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Kids in Clouds project

Intellectual Output 5: Pilot 2 (educational materials for children) and guidelines on pedagogical strategy

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Table of contents

Introduction

In order to integrate previously created educational materials for children (Intellectual Output 4) into the learning environments of project partners, methodology for conducting the pilot process was established. Furthermore, pilots were organized and ran in schools which are partners of the *Kids in Clouds* project. Algebra was responsible for establishing evaluation tools and evaluating the pilot process.

As a final result, report on Intellectual Output 5 of the *Kids in Clouds* project contains:

a) insights gained during the process of piloting in the following schools:
   - Secondary School St. St. Cyril and Methodius (Smolyan, Bulgaria)
   - Primary School Horvati (Zagreb, Croatia)
   - College Jules Reydellet (Reunion France)
   - Ludina Primary School (Velika Ludina, Croatia).

b) the results of the pilot process - evaluation of the pilot efficiency and success-rate of the produced digital educational materials for children

c) guidelines on pedagogical strategy for teachers, based on best practices of implementing the cloud-computing in teaching, noticed by pilot participants

1. The aim and objective of the Kids in Clouds project

Before drafting the *Kids in Clouds* project, a desktop research was conducted. Based on this research and trends showing increase in usage of the cloud-based tools, it was concluded that the cloud-based services are growing rapidly in the global and European economy. With the rise of 5G technology not only storage but also all data processing and applicative services will move to the cloud environment. Based on our research, this change is anticipