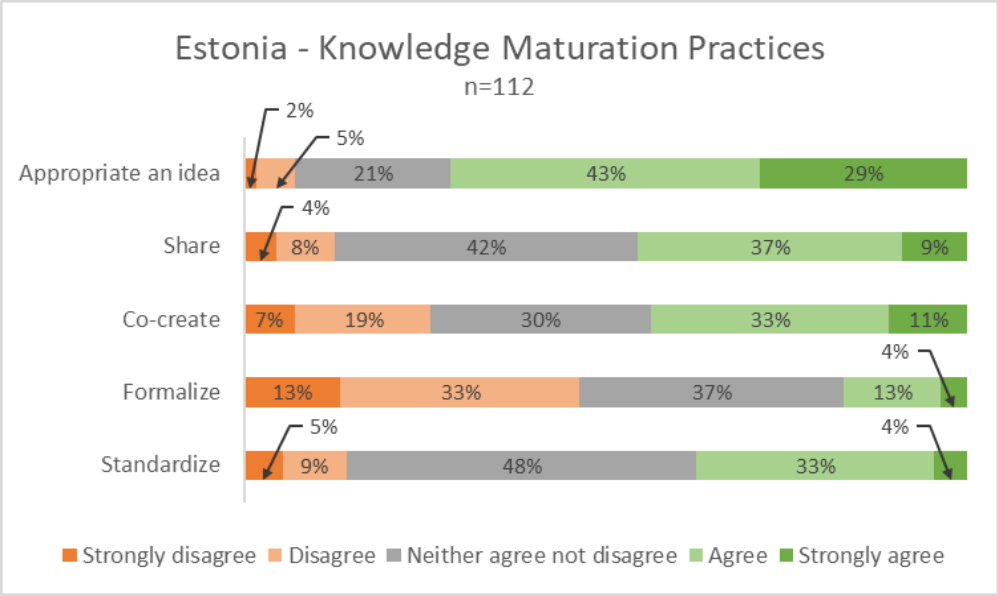

Figure 9: Estonian teachers' perceptions on knowledge maturation practices during the mentoring activities

In the case of **Estonia** (Figure 9), 71% of the teachers agreed or strongly agreed that they felt a considerable degree of individual agency in applying their experiences and ideas when developing new teaching and learning methods. However, the practice of **sharing these experiences** and materials with others, both within and outside the mentoring context, was reported by less than half (45%) of the teachers. This implies a less pronounced inclination to share and collaborate in the creation of new methods. But as this mentoring case is targeting development of basic digital competence, then teachers are not ready to share their materials, they do not have the confidence yet, in the program the main focus is on sharing between your own school team. Similarly, 43% of the teachers reported actively **engaging in the co-creation** of new teaching and learning materials. This relatively smaller segment of teachers contributing towards co-created materials indicates a potential opportunity for enhancing collaboration and collective creation within the group. Only 16% of the teachers stated that they **engaged in the formalisation of new methods** and materials for use by those outside the mentoring program. This statistic suggests that the formalisation and sharing of resources beyond the immediate group was not widespread. Interestingly, the **new methods** and materials developed in the mentoring were reported to be **regularly implemented** in the schools by 37% of the teachers. This moderate statistic suggests a positive degree of standardisation, reflecting the integration of these innovations into regular teaching practices. Overall, Estonian teachers' responses underscore a high level of personal engagement in knowledge maturation practices, while displaying lower levels of sharing, co-creation, and formalisation (Documented, published, and shared good practices, was, however, a success indicator for the Digital Accelerator program). This suggests that teachers who are in the early stages of adopting digital innovation and acquiring basic digital skills require more time and confidence before they can begin sharing materials and formalising and standardising their knowledge. Also, in addition to the time constraints as mentioned above, we need to keep in mind that the Estonian education system was affected by the Ukrainian war. Several mentored schools received Ukrainian students, who do not speak Estonian and need special support and conditions, which meant extra resources were required from schools and local governments. Teachers in the program were navigating their ongoing teaching responsibilities, which could have been especially demanding as the training program was initiated at the start of a hectic academic year. Consequently, the simultaneous demands might have impacted their ability to fully engage in more collaborative and formalised practices. These observations underscore the importance of considering the practical constraints faced by teachers when designing and implementing similar programs.

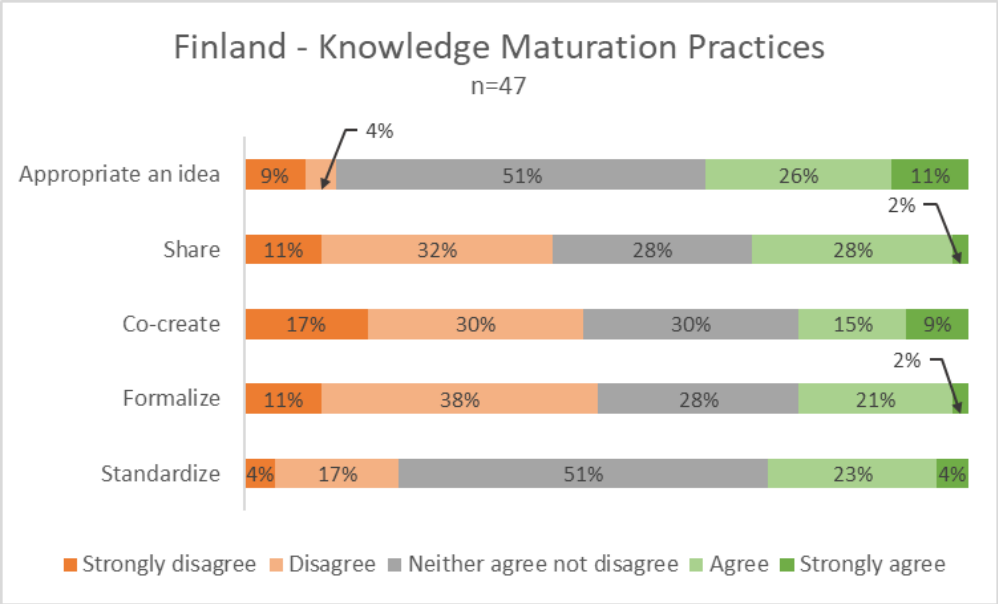

Figure 10: Finnish teachers' perceptions on knowledge maturation practices during the mentoring activities

In the context of **Finland** (See figure 10), 37% of the participants perceived that their **own experiences and ideas were considered** when developing new teaching and learning methods. This highlights that for more than a third of the participants, personal insights were valued. 28% of the teachers stated that **they shared experiences and materials** with other teachers, both inside and outside the mentoring program, indicating that sharing practices could be enhanced. This finding points towards a potential need for more robust mechanisms to facilitate collaboration and knowledge sharing among participants. 24% of the teachers reported **active involvement in co-creating activities**, suggesting that for most teachers, there were not enough possibilities for developing new teaching and learning materials. This could relate to the relatively short duration of time allocated in the Finnish cases for collective design and collaboration workshops during the project, hinting at an opportunity for reinforcing these processes in the participating schools in the future. 23% of the teachers agreed that **they engaged in the formalisation of new teaching and learning methods** and materials for use by those outside the respondents' own classroom, signifying the need for greater emphasis on formalising and disseminating resources in the teacher community inside the schools. Such an approach could increase the impact and reach of the innovations developed in the whole school activities. Finally, 27% of the teachers stated that **they took part in the standardisation process,** where the newly developed methods based on city-level strategies were regularly implemented in the school. This indicates a promising trend towards the standardisation and sustainability of these new techniques. In summary, the findings from the Finnish case studies provide valuable insights into the need for enhanced collaboration, knowledge sharing, and collective resource creation among the participants while acknowledging the positive strides made in standardising new teaching methods. In reflecting on the lower frequency of engagement in the domains of sharing, co-creation, formalisation, and standardisation in Finland, participants' comments provide valuable insights that suggest potential reasons behind these outcomes. In the Finnish cases, the interviewees were development team members who coordinated the activities inside their school and between the schools.

A common thread throughout their responses is the persistent challenge of time management, resource limitations, and coordination difficulties. For instance, participant F8 sheds light on the struggles associated with collaboration and logistics, remarking on the complexities involved in "*experiments with a pair/team*" and asserting that "*coordinating the schedules of two schools requires thinking, coordination and a positive attitude to try*." This perspective illuminates how these logistical hurdles may have hampered more robust collaboration and knowledge sharing. Echoing this sentiment, participant F3 emphasised the importance of proactive scheduling in hindsight, stating, "*I would have booked all teacher meeting times right away at the beginning.*" Additionally, F1 underscored the constraints of time and resources, stating, "*Finding time afterwards is really challenging. Perhaps we also should have more resources…when we get down to everyday life, do we have enough experts and workers to implement it?*" These observations underscore the possible impacts of these limitations on the formalisation and standardisation of the new teaching and learning methods. The constraints may have obstructed systematic documentation and regular implementation of these innovative approaches. Furthermore, a potential disconnect with wider city-level developments was also highlighted by participants F2 and F3. They reflected, "*We probably did some unnecessary things at the beginning because we did not know about DigiPath development at the city level. If we had known, we would have started differently.*" As the DigiPath initiative later became the focus of the Finnish case, it's plausible that this shift in focus during the initial stage may have affected the formalisation and standardisation process. Therefore, the insights from participants suggest that improvements in time management, resource allocation, and better coordination with broader educational initiatives could potentially enhance outcomes in sharing, co-creation, formalisation, and standardisation.

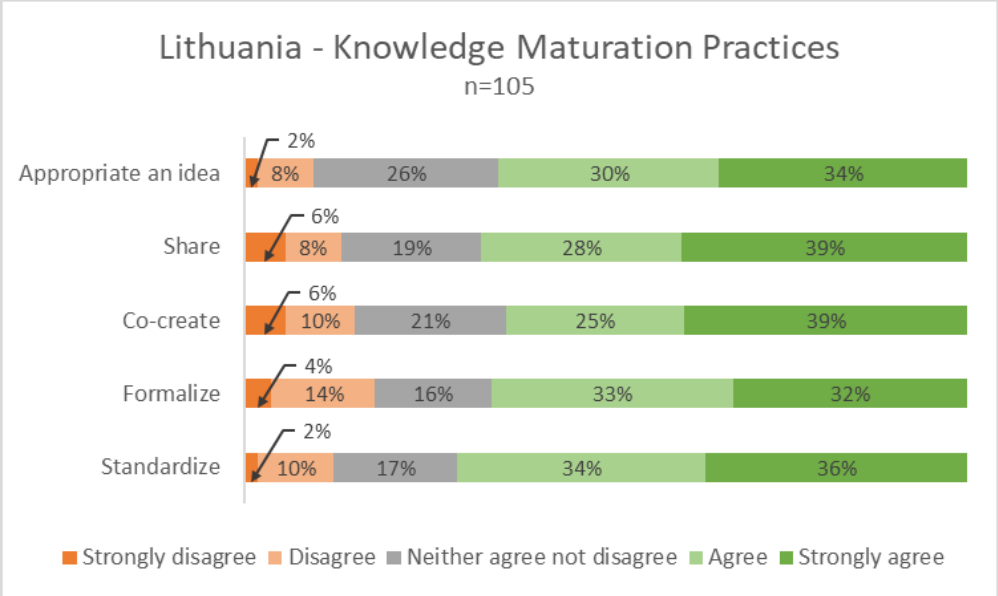

Figure 11: Lithuanian teachers' perceptions on knowledge maturation practices during the mentoring activities

In the **Lithuanian** case (see figure 11), our findings suggest a substantial degree of engagement in knowledge maturation practices among participants. 64% of the participants' responses suggest that their o**wn experiences and ideas were considered** when developing new teaching and learning methods, indicating a certain degree of individual agency in the innovation process. This appreciation for personal

input suggests that most participants value their own contributions and insights in shaping educational innovations. 67% of the participants reported **sharing their experiences and materials** with others, both within and outside the mentoring. This shows a willingness to engage in knowledge sharing and to potentially collaborate with others in spreading innovative practices. Similarly, 64% of the teachers agreed with the statement that **they engaged in the co-creation practices,** involving active participation in group work for developing new teaching and learning materials. This underscores the proactive involvement of a large number of participants in collective creation. 65% of the participants responded that t**hey engaged in the formalisation process**, in which new methods and materials were documented for external use. This suggests most participants' recognition of the importance of formalising their innovations to make them accessible to those outside the immediate training group. Lastly, 70% of the teachers reported **engaging in the standardisation** of new methods and materials, manifested through regular implementation in the school. The Lithuanian case reflects a strong engagement in knowledge maturation practices, including valuing personal experiences, active knowledge sharing, collaborative material co-creation, and recognizing the importance of formalisation and standardisation.

Participants' testimonials from Lithuania provide further validation of our findings on high engagement in knowledge maturation practices. In particular, they underscore the **integral role of collaborative experiences** and the value participants found in learning together throughout the training/development project. For instance, Participant 1L stressed the importance of collaboration and knowledge sharing, noting, "*The most valuable experience is to learn by collaborating and sharing digital experiences and innovations*." Similarly, Participant 2L affirmed the productive nature of collaboration, emphasising how the sharing of best teaching practices enriched the learning environment. Their words encapsulate the cooperative spirit among the participants, their willingness to learn from each other, and the consequential impact on their professional development. Another significant theme that emerged from the Lithuanian case was the **formation of vibrant learning communities**, underpinned by collaborative learning and peer support. Participant 16L recounted the enriching experience of collaborating with pioneers in the ViLLE platform, stating that learning from their expertise was "*particularly valuable.*" Meanwhile, Participants 1L and 10L highlighted the empowering nature of **group work sessions** and the personal and professional growth they experienced as a result of the program. Participant 12L and 14L emphasised the enriching nature of the learning community and the benefit of sharing diverse experiences. Participant 8L lauded the impact of tools like ViLLE and Bebras tasks in fostering a collegial atmosphere among teachers and promoting professional growth. Further, the testimony of Participant 8L underscores the profound influence of the project on building a stronger, more cohesive community among teachers. They enthusiastically endorsed their willingness to participate in similar projects, stating, "*Of course we would take part, because it's a great, great experience for teachers and quality learning for students. And we are also seeing a stronger, friendlier community of teachers*." These testimonies collectively amplify the power of collaborative learning and peer support in fostering a robust and dynamic learning community. The benefits extend to the sharing of practical experiences and advice, nurturing a supportive environment that fuels motivation and growth. This feedback echoes our findings, reinforcing the high degree of engagement in knowledge maturation practices observed in the Lithuanian case.

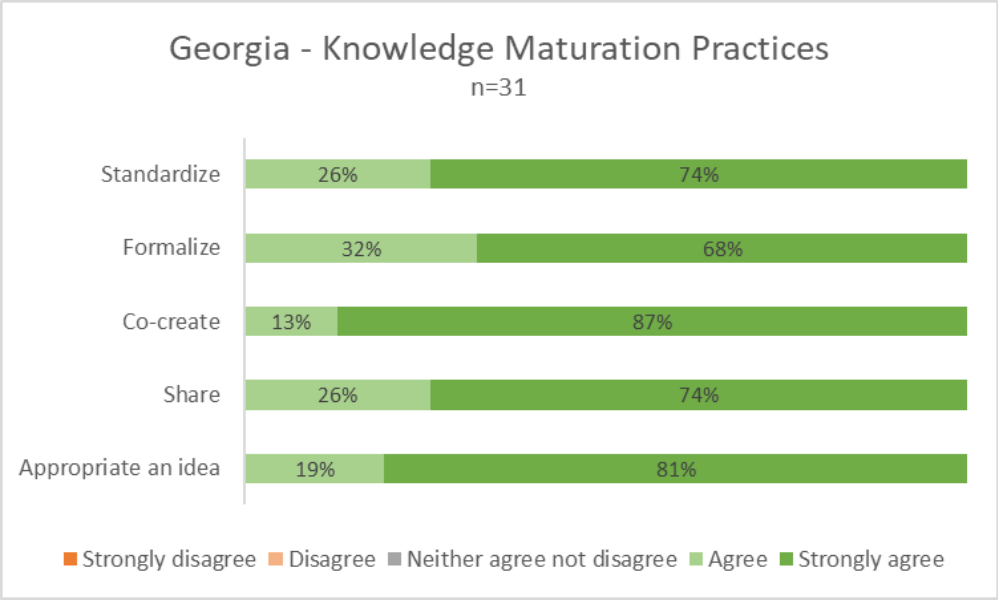

Figure 12: Georgian teachers' perceptions on knowledge maturation practices during the mentoring activities

In the **Georgian** case (see Figure 12), **all participants reported engagement in knowledge maturation practices**. All participants expressed positive perceptions towards incorporating personal experiences and ideas into the development of new teaching and learning methods. This suggests that participants perceived their own contributions as integral in developing innovative methodologies. Likewise, the reported frequency of sharing individual experiences and materials with peers, both within and beyond the mentoring context, was high, with all teachers reporting stating that they engaged in the same. This implies that all participants perceived a strong culture of collaboration and knowledge sharing. All participants reported co-creating new teaching and learning materials. This suggests a strong perception of shared ownership of the learning process and collaborative development of new pedagogical resources. All teachers also agreed that they were active in documenting these new methods and materials in a manner accessible to others outside the immediate training group. This indicates participants' perception of the importance of formalising their innovations for wider use. Finally, all teachers reported being engaged in the regular implementation of these new methods and materials into school practices, demonstrating a strong perception of commitment to the consistent application of their innovative methods and their long-term sustainability. Overall, the Georgian case showcases widespread high positive perceptions towards various aspects of knowledge maturation practices. Participants not only perceive their own experiences as valuable, but they also report active engagement in knowledge sharing, co-creation, and formalisation, coupled with a strong commitment to implementing and standardising the new teaching and learning methods in their classrooms.

In summary, the mentoring provided by iHub4schools supported **all the cases in adapting and sharing the knowledge gained about the new methods.** However, it is likely that more time and additional focus are needed to **formalise this new knowledge** and subsequently **translate it into standardised** practice.

4.2.2 Scaffolding practices

Scaffolding practices in the Knowledge Appropriation Model describe a learning approach through which novices are guided towards appropriating negotiated knowledge in collaboration with experts or a mentor. In our case, this refers to practices where teachers are supported in implementing new practices until they no longer need support and are ready to support and mentor others themselves.

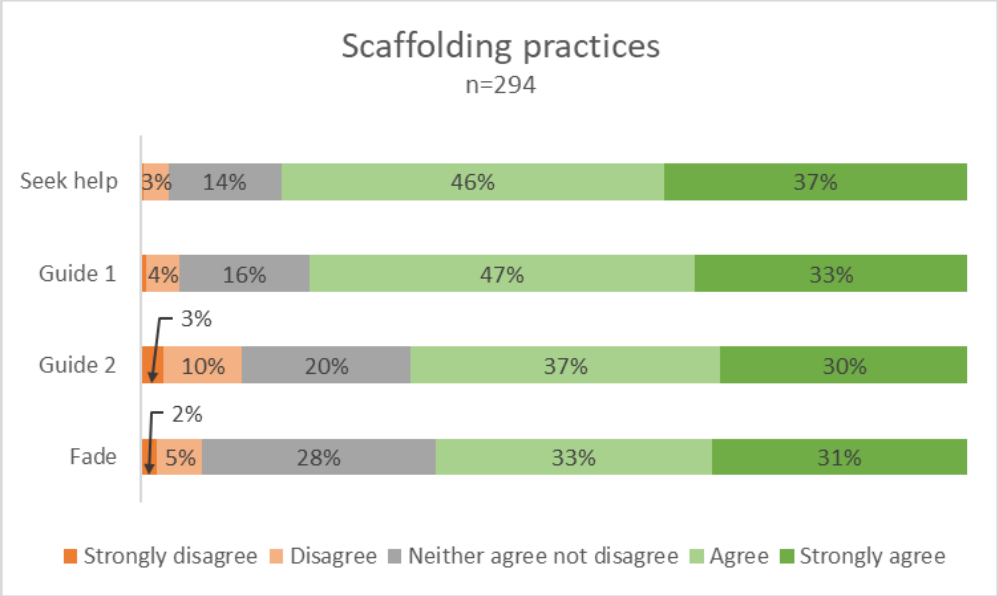

Figure 13: Teachers' perceptions on scaffolding practices during the mentoring activities

Figure 13 shows how during the mentoring activities, 83% of the teachers agreed or strongly agreed that when introducing new learnt methods in their practice, they could have **asked for help** or support when they did not know what to do. 80% of the teachers reported that when introducing new methods in their practice, they **had sufficient guidance** by other people or through the materials that were provided. Less number of teachers (67%) reported **to offer guidance themselves** and help colleagues when introducing new methods. And 61% of the teachers feel themselves **more confident over time to introduce** new methods without outside help.

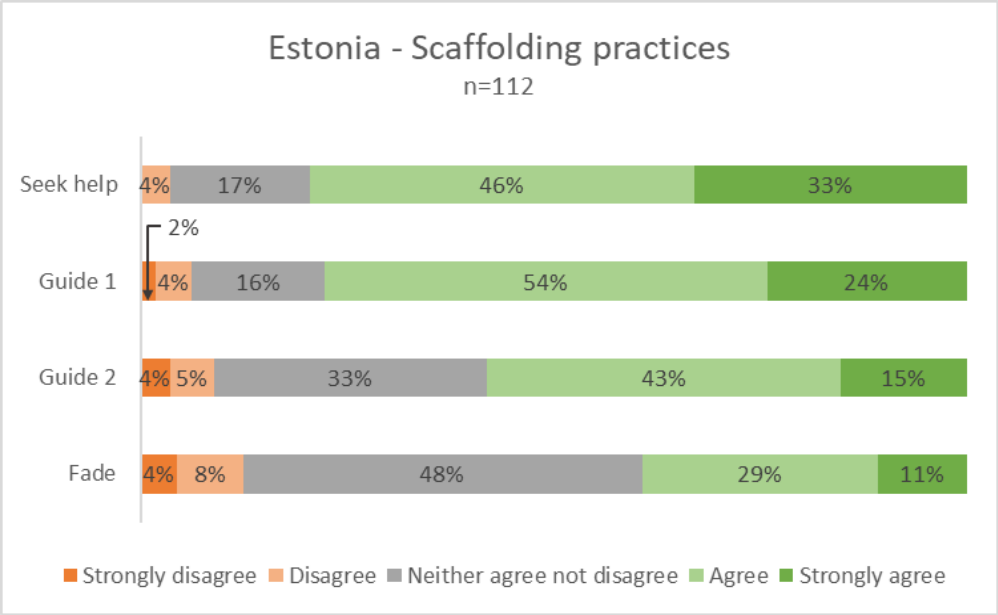

Figure 14: Estonian teachers' perceptions on scaffolding practices during the mentoring activities

In **Estonia** (Figure 14), the data shows similar trends: 79% of the teachers perceived that they **received help to introduce innovations in their practice** and 78% of the teachers received **adequate guidance from others** or through the materials provided when they were implementing new methods. Given that in this case each school had its own educational technologist as a mentor, this outcome is both expected and encouraging. However, when it came to offering **guidance to their colleagues** during the introduction of a new method, teachers had a somewhat lower inclination, evidenced by a smaller proportion, 58%, agreeing or strongly agreeing that they helped colleagues. This indicates that while they were open to seeking assistance themselves, teachers were not ready yet to provide guidance to their colleagues. Given that the program in Estonia targeted teachers with lower digital competence and lesser initial willingness to engage in digital innovation, these results are understandable. Only 40% of the teachers reported growing confidence in introducing new methods without outside help over time. While the proportion of teachers agreeing or strongly agreeing to this item is the smallest among all categories, it still points to a significant number of teachers having developed increased self-reliance over time and showing a growing assurance in their capability to introduce new methodologies autonomously.

In sum, the data from Estonia shows a clear pattern: teachers were active in seeking assistance when introducing new methods, yet somewhat less inclined to offer similar support to their colleagues. The qualitative data gathered from the participant interviews substantiates the trends seen in the quantitative findings. For instance, Participant 4E's experience in Estonia highlights the teachers' notable willingness to seek support when first introducing a new method into their practice. They stated: "*Great personal development. They (management) literally forced me into that digital accelerator project... I got environments/tools where I could just start building things. A life-changing experience.*" This account illustrates the participant's transformation from initial resistance to an appreciation of the guidance and support provided during this innovative period. The perception of receiving adequate guidance during the implementation of new methods was echoed by Participant 2E, who emphasised the value of management

room meetings with mentors and the digital accelerator team. They said: "*For me personally, the meetings in the management room with the mentor and the digital accelerator team were invaluable... These meetings offered a practical and productive environment, where we actively engaged in practical work and discussions.*" This narrative further substantiates the perceived benefits of the external support and guidance provided during the transition to new methodologies. The theme of continued support from mentors was prevalent in the narratives of Participants 4E and 5E as well. Participant 4E expressed gratitude for the sustained support of their mentor, saying: "*That, well, the individual work and individual counselling that the mentor provided…He also offered assistance even after the digital accelerator had ended*." Similarly, Participant 5E spoke highly of their mentor's continued support, stating: *"We had a great mentor who answered all our questions and was ready to help us with any problems*." While the general trend showed a slightly lower propensity among teachers to offer guidance to their colleagues, there were individual accounts that pointed to the contrary. Participant 1E took pride in being a resource for others, stating: "*I took pleasure in the fact that when my colleagues encountered a problem, they turned to me for help*." This statement suggests that there were teachers who relished their role as guides and found joy in assisting their peers.

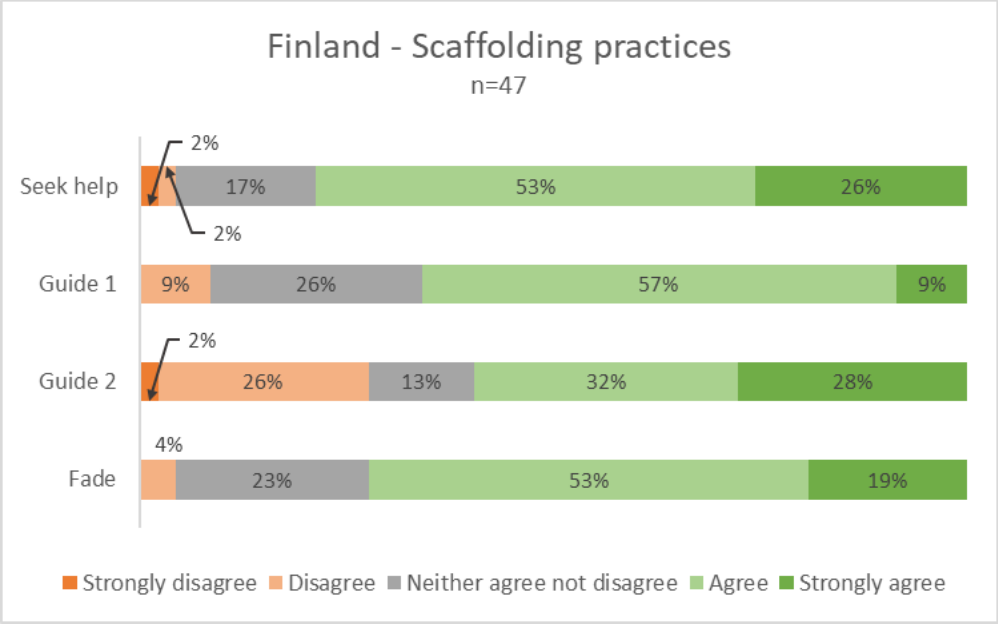

Figure 15: Finnish Teachers' perceptions on scaffolding practices during the mentoring activities

In the case of **Finland (see Figure 15)** the participants exhibited a strong inclination towards seeking help and support when introducing new methods. 79% of the teachers expressed **willingness to ask for assistance or support** when faced with unfamiliar situations in their professional practice. 66% of the participants in the Finnish cases **valued having sufficient guidance** provided by others or through the materials provided when introducing new methods. In terms of offering guidance and help to colleagues when introducing new methods, 60% participants in the Finnish cases **indicated a willingness to support their colleagues** in their implementation efforts. Finally, 72% of the participants in the Finnish cases reported **feeling more confident** over time to introduce methods without external help. This suggests that Finnish teachers gradually developed self-confidence in implementing new methods independently as they

gained experience and familiarity with the innovations. Overall, the Finnish case highlights participants who actively seek help and support when introducing new methods, value guidance from others and materials, and exhibit a growing sense of confidence over time. Their willingness to support colleagues and their increasing self-assurance contribute to the successful implementation of new teaching and learning methods. The qualitative data gathered from the leadership teams' interviews substantiates the trends seen in the quantitative findings. For instance, Participant F5's comment, "*Even when we have such a small team [ICT coordination team with the other school] as well, so [teachers] know who to turn to if they need any help or explanation, or someone to play with... But now we also serve new ideas*," illustrates the comfort teachers feel in approaching their ICT coordination team for support with new methods. Similarly, Participant F6's statement, "*An important part is probably this very fact that you can help [teachers]. A bit like this kind of workshop function, that you fix it then when needed*," serves as a qualitative testament to collaborative spirit present in the Finnish schools participating in the mentoring cases. This echoes the **ICT teachers' willingness to offer guidance** and help to their colleagues. Furthermore, Participant P6's observation, "*teachers feel more comfortable with digital technology; they have started to use new apps; they know where to ask help; they collaborate more*," underscores the reported increase in confidence over time to introduce methods without outside help. This aligns with the findings indicating growing self-reliance among the teachers. Finally, Participant F8's testimony: "*Faces are familiar now, people know whom to ask and it is easier to discuss and ask... In teacher teams, it is easier to discuss digital issues when you have seen and know what others do, easier to ask for help. Earlier other issues have overridden these digi issues*," gives a glimpse into the evolving culture of discussion and support among the teachers in the participating schools concerning digital issues. This ties back to the teachers' perceived adequacy of the guidance received when introducing new methods.

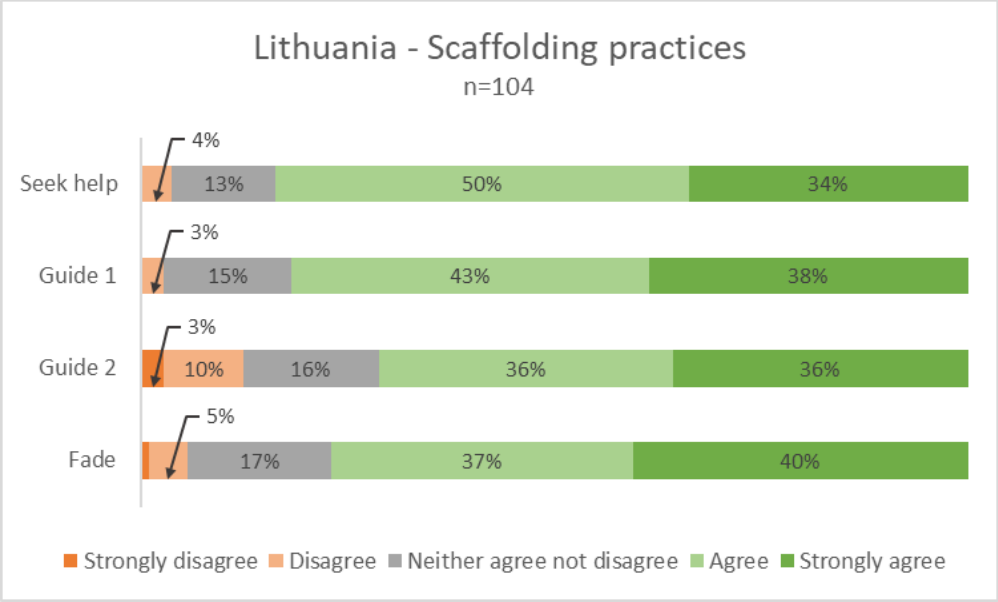

Figure 16: Lithuanian teachers' perceptions on scaffolding practices during the mentoring activities

The results from **Lithuania** (see Figure 16) show a strong propensity amongst participants towards **seeking assistance** when introducing new methods for the first time in their professional practice, with 84% of the teachers agreeing with the relevant statement. The data shows 81% of the participants **perceived that**

sufficient guidance was available to them, either from other people or through provided materials, when introducing new methods. Regarding the aspect of **offering guidance and help to colleagues** during the introduction of new methods, 72% of the Lithuanian teachers engaged in this practice. Finally, 77% of the participants reported f**eeling more confident over time** to introduce methods without external help. This indicates a perceived trend of growing self-confidence among most participants in implementing new methods independently, demonstrating an increase in their comfort and familiarity with new innovations over time. Results from Lithuania reveal a set of participants who demonstrate a strong inclination to seek help when introducing new methods, appreciate the availability of guidance from others or provided materials, are willing to offer help to their colleagues, and exhibit a growing sense of confidence over time in introducing methods without external help.

The quantitative data collected from the participants in Lithuania is further substantiated by the qualitative insights gathered from the interviews. For instance, Participant 1L's testimonial highlights the perceived value of collaboration and shared learning experiences. They stated, "*The most valuable experience is to learn by collaborating and sharing digital experiences and innovations...we need to constantly discuss and learn from each other*." This resonates strongly with the finding that participants were willing to offer guidance and help to their colleagues when introducing new methods, denoting a culture of collaborative learning and peer support. Participant 16L also emphasised this collaborative spirit, especially when interacting with colleagues from another school. They said, "*Communicating and collaborating with colleagues from another school was an enriching experience. Learning from their experience was particularly valuable to me*." This participant's narrative validates the quantitative data indicating a strong inclination among teachers in Lithuania to seek help when necessary. The shared experiences of Participant 12L ("*I found very enriching to learn from each other*.") also highlights the perceived benefits of peer learning and the enriching nature of learning from each other, echoing the overall theme of collaboration and knowledge sharing. Participant 14L's mention of a thriving learning community, which encourages sharing experiences, further illustrates this point. They stated: "*The teachers in our school coming together as a learning community and sharing their different experiences was very enriching*." These testimonies highlight a strong correlation with the quantitative findings of teachers' readiness to support their colleagues and their perceived value of guidance provided by others. The reflections of Participants 4L, 5L, and 7L illustrate the value of external support, particularly consultations and training, in enhancing their professional growth. For instance, Participant 7L found value in meeting with external teams, stating, "*Attending meetings with the VILLE team and the developers of the Bebras cards provided a wealth of knowledge and expertise*." These narratives further bolster the quantitative findings of a strong inclination among participants to seek help and their perception of receiving adequate guidance when introducing new methods.

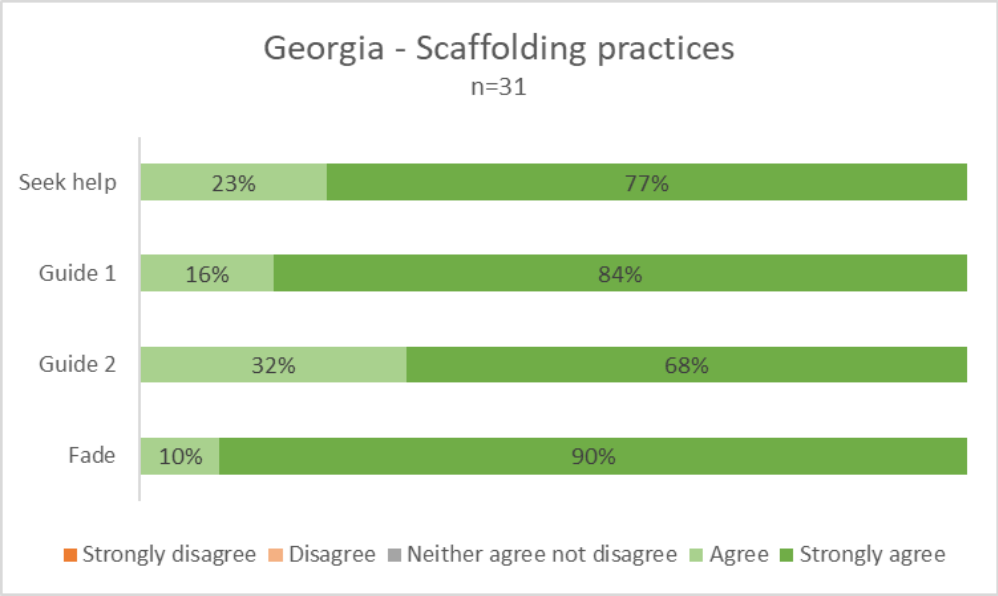

Figure 17: Georgian Teachers' perceptions on scaffolding practices during the mentoring activities

In the case of **Georgia** (see Figure 17), all participants **exhibited a predisposition towards seeking help** and support when introducing new methods. This unanimous response suggests that they did not hesitate to request assistance or support when confronted with unfamiliar scenarios in their professional practice. All the participants from Georgia also **reported receiving sufficient guidance** by others or through the provided materials when introducing new methods. When it came to **offering guidance and help to their colleagues** during the introduction of new methods, all Georgian teachers reported engaging in this practice. Furthermore, participants from Georgia reported **growing confidence over time** in introducing the new methods without external help. This indicates a strong trajectory of growing self-reliance in implementing new methods independently. In summary, the Georgian case presents a picture of teachers who show a considerable propensity to seek and offer help when introducing new methods, appreciate external guidance and resources, and exhibit an extraordinary increase in confidence over time.

Participants' narratives substantiate and bring to life the strong quantitative trends observed. Participant 2G from Georgia emphasised the value of sharing best practices and the productive nature of collaboration. They commented, "*Those who already were familiar with these tools/programs shared their experiences with the schools involved in the project. I would say that the best teaching practices were shared, and it was very productive*." This narrative aligns with the quantitative data, which shows a strong propensity of participants to offer guidance and help to their colleagues when introducing new methods. Additionally, Participant 1G underscored their significant learning experiences within the project, highlighting their interactions with colleagues and sharing experiences with other teachers. They stated, "*Within the framework of the project, I gained important experience: a) Teachers involved in the project often shared their own practice and gave advice on using this or that digital tool. ... In addition, I share my resources and experience with other colleagues (not involved in the project) and help them choose interesting and customised (subject-wise) activities*."

Overall, the findings from the mentoring experiences emphasised that teachers acknowledged the **significance of seeking assistance** and a**ppreciated the guidance received from others**, which aligns with the anticipated outcomes of systematic and personalised mentoring. It can be concluded that additional time is required to foster **increased self-confidence** in implementing new teaching methods and **to develop a willingness to support colleagues** to introduce new methods in their professional practice.

4.2.3 Knowledge Appropriation Practices

As stated earlier, we assumed that learning is supported by appropriating the shared norms, values and practices of a community (Ley, 2020). In the centre of the appropriation are the shared artefacts which are introduced and created in maturation practices and used in scaffolding practices. During the mentoring, teachers are made aware of the new knowledge and methods, and they build a shared understanding, and then adapt and validate knowledge in new situations, which is called knowledge appropriation.

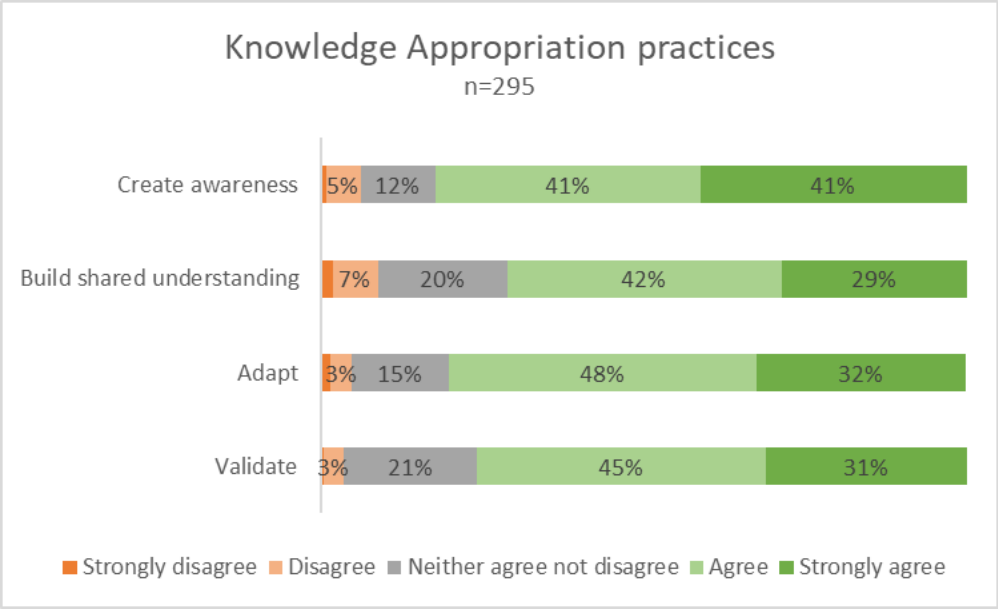

Figure 18: Teachers' perceptions of knowledge appropriation during the mentoring activities

Overall, it can be observed that (see Figure 18) most of the participants (82%) reported **awareness of new teaching and learning methods** through mentoring. 71% of the participants reported **developing a common understanding with other participants**. Additionally, 80% of the participants **indicated a willingness to make changes** (adapt) based on their own needs and wishes during lessons with new methods. Finally, 76% of the participants had a relatively **high level of understanding the effectiveness** (validation) of the new teaching and learning methods.

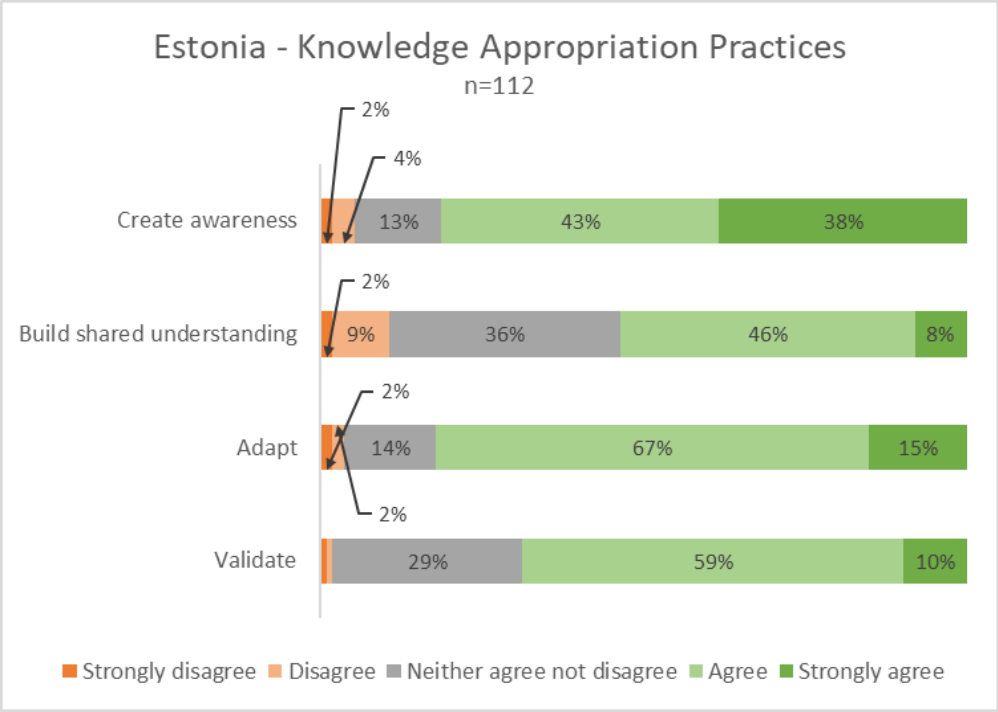

Figure 19: Estonian teachers' perceptions on knowledge appropriation during the mentoring activities

In the case of Estonia (Figure 19), 81% of the participants showed a **high level of awareness and** 82% of them indicated **willingness to adapt** the new teaching and learning methods to their own needs. However, there is scope for **further collaboration to foster a common understanding** among participants, as only slightly more than half (54%) reported engaging in the relevant activities. Additionally, **efforts can be made to enhance their understanding of the effectiveness** of these methods through ongoing support and evaluation as 69% of the participants reported having developed an understanding of the effectiveness of the new methods. This indicates that the mentoring process effectively introduced them to new methods and contributed to their knowledge appropriation. The teachers in this case reported **a notable level of awareness and a proactive approach in customising** the methods. However, there is room for improvement in developing a common understanding among participants.

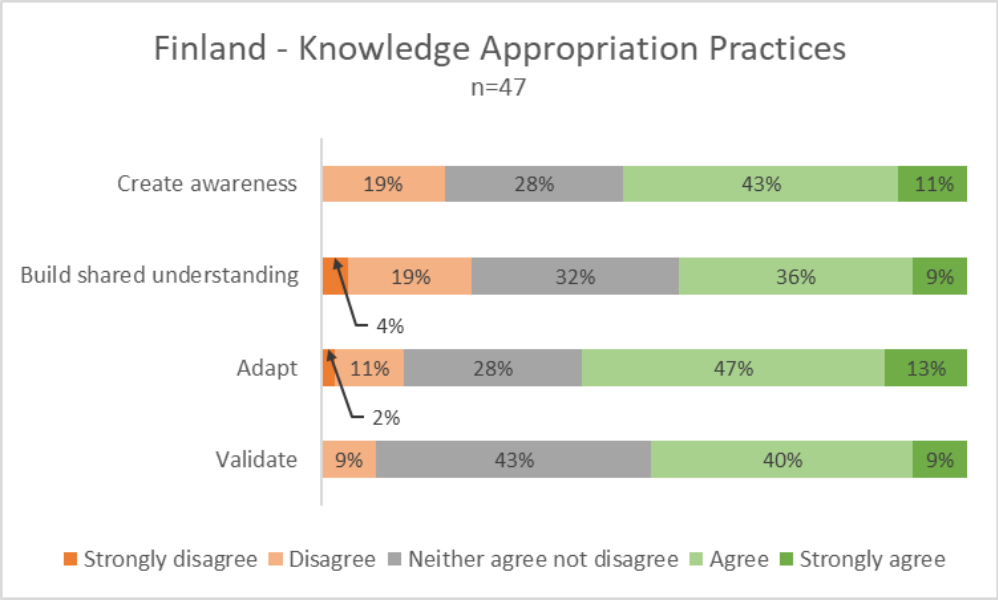

Figure 20: Finnish teachers' perceptions on knowledge appropriation during the mentoring activities

In the two cases of Finland, which both focused on collaborative learning between two schools to adopt the city-level DigiPath into teaching and learning, we can see from Figure 20 that 60% of the teachers perceived that when carrying out lessons with new methods, **teachers made changes to materials and methods** based on their needs. 54% of the teachers reported having an **awareness and understanding of the new teaching and learning methods**. 49% of the teachers reported the development of an **understanding of the effectiveness** of new methods. It is noteworthy that the Finnish cases did not include extensive training of the new digital practices for teachers, the briefing events and inter-school workshops were organised as part of everyday school work, utilising the teachers' regular meetings times when possible. Rather low engagement in knowledge appropriation practices might have hindered the participants' confidence and motivation to fully embrace the innovation in their teaching practices. Allocation of additional resources for training and teacher collaboration can contribute to increasing teachers' intention and adoption of the new teaching and learning methods.

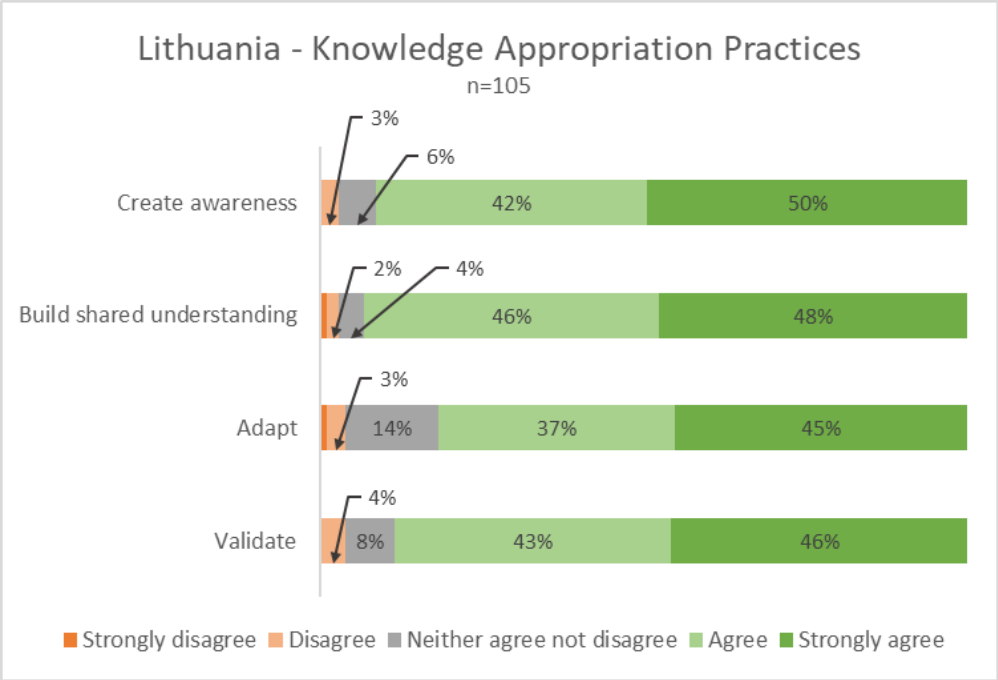

Figure 21: Lithuanian teachers' perceptions on knowledge appropriation during the mentoring activities

In the case of Lithuania (see Figure 21), 92% of the teachers reported **awareness and understanding of the new teaching and learning methods** and 94% reported **developing a common understanding about the new methods**. Overall, the findings in this underscore the significance of knowledge appropriation practices, particularly in terms of awareness, shared understanding, and customization, as facilitators of successful intended adoption and implementation of the new teaching and learning methods.

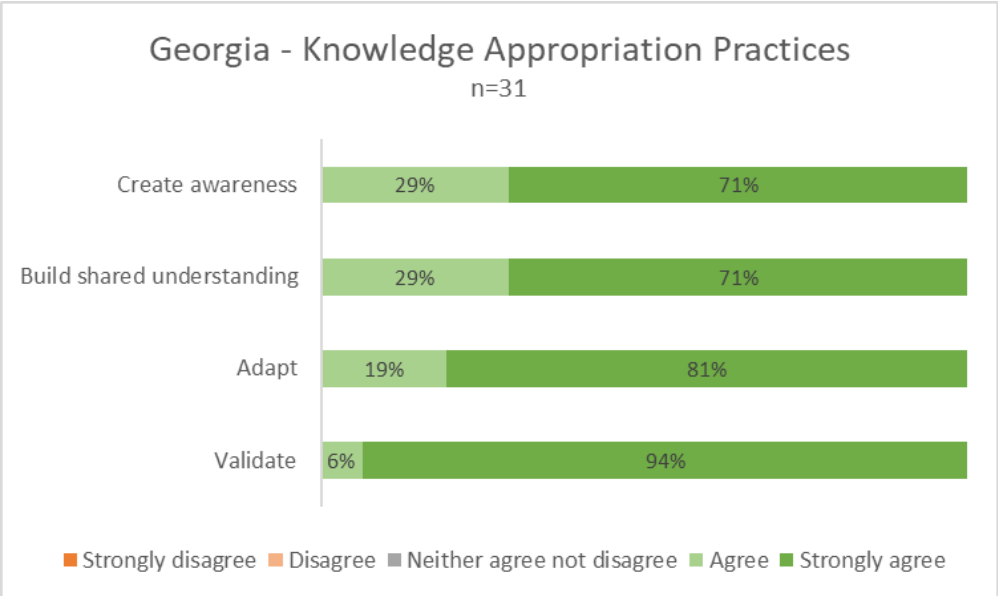

Figure 22: Georgian teachers' perceptions on knowledge appropriation during the mentoring activities

In the case of Georgia (see Figure 22), all teachers reported engaging in all four knowledge appropriation practices. These results clearly highlight Georgia's highly positive results on the mentoring process experience.

Overall, it can be observed that in most cases, the participants reported moderate to widespread awareness of new teaching and learning methods through mentoring. However, the frequency of **developing a common understanding** with other participants varied across the cases. Additionally, participants generally indicated **a willingness to make changes to materials** and methods based on their own needs. Finally, most participants across all cases indicated **understanding the effectiveness of the new teaching and learning methods**. Unpacking the qualitative findings, participant narratives provide a vivid and valuable illustration that aligns with the quantitative data. A recurring theme is the transformative power of discovering new teaching methods, as Participant 3E from Estonia expressed: "*For me, learning how to make e-books was the most enriching...A life-changing skill now available.*" Similarly, Participant 9L from Lithuania discussed the enrichment of "*learning how to use Bebras tasks for introducing computational thinking*," encapsulating the sentiment of discovering new methods through mentoring. The understanding of the effectiveness of these methods is illustrated in the observations of participants who reported tangible improvements in learning outcomes. For instance, Participant 1L from Lithuania linked the improvements in pedagogical practice to better student performance, stating, "*Yes, improved pupils' performance*." Similarly, Participant 12L mentioned, "*Students' knowledge and skills in mathematics have improved,*" highlighting the understanding of the effectiveness of the new teaching and learning methods.

The findings indicate that the application of the School Mentoring Model developed in iHub4schools has laid a solid foundation for initial progress. It has led to the development of new insights, provided assistance and support to teachers, facilitated the adaptation of materials, and generated a strong willingness among them to incorporate these innovations into their future practice. However, the diversity in individual cases may account for variations in perceptions of co-creation and the level of readiness to mentor others. Additionally, it is evident that mentoring contributes to the acceleration of innovation, but the process of standardisation and formalisation of these innovations is still somewhat separated from this mentoring process

Overall summary of the knowledge appropriation practices and intended adoption:

- While Lithuania and Georgia demonstrated higher scores across all knowledge appropriation practices compared to Estonia and Finland, **it is not possible to make direct comparisons in this study** due to the **different innovations and setups used** in each case. Each case embodied various aspects, such as individual teachers' pedagogical practices, school-level improvements, learning specific tools for certain pedagogical approaches, or developing basic digital competence. Additionally, each case took a different **mentoring approach;** for instance, Finland pursued a school-wide development effort that involved all teachers and fostered inter-school collaboration, albeit without extensive training for teachers. This may explain reported challenges such as time management, logistical hurdles, and resource constraints. Moreover, initial unawareness about the DigiPath development may have diverted attention from the practices under examination, influencing the responses. Lithuania's robust engagement can be likely attributed to a strong sense of community, emphasising collaborative learning and peer support to create concrete learning environments. Overall, these findings highlight the complex interplay of factors influencing the

successful integration of new teaching and learning methods, and the importance of fostering a supportive and collaborative educational environment.

- Nevertheless, results from all cases underscore that **teachers reported learning new methods** and **expressed a willingness to implement** these methods in the future. The mentoring process facilitated extensive **collaboration** among teachers, enabling them to develop **a shared understanding** of innovation. They actively participated in the **co-creation of materials** and to **adapt innovations** to their own practices. Throughout this process, they received **support** from both individuals and available materials and these practices also seemed to contribute to the intention to adopt.
- However, teachers perceived themselves as less prepared **to support colleagues** and reported a lack of opportunities to **formalise and standardise the knowledge** they had created.
- The knowledge appropriation model served as an effective tool for understanding social learning practices within multi-stakeholder networks. It facilitated an exploration of individual learning and knowledge generation processes, and how this knowledge can be transferred to the collective level in a tangible and reusable manner. Simultaneously, the application of the model allowed us to comprehend that the adoption of innovation is a lengthy process. Over a six-month mentoring period, with teachers balancing various responsibilities, all anticipated changes might not be immediately apparent. This underlines the significance of ongoing collaboration with schools via Regional Innovation Hubs and the continued promotion of school development efforts.

4.3 Perceived changes

Section 4.3 delves deeper into the interview findings, focusing on the perceived changes identified by both teachers and school leadership as a result of their participation in mentoring-related activities. These observed changes traverse numerous areas of the educational ecosystem: an amplified interest in, demand for, and utilisation of digital resources; modifications to the curriculum; heightened motivation among educators and the proliferation of professional learning opportunities; enhanced integration within the school community and optimised curriculum use; improvements in digital proficiency and bolstered confidence; alterations in classroom dynamics, learning outcomes, and shifts in students' attitudes toward learning; and finally, transformations in the supportive infrastructure. Unless otherwise specified, these shifts were universally observed across all participating countries.

Increased interest in, demand for and use of digital resources

Participants have expressed an increased interest in and demand for digital technologies and reported more frequent use of the same across all four pilot countries. Participant 1E from **Estonia** provides a telling account of this trend, stating, "*Perhaps the fact that teachers started desiring more tablets to be freely used in classrooms, from one classroom to another, led to this newfound interest... Other teachers also became more interested, thanks to the Digital Accelerator training.*" This comment suggests that mentoring activities and training provided by the project through the Digital Accelerator Program have contributed to an increasing inclination among Estonian teachers to utilise digital resources.

In the case of **Finland**, participants 4F, 5F, and 6F highlighted a similar trend, noting that "*teachers feel more comfortable with digital technology; they have started to use new apps*." This highlights the collaborative effort between the participating Finnish schools in implementing the DigiPath curriculum,

which also contributed to enhancing the teachers' digital literacy skills and broadening the range of instructional tools at their disposal.

Participant 6L from **Lithuania** echoes this sentiment and additionally emphasises the practical application of digital technologies, saying, "*I am now using the apps much more to teach students about different topics*." Further insights from Lithuania, provided by Participants 7L, 10L and 15L, underscore a growing use of specific digital tools such as VILLE/Eduten and Bebras cards in classrooms, as well as an increased use of Moodle learning environment. These participants noted: "*More and more teachers are working with ViLLE/Eduten. More and more teachers started to use the Bebras cards in the classroom activities*."(7L); "*All classes have started using the Moodle learning environment. Then to this project (iHub) maths and primary school children have started working with Eduten/ ViLLE*", and "U*sing the tablets in science lessons for various activities. I use the Eduten platform, and I also use Ville in my computer science classes*." (15L). These examples highlight the changes in teachers' pedagogical practices, showcasing an increased integration of learning technologies fostering the development of students' computational thinking skills compared to previous times.

In **Georgia,** participants acknowledged an amplified awareness and use of IT programs following participation in the project. Participant 2G articulated, "*After participating in this project in the school, the awareness about IT programs has been enhanced, it is used more frequently and actively in the teaching process, the lessons have become interesting and fun for the students*." Similarly, Participant 4G noted the introduction of digital innovations in their educational process, leading to infrastructural improvements like the addiction of new projectors. "*After the implementation of the project, teachers actively started introducing digital innovations in the educational process. We added new projectors to the school as well*." Similarly to Lithuanian teachers, Georgian teachers highlight the increased usage of learning technologies and improved digital infrastructure at school.

While the broader application of these observations would require further study, the shared experience of the participants indicate a positive influence of the project on the integration of digital tools into teaching methodologies. The mentoring efforts across these three countries, thus, appear to have contributed to a more digitally adept educational landscape. In some of the cases teachers learnt to use more general applications (e.g. creation of e-books, Moodle) and in some of the contexts teachers learnt specific tools to develop students computational thinking skills or tools to support the implementation of DigiPath.

Changes in curriculum in Estonia and Lithuania

Several participants pointed out that their schools **have made changes to the curriculum** to include digital literacy from early grades since the beginning of the project, a trend notably prominent in Estonia and Lithuania. Participant 2E from **Estonia,** for instance, detailed the strategic process their school undertook to implement this change. They shared, "*We had such plans, we sat together, wanting to change the curriculum a bit... for example, we introduced learning to learn skills to the fourth grade... these changes started already from the first grade. We deal with computer topics as a precaution... So that if this option should happen, that we are down to distance learning somewhere, so that the student knows what to do…/…/…And then, gradually, until the ninth grade, such digital topics were out into the curriculum a little bit.*." Similarly, Participant 11L from **Lithuania** highlighted the review and refinement of their digital technology plans, particularly for primary education, stating, "*We reviewed the digital technology using plans and adopted them especially for primary education*." These comments from participants highlight a

growing commitment to digital literacy within the curriculum and credit the project's mentoring efforts, particularly in the Estonian and Lithuanian hubs in catalysing strategic curriculum changes.

Increased motivation and professional learning opportunities in Georgia and Lithuania

The project is associated with reported enhancements in both motivation and professional learning opportunities among its participants. Participant 1G from **Georgia** provides a noteworthy reflection on the considerable changes within their educational environment. They describe a positive correlation between the project and increased motivation, not only for themselves but also for colleagues and students. They shared: "*Within the framework of this project, my working environment at the school has changed significantly, my motivation, my colleagues' and also the students' motivation has changed, lessons have become more diverse, fun, modern and adapted to the student's interests*". This reflection suggests that with the implementation of the project, they note a shift towards more varied, engaging, contemporary, and student-centric lessons.

In addition, Participant 1G from **Georgia** highlights the active organisation of workshops in their school, which provided opportunities for staff members to learn about new digital resources from colleagues and to plan their use, saying, "*Workshops are actively held in the school, where employees have the opportunity to learn about the digital resource offered by another colleague and plan its use*." Similarly, participants in Lithuania also discussed concerted efforts to enhance the digital competence of teachers in their schools. For example, Participant 12L from **Lithuania** mentioned the deliberate use of specific learning technologies, such as Eduten, to foster digital competence among their teaching staff. They mentioned: "*Using Eduten and other learning technologies, we started serious digital competence development for all teachers*." These responses illustrate the proactive steps taken by schools to upgrade the digital skills and competence of their teachers, thereby positioning them to better leverage digital resources in their teaching practices.

Enhanced school community integration and DigiPath utilisation in Finland

Two overarching themes from **Finnish participants'** reflections point to a shift towards a more interconnected and informed school community and an increased awareness and use of the DigiPath initiative within the educational community. Participant 8F reported increased awareness of the DigiPath's content and expectations among participants. They reported that teachers are more engaged with digital content and have a clearer idea of where to find materials and help: "*People are more aware of DigiPath content and what is expected. Everyone is a member of these Teams areas and knows where the materials are (city-level materials, pedagogical ideas produced in iHub). Faces are familiar now, people know whom to ask and it is easier to discuss and ask. In teacher teams it is easier to discuss digital issues when you have seen and know what others do, easier to ask for help…*" Echoing this sentiment, Participant 7F shared how in-depth familiarity with DigiPath, right down to specific lesson plans, has given the participants a head start: "*We have been familiarised with DigiPath on a general level, but also gone into specifics through those lesson plans. This is a good start and some kind of leap has been made directly to the practice*."

These reflections indicate that by promoting a comprehensive understanding of the DigiPath curriculum and nurturing a more collaborative school community, the project has effectively boosted digital literacy and optimised the use of digital resources within the Finnish participating schools.

Increased digital proficiency and confidence in Estonia, Lithuania, and Georgia

Participants' experiences in the project signal noteworthy shifts in digital proficiency, confidence, and the emergence of leadership roles. Particularly notable is the case of participants who already had a degree of digital competence. Such individuals, like Participant 2E from **Estonia,** found themselves stepping into leadership or supportive roles within their school teams. As 2E articulated, they felt an increased sense of responsibility, becoming a vital link between the management and the rest of the team: "*I ended up leading it in the sense that I reminded our management all the time... that I was still keeping an eye on things*." This highlights how participants with existing digital skills became instrumental in driving the adoption of digital tools and technologies within their schools.

Additionally, the project seems to have ignited a sense of enthusiasm and confidence among participants in exploring and integrating digital tools and platforms. This is evident in the shared experience of Participants from **Estonia, Lithuania, and Georgia** (3E, 4E, 5E, 12L, and 3G), who expressed their eagerness in trying new things and developing their digital competencies. Participant 3E, for instance, reflected, "*The biggest plus was that the course was delivered to us... It gave me the most courage to experiment and try things out*." This sentiment is echoed by participant 3G from Georgia: "*The involvement in this project gave me a lot of experience and increased my self-confidence*." These quotes suggest a potential positive outcome of the project in enhancing participants' digital proficiency and instilling confidence in their ability to leverage digital tools effectively. Overall, these observations suggest that the project may have acted as a catalyst for systemic changes within participant schools. It seems to have encouraged the emergence of digital literacy-linked leadership roles and stimulated a culture of experimentation and confidence in using digital technologies.

Classroom dynamics, learning outcomes, and shifts in students' attitudes toward learning in Estonia and Lithuania

Estonian and Lithuanian participants involved in the project reported constructive changes within their classrooms and improvements in student learning, which they attributed to the integration of innovative pedagogical techniques and digital resources.

Participant 5E from **Estonia** reported a noticeable enhancement in classroom dynamism and engagement, sharing, "*Lessons are progressing at a quicker pace and are more captivating*." This observation implies that the incorporation of innovative methodologies has stimulated students' curiosity and fostered their active participation in the learning process. In providing a concrete example, Participant 5E cited the use of QR codes and the Wordwall program, remarking, "*These tools have proved very interesting for the children, and have notably increased their motivation to learn*." This sentiment was echoed by Participant 1E, who highlighted their positive experiences using applications like crossword-making and Canva in their classroom. They shared, "*The students enjoyed the crossword-making app as it was very user-friendly for them. One innovation that particularly resonated with them was Canva. I introduced it to them for the first time, and they used it to create their own posters. I created a teacher account that allowed me to see all their works. I was quite impressed with the system. Their posters were remarkable, and they discovered that their presentations didn't always have to be in PowerPoint. Instead, they could search for information on the internet, adapt it, and present it creatively. This was a refreshing change from the usual classroom routine*" This testimony emphasises the potential of digital tools in fostering creativity and engagement among students while diversifying their learning experiences.

Lithuanian participants universally acknowledged the transformative role of digital tools in teaching and learning. They stressed the advantages of incorporating the Eduten/ViLLE platform into their classrooms. Participant 3L spotlighted the positive outcomes of introducing Informatics/Computational Thinking lessons and using the Eduten/ViLLE platform, arguing, "*The implementation of Informatics/ Computational thinking classes, supplemented with the robust Eduten/ViLLE platform, has fostered students' motivation and the use of digital technologies in their learning journey*." Participant 4L praised the platform's personalised learning environment, stating, "*Pupils can complete Eduten/ViLLE maths tasks at their own pace and select the level… I have also observed how the pupil learns.*" Participant 6L found the platform extremely beneficial for identifying and supporting struggling students promptly. Participant 2L noticed the heightened student engagement from Eduten/ViLLE, stating, "*Our initial difficulties seemed to disappear once we observed the students' increased interest, motivation, and steadily improved knowledge and skills*." Participant 5L echoed this sentiment, praising ViLLE for its dynamic features that enhance efficient learning and individualised assistance. They stated, "*The children are delighted to learn, they can see their results, and I, as a teacher, can monitor their progress.*" Participant 7L remarked, "*Using ViLLE and Bebras in the national project 'Informatics in Primary Education' over the past four years has led to quicker multiplication table learning, improved mental calculation skills, increased focus on tasks, and enhanced reading abilities*." Participant 11L encapsulated these sentiments, noting, "*I've observed an increase in students' creativity and logical reasoning.*"

Participants in **Lithuania** also observed a significant shift in their students' attitudes towards learning. Participant 13L highlighted the change in students' attitudes towards computer science, stating, "*Pupils' attitudes towards computer science have changed. Pupils have been more adventurous about programming, even with the simplest of tools, but they are now more interested in creating something themselves, rather than typing text or writing papers on the computer. My own relationship with the pupils has changed, and now I have to plan classroom activities in a targeted way, emphasise the motivating moments for the pupils, and anticipate a common outcome with the pupils, and I have to spend a lot of time looking for interesting topics that are related to the pupils' other subjects*." Similarly, Participant 15L shared their experience with computer science classes, noting that it has made their pupils even more eager to code and requiring them to think deeply about coding tasks and their integration with science activities ("*My computer science classes have made my pupils even more eager to code, so I have had to, and still have to, think even more about coding tasks and try to combine them with science activities.*") These testimonies highlight the positive impact of the projects on students' engagement and enthusiasm for learning, showcasing the transformative power of innovative teaching methods and digital tools. Collectively, these reflections strongly indicate that the **combination of mentorship and innovative digital resources** has the potential to drive substantial positive changes in teaching and learning experiences.

Changes in supportive infrastructure in Estonia and Lithuania

In **Estonia**, many participants indicated that their schools have started recruiting educational technologists and making infrastructural adjustments to facilitate the transition towards digital learning. Participant 3E, for instance, spotlighted the inception of a new role in their school, stating, "*We didn't have an educational technologist before, but now we do. I've found this role incredibly beneficial... Our teachers already possess extensive knowledge of the digital world*." Participant 6E, another Estonian respondent, shared the restructuring of management meetings to include IT-related discussions: "*In our management team, we revisited and updated the ICT development plan. The demand for an educational technologist has surfaced.*

We've also approached the city government regarding this position, though we've not yet received a response. Now, we hold management meetings every Monday to discuss IT-related topics, which is something new." This quote **highlights the changes not only in infrastructure, but also in the mindset of school leaders:** very important outcomes of the mentoring are leaders' readiness to create additional roles in the school and to conduct regular meetings to discuss school activities in terms of implementing digital innovation.

Participants from **Lithuania** also echoed these changes. For instance, Participant 8L detailed their school's investment in computer equipment and a shift in pedagogical focus: "*Our school has invested substantially in computer equipment, equipping all methodological groups with sets of computers. Consequently, teachers frequently employ digital technologies. However, our primary emphasis remains on innovative teaching methods and enhancing student performance through digital technologies"*. Participants 13L and 14L recounted technological upgrades in their schools, stating, "*Interactive whiteboards are being replaced by smart boards, and schools are transitioning from paper-based to digital exercises with the help of ViLLE for computational thinking exercises*." (13L) and "*We're transitioning from interactive whiteboards to smart boards. Schools are shifting from paper-based to digital exercises, employing ViLLE for computational thinking exercises*." (14L). These responses collectively underscore a growing focus on engaging specialised staff and revamping school infrastructure to support digital learning. The accounts from Estonia and Lithuania suggest that initiatives and training provided by the project have played a significant role in fostering these changes.

The **Finnish participants** - who were ICT teachers and principals in their schools and members of the coordination team of the mentoring process - have reported some external challenges to the project. Participants expressed concerns over local government restrictions, rapid technological obsolescence, and the increasing pressure on teachers. Participant 3F lamented that city regulations seem to limit what they can implement in schools, leading to increased apprehension about the procurement of equipment. They shared, "*The city seems to heavily control what we can do in schools, the equipment we have, and what can be installed, etc. It feels like these limitations are getting tighter. Now I'm beginning to worry about what tools I can use*." Participant 2F pointed out the challenges of keeping up with the rapid pace of digital evolution, suggesting that currently acquired equipment may soon become outdated, "*The digital world is rapidly evolving. What's current now may only reach schools in five years when it's already outdated. One problem with digital technology is its rapid obsolescence; it's hard to keep up*". Participant 3F mirrored this sentiment, stating "*Technology is constantly evolving. We can never fully prepare for developments like artificial intelligence, which is rapidly gaining ground. I'm curious to see how it will shape our field in the future*." These statements from Finnish participants emphasise the complexities of the digital transition in education and emphasise **the importance of continuous dialogue between policymakers and practitioners.** These responses underscore the increasing demand **for specialised staff and improved infrastructure** to facilitate digital learning, while acknowledging the difficulties arising from rapid technological advancements and local government constraints.

- Summarising the qualitative findings from the interviews with participating teachers and principals, we arrive at several key insights: The most significant change perceived by teachers revolved around an enhanced and diversified **use of learning technologies.** This expansion in the use of technology fostered increased **collaboration** among teachers and facilitated more fruitful

engagements with mentors. Concurrently, the **digital infrastructure within the schools was seen to improve during the mentoring period,** creating conditions for digital innovation.

- In schools where teachers implemented specific methods - such as in Lithuania - these methods were implemented in classroom settings. This implementation resulted in a notable **change** i**n their students' learning experience,** as reported by teachers.
- Changes were also observed at e the school level, particularly among teachers **whose school received leadership training** as part of the mentoring process (e.g., Estonia). These teachers reported recognition for new practices that were previously nonexistent, such as the need for a new position in school helping teachers to adopt digital innovation (educational technologist) and meetings focused on digital innovation.
- However, the interviews also highlighted the challenges faced by teachers trying to balance their commitment to professional development with the daily demands of teaching and learning.

4.4. Mentors' experiences and assessment of the mentoring process

Mentors' mentoring experiences were investigated in M18 and M30. Below we will integrate the results from two phases. Mentors from all the cases reflected the importance of school mentoring, the values they experience as the mentors, the perceptions of the schools' incentives to motivate schools to participate in interventions to become digitally innovative and also the challenges mentors perceive in this process.

4.4.1 Mentoring activities

We carried out a reflection exercise with mentors to gain insight into the main activities they perceived they were primarily engaged in during their mentoring relationships. These activities can be categorised into the following interrelated themes:

- Mentors engage in **mentoring talks,** both online and offline, based on their perceptions. These discussions can be initiated by mentees seeking guidance on specific questions or mentoring activities related to school leadership and teaching. They can take place in informal settings, individual or group mentoring sessions, or during lesson observations. Mentoring talks facilitate the exchange of experiences, generation of new ideas, and provide teachers with valuable support and feedback.
- In addition to mentoring talks, mentors identified training as a significant aspect of their mentoring activities. This included individual and group training sessions covering pedagogy, methodology, leadership, and technical aspects related to digital innovation.
- Mentoring also involved integrating activities aimed at **demonstrating technical equipment** and tools: preparation of instructions, guidelines, and materials to effectively implement these resources.
- Furthermore, mentors emphasised their involvement in supporting school leaders and teachers in **writing project or funding proposals** to upgrade their technical infrastructure and apply for funding dedicated to training initiatives.

4.4.2 Importance of school mentoring

From the mentors' reflections, we can conclude that one of the important reasons to mentor schools in their way to become digitally innovative is to **avoid the inefficient way of using the technology** *(It is so easy to use digital tools inappropriately, digital innovation is about using the digital in a good way, to provide*

more mastery, motivation and learning experience for our students). During and after the Covid-19 distance learning situations, teachers and leaders may mistakenly believe that extensive use of digital tools alone is sufficient. The role of mentors is to guide teachers and leaders in realising that digital innovation entails using digital tools effectively.

From the mentors' perspective, they help to **change the mindset of the school teams and school culture** not to show how the tools are working with the ultimate goal to provide the best possible learning experience for the students (*The mentoring process is important for schools because in this way we help teachers apply theoretical knowledge in practice and in their professional development; I am interested in improving the pedagogical quality of teaching practices, and that seems to be very difficult if teachers do not get support or if only individual teachers are trained or guided. The focus should be on school level change, and the role of principals is central; The process of mentoring not only benefits teachers but also the entire school as it establishes a collaborative system within the school*). It is crucial to focus on whole-school change, with principals playing a central role.

Additionally, mentors pointed out that the research claims that **mentors are taking an external view** and role to support schools to change (*The external support for improvements has been proven effective as adopting digital technology into existing practices, which is always challenging without external support and reflection*). Mentors found that research suggests integrating digital tools and practices alone does not lead to transformative pedagogy or significant added value without external support and deliberate development initiatives. Therefore, it is crucial to provide teachers with necessary resources, training, and mentoring to effectively implement digital practices.

4.4.3 Benefits and challenges of mentoring for the mentor

Some of the mentors reflected that mentoring provides them with possibilities to **professionally learn and develop** because through the mentoring process it is possible to see how things are done in different schools and this leads to the realisation that there is a need to constantly adapt to different situations and cultures (*It was helpful in this process to get acquainted with the mentoring and coaching strategies and the specifics of its use; For me it was useful to see how are things done in different schools; Mentoring provides me an opportunities to get to learn one school in depth*). According to mentors, **readiness to change, openness to innovation** and a basic level of teachers' digital competence, were the aspects that were considered supportive for the mentors (*The school(s) are already on a good / basic level with digital technology and they were ready for new ideas and change; it was good to see how teachers improve their teaching methods; During the mentoring teachers readiness and being open to innovations was useful*). Also, mentors' **professional knowledge, research-based methods** and ability to answer questions were perceived as aspects that have supported their mentoring process (*What has been useful for me is that I always have to have an answer as to why I do something, as well as how*). Mentors highlighted the **importance of collaboration with colleagues** (*Mentoring offers a lot of opportunities for professional development and to practise the role of counsellor, listening, mirroring, "nudging*"), which could be also transferred into own professional context as well (*I was often discovering a solution to a problem or just looking for interesting new material to share at school, and I often shared similar material in my real workplace*). Collaboration with other mentors was perceived as useful (*Doing everything together with a colleague working as mentors during the whole process together was very useful: joint planning, written instructions,*

materials etc. together, and were able to share responsibilities and combine our expertise in a way that was beneficial for the schools).

Turning to **challenges** of mentoring in school development initiatives - all of the mentors agreed that the biggest **challenge is related to the mindset and the willingness to change** and this applies to individual teachers as well as to the school leadership and the organisation in general. According to the mentors, it is not enough for leaders to implement change in the school if teachers are not on board with the same, nor is it enough for teachers to change their practices if leaders do not support them (*It is difficult to change those who don't want to be changed; If there is no innovation, motivation, encouragement from the leaders, then these kind of projects are only the thing of some individual enthusiasts; Involvement in such initiatives should be supported by the school administration; It is also important that the principal is willing and encouraging; It is difficult when you see that teachers are not interested; I think that we succeeded quite well because we focused on collaborating with the leadership team, not directly with teachers. This way there is a bigger probability that the changes, learning and new practices will sustain in the schools.*). Such results highlight the importance of systematic leadership and change management for implementing whole-school level change. School level readiness and willingness is tightly related to **time constraints**. If change is not a priority for the school, it is difficult to find the time and create the time to work together (*Somewhat difficult was being in contact with schools and organise activities and meetings, because schools do not have much time and resources for extra work; Because of busy schedule of teachers, it was difficult to coordinate the meetings with them*). From their own professional experience, mentors perceived it challenging to be **ready to know all the technical tools**, finding and learning appropriate methodologies, and drafting guidelines to meet the needs of the teachers, but this can be mitigated by collaborating with other mentors and participating in mentors' networks.

4.4.4 Factors that motivate and discourage schools to participate in mentoring.

Mentors felt that, above all, it should be an incentive for school teams to take part in such initiatives, as the **mentor will provide them with support to help them implement change** (*School teams get comprehensive support for the integration of different subjects and the introduction of digital solutions; Mentoring provides opportunity to be supported in the school improvement process. An opportunity to find solutions, innovative approaches*).

Another important incentive from the mentors' perspective is the **external recognition and acknowledgement** from universities or teacher training institutions (*Many of schools are motivated by the recognition of external sources like university or programme etc; Leaders and teachers, in addition to gaining experience, are focused on obtaining the relevant proof (certificate); Through such programmes, schools can become a role model for other schools*). Mentors also perceive that as the **external pressure** (national curriculum, nation or local level strategies) set high expectations for schools and teachers, and mentors support teachers and leaders in meeting these challenges (*We help schools and teachers do what they need to do anyway but feel challenging to accomplish alone, or, for example, our national curriculum is rather advanced pedagogically and many teachers struggle with implementing all that they should*).

From the practical perspective, **collaboration with the mentors gives the schools new ideas**, knowledge, tools and resources. Good practices and examples that can be reused in the classrooms are highly valued by the teachers not only by introducing the innovation, but helping teachers to try out new ways of teaching

and learning, providing practical co-creation type of events helps teachers to reconstruct new knowledge (*It is important that we do not only introduce the innovations but it is about showing in practice how can teachers use different tools for different purposes and subjects, and teaching different skills*). Finally, participation in mentoring initiatives **provides networking and peer-to-peer learning opportunities** for the teachers and leaders, which was considered by the mentors as a motivating factor *(It is important for the schools to learn about the experiences of other countries; it is very important to some teachers to have a possibility to share what they have been achieving; I have an experience that the majority of teachers always get much more that they expected from the projects and for many teachers participation is a nice possibility of learning from research and other schools and teachers; Mentoring program provides opportunities to exchange ideas and experiences. Gain experience from other schools in developing digital competence*).

With regard to the challenges that schools experience, mentors again highlighted **aspects related to leadership**. Leaders' support for initiating change is crucial (*There must be support from the school-leaders, otherwise it is very difficult for teachers to participate. I think the most important part is to work with the school-leaders first; the Principal is the key person and if they are not interested in advancing digital innovations, it is much more difficult to affect the school*). School improvement and implementation of digital innovation have to be meaningful for all of the staff members, as **top-down approaches do not usually lead to change** (*If the project ideas are strongly top-down and it is difficult to find out any use for teachers and daily practices, then it will not have an impact; If there is no motivation and someone is forcing (e.g. the municipality), the director will not want to participate. If the director does not lead by example, the teachers don't want to either, they're short of time all the time anyway; In my experience, a lot depends on the attitude of the leadership and also on the school atmosphere: if the school is innovative, they will come along; Often, being in the comfort zone is an obstacle: everything works sort of well for us here, we don't need to have this digital thing*).

Another challenge faced by the mentors is **teachers' and leaders' time**. When something is prioritised, something else must be de-prioritised. Often, schools jump between different initiatives and projects and such decisions are not always goal-oriented or based on a needs or gap analysis. Therefore, the competence to understand why one or another initiative or intervention helps school to improve, has to be supported (*Having no time, being too busy - the seminars, webinars, meetings should be as practical as possible; We consider the lack of time to be the biggest problem. Teachers have a lot to do, some of them even teaching in two schools; Time is crucial. When prioritising something, something else must be prioritised away. What you are offered must be goal-oriented, practical and constructive. A teacher must be able to take what he has learned right back to the classroom. Then it is relevant to set aside time for that*). It is also important **to give teachers time to validate new knowledge** in their practice without worrying about whether post-curricular material will be taught (*Teachers often have heavy workloads, no time to study and implement, and obviously it is not a priority*). Innovation takes time and teachers need to be given time to innovate. Time is also associated with opportunities for teachers to participate in seminars, document their innovative approaches etc. Mentors suggest that participating in such initiatives should be part of the normal workload or it should be additionally paid. Teachers' lack of time may cause the situation where only very practical tools and tips are valued, but no time for co-constructing knowledge or interest in theoretical research-based knowledge. Related to time and the culture, one of the mentors pointed out that gradually lack of those aspects has an effect on **school-to-school collaboration** *(One issue is that teachers collaborate much less with each other than they could; especially less-active and less-competent teachers would benefit from*

sharing inside school. One important role of the mentor could be to organise and provide a model for such light-weight collaboration and sharing events and practices which could be easily adopted as established practice in the school).

Finally, mentors said that **the level of technical infrastructure** has an effect on the school teams' readiness to implement digitally innovative practices in their school (*The school's infrastructure definitely needs upgrading, both in terms of premises and hardware and software; The digital infrastructure should meet basic needs (normal Wifi and Digital Learning Resources); Need to develop digital learning materials in line with the national curriculum in an open environment; Equipping the educational process with appropriate technologies (computers) can probably be named as one of the problems*).

To summarise, the above findings indicate that **mentors perceive their role in supporting schools as highly significant**, and the collaboration is not a one-way process; mentors themselves experience personal growth and development during the mentoring journey. Additionally, the effectiveness of this **collaboration is greatly influenced by leadership,** as it shapes the collaborative culture within the school, impacts teachers' willingness and ability to embrace change, and enables the implementation of systemic changes in the school's organisation. Top-down mentoring in schools is a two-pronged approach: while mentoring is sometimes necessary, it is crucial for school leaders to understand the purpose and value of mentoring. Without this understanding, the expected changes in the learning process and other practices may not be achieved.

4.5 Evaluation of the models and methods

The evaluation conducted during the implementation of the School Mentoring Model aimed to assess mentors' experiences with the model and its associated components. The following is a descriptive summary of the responses gathered from the case reports and feedback provided by external experts regarding the evaluation of mentoring models and methods.

4.5.1 The Conceptual model

The mentors of different cases approached the **evaluation of the Conceptual model** (see D3.3 for more details) from different viewpoints: describing **how they used the model** in their own mentoring cases, reviewing how their own cases **addressed the main elements of the model,** considering what elements are relevant in the model, or **what is the benefit of the model** in general. It can be said that the model helped the mentors **in examining and explaining what was relevant** in their case or in supporting schools in digital development. It is important to note that these evaluations focused on the first versions of the Conceptual model, which was then revised to the recent version.

In the **Lithuanian** case that included collaboration between the university, schools, and national level stakeholders, the mentors emphasised collaboration at various levels. In addition, the importance of highlighting leadership practices in the model was considered relevant (*...when developing the conceptual model, it is important to emphasise that leadership practices are part of every school's learning, and every school needs to reach this stage.*). The **Estonian** head mentor described that they used the Conceptual model for analysing previous mentoring practices. Based on the analysis, they focused on supporting school management, improved evidence-informed practices by renewing teachers' digital practice survey, assigning management to complete schools' digital maturity survey and conducting a SWOT analysis for

schools, as well as organised initial mentoring for teachers' in digi-pedagogical practices before the training program. In general, "*the conceptual model gave the ... program a good theoretical basis and more structure for the topics to be covered during the mentoring.*" The Estonian mentor suggested separating co-creation and peer-learning clearly in the model. In the **Finnish** cases, the mentors experienced the Conceptual model as useful for joint discussions with the schools' development teams. They reported starting the mentoring process with a reflective teacher workshop for collecting evidence and for engaging the whole teacher community. The Finnish mentors pondered about the balance between the Conceptual model being detailed and complicated or too simplified. The mentors in the **Georgian** case emphasised the uniqueness of the whole model "*to help school principals and policy makers in school management, strategy definition and reform implementation*". They thought that it is valuable that the Conceptual model does not simplify the key aspects of the development work too much and we could argue that **the conceptual model could be seen as the boundary object** during the mentoring process between multi-stakeholder communities. The **external experts** did not have specific comments about the Conceptual model as such. They emphasised practical guidelines and examples and focused more on the Process model and Individual method descriptions in their feedback.

4.5.2. The Process models

When the mentoring cases were conducted, two versions of the process model (see D3.3 for more details) were available. The first described relevant phases for intra-school mentoring, the second emphasised inter-school collaboration, but the main phases were very similar.

The **Lithuanian** mentors described how they implemented the phases in their case. They mentioned that the model should be clearer about which stakeholders should be involved in the initial discussions and suggested that *"throughout the innovation process, cooperation with representatives of the ministry and municipalities should be encouraged"*. They also emphasised that in all phases (in mapping development needs, defining goals or forecasting the future) it is important to engage all teachers in self-reflection and development activities. The Process model led the **Estonian** mentor to realise that they should reconsider the balance between different activities in the mentoring process; she stated that *"content-wise it gave me a good deal of ideas and basis for further analysis and adjustments"*. The linearity of the model was a challenge for her, and she thought that phases 3 (Joint planning and getting acquainted with the possibilities) and 4 (Mapping joint development aims and needs) are quite similar. Also, the **Finnish** mentors mentioned that the model introduces abstract, plain steps; in practice several phases might be included in one event, or minor reflection activities might be included in every phase ("*In addition, we had planning and reflection meetings with the digi team throughout the process."*). The **Georgian** mentors thought that the Process model for school mentoring helped them plan, analyse and evaluate cooperation with the school and conduct the processes democratically in the school community. They mentioned that the Process model for school-to-school peer learning is *"a nice opportunity for schools to promote and share achievements and experience with each other"* and highlighted that it is important that the model does not divide schools into "strong" and "weak" ones.

The **external experts** provided some feedback about how the Process model and its phases were presented in the mentoring guidelines. One expert commented that "*it was enjoyable to walk through, as you have the intro, model picture and concrete descriptions of the different phases*". One expert said that she liked the questions through which the phases of the mentoring process and individual methods were introduced

("*They activate the reader to think and reflect."*). Another expert hoped for an even more systematic way to describe each phase with a purpose, important inputs, research-based evidence, activities to be performed, and achievable input; this feedback was considered when modifying the final version of the guidelines.

4.5.3 Individual methods

The mentors described the Individual methods that they had used in their cases with varying levels of accuracy. They mentioned some broader, general methods (combined training and peer learning; School-university collaboration for deepening teachers' digital competence; Generating ideas for promoting students' digital competence; A workshop for evaluating school's digital practices; Digital Accelerator Program) that have also been described in detail in the Individual method descriptions in D3.3. In addition to those, the mentors listed multiple methods that they had applied and experienced as useful as part of the mentoring activities. The following list demonstrates the rich variety of methods used:

- Learning through reflection developing innovations
- Sharing/exchanging data/planning
- Presentation/explanation/planning
- Focus group
- SELFIEforTEACHERS survey tool and analysis, synthesis and evaluation of results
- Discussions
- Feedback/reflection
- Sharing experience and feedback analysis
- Series of teacher training event (advanced teacher, expert, professional)
- Questionnaires
- Digital practice survey both before and after mentoring and digital training
- Feedback questionnaire after training
- Advanced digital training designed module by module based on the participants' needs
- Final reports filled out together by the mentors and school management
- Feedback seminar based on a specific survey carried out with mentors and educators
- Self-assessment of digital maturity of the schools implemented for the leadership training
- Focusing the mentoring on the schools' co-ordination/leadership teams
- Teachers presenting their good pedagogical practices to each other

As the **Lithuanian** mentors stated, "*a method must have the following aspects: an objective, a form of implementation, the production of a result, the full involvement of the participants (focusing on the whole community, maintaining the idea of an inclusive, whole school)*". The **Georgian** mentors thought that the models and methods give the schools more independence. The **external experts** emphasised that the selection of methods in the guidelines is good. One expert hoped for a small table listing the methods so that the reader can easily click on the ones they want to read more about.

The above insights highlight the Conceptual model as a valuable tool for conceptualising the essential elements to consider when planning mentoring initiatives to promote digital innovation. The Process model underwent iterative evaluations with mentors involved in the iHub4Schools project to ensure its validity, resulting in the development of validated guidelines for the wider community. Furthermore, the individual methods provide flexibility in how mentors can engage with teachers and leaders. These components

collectively make the School Mentoring Model adaptive, allowing for customization based on specific needs and goals, thereby enhancing its effectiveness. Formative and summative evaluation of local initiatives are needed to establish the validity of the School Mentoring Model.

5. Conclusion

The iHub4Schools project ambitiously aimed to enhance the readiness of school leaders and teachers to embrace digital innovation practices through the development of a School Mentoring Model. Engaging over 600 teachers, mentors and other experts across two iterations of mentoring activities, this deliverable presents both formative and summative evaluation of these activities, drawing on the experiences of nearly 300 teachers actively involved in various project activities.

Main conclusions:

School mentoring model and individual methods

- The **conceptual model serves as a valuable tool for guiding the planning of mentoring initiatives** aimed at promoting digital innovation. More specifically, it helps in identifying essential elements to consider during the process.
- **The process model** for school mentoring (D3.3) was validated through several iterations and evaluations with the wider community. The flexibility offered by individual methods enables mentors to tailor their approach to engage with teachers and leaders effectively. Its adaptive components appear to enhance effectiveness, but there is a need for both formative and summative evaluations of local initiatives to further establish the validity of the model.
- We proposed **a list of individual methods** to be used by the mentors to support schools to adopt digital innovation practices. Mentors followed different methods and combined: different approaches: development of individual pedagogical practices, school-level improvements, learning specific tools, and developing basic digital competence. This highlights the multifaceted nature of innovation adoption. Varying approaches to mentoring, such as whole-school development efforts and inter-school collaboration, resulted in challenges related to time management, logistics, and resource constraints.

Mentors' experiences during the mentoring:

- **Leadership plays a pivotal role in the effectiveness of mentoring,** shaping the school's collaborative culture, determining teacher engagement in change, and facilitating systemic changes in school organisation.
- **Digital infrastructure improvements** in schools during the mentoring process created **favourable conditions** for digital innovation.
- Mentoring involves **a wide range of activities** (meetings, training, individual and group counselling, creating guides), but it is important to encourage and provide as tailored an approach as possible.
- Mentors recognize the **significance of their role in supporting schools** and acknowledge that collaboration is not solely one-way; mentors also experience personal development throughout the process at the very least by explicitly externalising their thought processes during the mentoring processes.

Changes perceived by teachers as a result of mentoring

- Teachers across all cases **reported learning new methods** during mentoring and **expressed a willingness to implement** them in the future. Collaboration and co-creation were key practices during mentoring, supported by individuals (peers and mentors) and available materials and guidelines. This result is important because it was also one of the main success indicators of the mentoring cases.
- Differences in knowledge appropriation practices between countries **were influenced by the variations in innovations and setups** used in each case. The context specific comparisons provided interesting insights into the variations in how innovation adoption was supported in the local settings.
- Teachers felt less prepared **to support colleagues,** and the **opportunity to formalise and standardise the knowledge** created during mentoring was **limited**. This is very likely due to the short period of mentoring, highlighting the need for follow-up activities.
- Teachers experienced a significant increase in the **diversified use of learning technologies,** which boosted teacher **collaboration** and e**ngagement with mentors.**
- School-level changes were perceived **especially among teachers** whose schools received leadership training as part of the mentoring process. This led to the recognition of new practices, including the need for new positions, such as educational technologists, and the organisation of meetings focused on digital innovation.
- Implementation of specific pedagogical methods in schools, like in Lithuania, **resulted in** teachers' perceptions about **improved student learning** experiences when teachers implemented created materials. However, direct evaluations of student experiences were out of scope for this project.
- **Knowledge appropriation model** can be considered as **an effective tool t**o explain the social learning practices in multi-stakeholder networks to investigate how individuals learn and create knowledge and how the knowledge can be transferred to the collective level in a tangible and re-usable manner.
- **Balancing professional development alongside day-to-day teaching** and learning tasks proved challenging for teachers and it needs special attention by the leaders, mentors and other stakeholders, because it has an effect on how teachers are engaged in knowledge appropriation practices.
- The adoption of an innovation **is a time-consuming process**, and not all expected changes may be observed within a six-month (for instance) mentoring period. Continued collaboration through Regional Innovation Hubs is crucial for sustained progress and school development efforts.

These lessons shed light on the complex process of adopting innovation and underscore the crucial role of mentoring in supporting this transformative journey. The results are also in line with previous studies highlighting the importance of school culture and leadership in embracing innovation and the need for proper technical infrastructure to support the development of new pedagogical practices (e.g. Navaridas-Nalda et al, 2020). Which, in turn, highlights that mentoring alone may not lead to changes in schools and teachers' practices, but that we need to look at the whole holistic ecosystem.

6. Limitations

While this evaluation provides valuable insights, certain aspects could not be as comprehensively addressed as initially planned. Although the students were directly involved in the project activities, our main focus was on teacher professional learning and adoption of innovation. Considering the varying circumstances of each school and teacher, assessing the impacts of the practices stemming from mentoring efforts on student learning outcomes proved challenging. Even though in all cases teachers created scenarios and piloted them and also observed the changes in students' learning experiences, student data were not incorporated into our evaluation. Given the brief duration of the piloting period, expecting changes across all levels was unrealistic. Instead, we focused on the implementation of the School Mentoring Model as an initial step. Following this, further initiatives and assessments are required to fully investigate its potential impact on students.

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Annex 1: Survey for the teachers

iHub4Schools Evaluation Survey

Concept	Dimension	Original	Estonia	Finland	Georgia	Lithuania
			Instruction: Please consider the new teaching and learning methods created/shared through your participation in the Digital Acceleration Development program to answer the following questions	Instruction: Please consider the new teaching and learning methods created/shared through the school's efforts to implement the Digital Path framework to answer the following questions	Instruction: Please consider the new teaching and learning methods created/shared through your participation in the Developing Teachers Digital Practices program this year to answer the following questions	Instruction: Please consider the new teaching and learning practices of computational thinking created/shared through your participation in the [name of pilot] this year to answer the following questions
Adoption	Intended Adoption of a new learning and teaching method	I am certain I will use the new teaching and learning methods after the training has ended in my own teaching	I am certain I will continue to use the new ways of teaching and learning with digital technologies in my own teaching.	I am certain I will continue to use the new ways of teaching and learning with digital technologies in my own teaching.	I am certain I will continue to use the new ways of teaching and learning with digital technologies in my own teaching.	I am certain I will continue to use the new teaching and learning practices of computational thinking in my own teaching.
		I am certain I will promote the use of X (the new teaching and learning methods) in my school more widely	I am certain I will promote the use of the new ways of teaching and learning with digital technologies in my school more widely.	I am certain I will promote the use of new ways of teaching and learning with digital technologies in my school more widely.	I am certain I will promote the use of the new ways of teaching and learning with digital technologies in my school more widely.	I am certain I will promote the use of new teaching and learning practices of computational thinking in my school more widely.
		X (the new teaching and learning method/innovation) will influence my teaching for a long time	The new ways of teaching and learning with digital technologies will influence my teaching for a long time.	The new ways of teaching and learning with digital technologies will influence my teaching for a long time.	The new ways of teaching and learning with digital technologies will influence my teaching for a long time.	The new teaching and learning practices of computational thinking will influence my teaching for a long time.
		The X (new teaching and learning	The new ways of teaching and learning with	The new ways of teaching and learning with	The new ways of teaching and learning with	The new teaching and learning practices

		method/innovation) is very effective means to teaching xxx subject	digital technologies are very effective in supporting students' digital competence	digital technologies are very effective in supporting students' digital competence.	digital technologies are very effective in supporting students' learning.	of computational thinking are very effective in supporting students' computational thinking skills .
		I am using X method/innovation frequently in my teaching practice	I am using the new ways of teaching and learning with digital technologies frequently in my teaching practice.	I am using the new ways of teaching and learning with digital technologies frequently in my teaching practice.	I am using the new ways of teaching and learning with digital technologies frequently in my teaching practice	I am using the new teaching and learning practices of computational thinking frequently in my teaching practice.
Knowledge appropriation practices	Create awareness	Through X (method/innovation) I was made aware of new teaching and learning methods that I did not know before	Through my participation in the Digital Accelerator program I was made aware of new ways of teaching and learning methods with digital technology that I did not know before.	Through my participation in events related to the implementation of the Digital Path Framework I was made aware of new ways of teaching and learning methods with digital technology that I did not know before.	Through my participation in the Developing Teachers Digital Practices program I was made aware of new ways of teaching and learning with digital technology that I did not know before.	Through my participation in the Developing Computational Thinking Practices I was made aware of new teaching and learning practices of computational thinking that I did not know before.
	Build shared understanding	I have developed a common understanding about the X (method/innovation) with other participants	I have developed a common understanding about the new ways of teaching and learning methods with digital technology with other participants	I have developed a common understanding about the new ways of teaching and learning methods with digital technology with other participants	I have developed a common understanding about the new ways of teaching and learning methods with digital technology with other participants	I have developed a common understanding about the new teaching and learning practices of computational thinking with other participants
	Adapt	When I carry out lessons with X innovation, I make changes in X materials and methods based on my need and my own wish	When I carry out lessons with digital technologies, I make changes in my teaching materials and methods based on my need and my own wish	When I carry out lessons with digital technologies, I make changes in my teaching materials and methods based on my need and my own wish	When I carry out lessons with digital technologies, I make changes in my teaching materials and methods based on my need and my own wish	When I carry out lessons with computational thinking tools, I make changes in my teaching materials and methods based on my need and my own wish
	Validate	I have developed an understanding of the	I have developed an understanding of the	I have developed an understanding of the	I have developed an understanding of the	I have developed an understanding of the

		effectiveness of X (method/innovation)	effectiveness of using digital technologies to support students' digital competence	effectiveness of using digital technologies to support students' digital competence.	effectiveness of using digital technologies to support students' learning	effectiveness of using the new computational thinking tools to support students' computational thinking skills.
Knowledge maturation practices	Appropriate an idea	My own experiences and ideas were considered when developing X (method/innovation)	My own experiences and ideas were considered during events of the Digital Accelerator program	My own experiences and ideas were considered in my school's events related to the implementation of the Digital Path Framework.	My own experiences and ideas were considered during events of the Developing Teachers Digital Practices program	My own experiences and ideas were considered during events of the Developing Computational Thinking Practices.
	Share	I have often shared my own experiences and materials with other participants inside and outside the innovation lab trainings	I have often shared my own experiences and materials with other participants inside and outside the events of the Digital Accelerator program	I have often shared my own experiences and materials with other participants inside and outside my school's events related to the implementation of the Digital Path Framework.	I have often shared my own experiences and materials with other participants inside and outside the events of the Developing Teachers Digital Practices program	I have often shared my own experiences and materials with other participants inside and outside the events of the Developing Computational Thinking Practices.
	Co-create	I have been an active participant in group work in which we developed new teaching and learning materials with other participants	I have been an active participant in group work in which we developed new teaching and learning materials using digital technologies with my colleagues	I have been an active participant in group work in which we developed new teaching and learning materials using digital technologies for implementing the Digital Path Framework.	I have been an active participant in group work in which we developed new teaching and learning materials using digital technologies with my colleagues	I have been an active participant in group work in which we developed new teaching and learning materials of computational thinking with my colleagues.
	Formalise	We have documented with our group the new teaching and learning methods and materials in such a way that others outside the group of training participants would be able to use them	We have documented with our colleagues the new ways of teaching and learning with digital technologies and related materials in such a way that others outside of our	We have documented with our colleagues the new ways of teaching and learning with digital technologies and related materials in such a way that others outside of our	We have documented with our colleagues the new ways of teaching and learning with digital technologies and related materials in such a way that others outside of our	We have documented with our colleagues the new teaching and learning methods and related materials of computational thinking in such a way that others outside of our school would be able to use them

			school would be able to use them	school would be able to use them	school would be able to use them	
	Standardise	X (method/innovation) and related materials we developed in the trainings has become regularly implemented in the school	The new ways of teaching and learning with digital technologies and related materials we developed during our participation in the Digital Accelerator program have become regularly implemented in the school	The new ways of teaching and learning with digital technologies and related materials we developed during our school's implementation of the Digital Path Framework have become regularly implemented in the school	The new ways of teaching and learning with digital technologies and related materials we developed during our participation in the Developing Teachers Digital Practices program have become regularly implemented in the school	The new teaching and learning methods and related materials of computational thinking we developed during our participation in the Developing Computational Thinking Practices have become regularly implemented in the school
Scaffolding practices	Seek help	When introducing X (method/innovation for the first time in my professional practice, I could ask for help or support when I did not know what to do	When introducing the new ways of teaching with digital technologies for the first time in my practice, I could ask for help or support when I did not know what to do	When introducing the new ways of teaching with digital technologies for the first time in my practice, I could ask for help or support when I did not know what to do	When introducing the new ways of teaching with digital technologies for the first time in my practice, I could ask for help or support when I did not know what to do	When introducing the new teaching and learning practices of computational thinking for the first time in my practice, I could ask for help or support when I did not know what to do
	Guide	When introducing X (method/innovation) I had sufficient guidance by other people or through the materials that were provided	When introducing to the new ways of teaching and learning with digital technologies, I had sufficient guidance by other people or through materials that were provided	When introducing to the new ways of teaching and learning with digital technologies, I had sufficient guidance by other people or through materials that were provided	When introducing to the new ways of teaching and learning with digital technologies, I had sufficient guidance by other people or through materials that were provided	When introducing to the new teaching and learning practices of computational thinking , I had sufficient guidance by other people or through materials that were provided
		I offer guidance and help to my colleagues when introducing X (method/innovation)	I offer guidance and help to my colleagues when introducing new ways of teaching with digital technologies	I offer guidance and help to my colleagues when introducing new ways of teaching with digital technologies	I offer guidance and help to my colleagues when introducing new ways of teaching with digital technologies	I offer guidance and help to my colleagues when introducing new teaching and learning practices of computational thinking
	Fade	I have felt more confident over	I have felt more confident over	I have felt more confident over	I have felt more confident over	I have felt more confident over

		time to introduce X (method/innovation) without outside help	time to introduce the new ways of teaching with digital technologies without outside help	time to introduce the new ways of teaching with digital technologies without outside help	time to introduce the new ways of teaching with digital technologies without outside help	time to introduce the new teaching and learning practices of computational thinking without outside help

Demographics	Estonia	Finland	Georgia	Lithuania
Age: 20-30; 31-40, 41-50, 51-60, More than 60				
Gender: Female, Male, Other, I prefer not to answer				
Years of experience in education: 0-5,6-10, 11-20, more than 20				
Years of professional experience in using technology-based tools in teaching: 0-5,6-10, 11-20, more than 20				
Educational background: Teaching Certificate, Bachelor's degree, Master's degree, PhD, Other				
Discipline (please mark all appropriate answers): Biology, Chemistry, Physics, Mathematics, Computer Science, Language, Foreign Language, Other				

Annex 2: iHub4School Interview Protocol

1. How did you get involved in the [training/program/development project]? Please tell me what happened, starting from the beginning. Alternatively, begin by asking the interviewee how she/he has participated in the activities (of the training, project, development program etc). Follow-up whenever something of significance comes up.
2. Can you think of any concrete instances of changes in your school since the beginning of the training? Please give two concrete examples.
3. And what about things that have not changed? Can you give two concrete examples of those as well?
4. When you think back about your experience participating in this training/development project…
    a. What was it like for you?
    b. Can you think of what has been the thing that has been the most challenging of all the things you've had to do during/since [adapt to your pilot]....?
    c. Can you think of what has been the thing that has been most enriching of all the things you've had to do during/since [adapt]...?
5. If your school had to do it over…
    a. Would you get involved again? Why?
    b. What would you do differently?
    c. What could the principal/leaders have done differently?
    d. What could the principal/leaders have done differently? ?
6. Could you name 3 or more people [teachers or leaders from my school, teachers or leaders from other schools, other stakeholders involved, mentors, expert etc] that were important in the process of learning to use the new digital tools and methods? Would you please order them from most helpful to least….? Why did you choose this order?
7. Considering what has been done in [the program, the training, etc]
8. What are the two most important things that you learned? Why?
9. What have been the two most important events? Why?
10. Can you tell me about a class in which you use the new teaching and learning methods that you thought [went really well/was effective in supporting students' learning]? And one that [didn't' go so well/was not so effective in….]?
11. Is there anything else that you would like to share with me that I have not asked you about?

Annex 3: Mentors' reflective questions

1. Explain shortly your background as a mentor: what is your main job, for how long you have been mentoring.
2. Mentoring may include a variety of activities. Describe what kind of activities you carried out in the mentoring process
3. Why do you consider it important to mentor schools, school teams and teachers to support them in adopting digital innovation?
4. What is motivating you to act as a mentor? What kind of benefit, motivation and incentives do you get from this experience? What is difficult about mentoring?
5. What do you think is the most motivating for the school teams, leaders and teachers to participate in such school development projects? How could we support such a motivation system and incentives from the project side?
6. What do you think are the hindering aspects for the school teams, leaders and teachers to participate in such school development projects? How could we support such challenges from the project side?

Annex 4: Question evaluating the models and methods

1. The conceptual model

See the Conceptual model and write your comments about it. How did you use it in the mentoring case? Did it help your work of mentoring? How would you improve the model?

2. The process models

See the Process model for school mentoring and the Process model for school-to-school peer learning and write your comments about the one that you used. How did you use it in your mentoring case? How did it help your work for mentoring? How did the various phases support you in the mentoring work? How would you improve the model?

3. Individual methods

List all the individual methods used and created in your mentoring case, and write a reflection of their usability (benefits, problems, suggestions for improvements).

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This project has received funding from the European Union's Horizon 2020 research and innovation programme
Project Number: 101004676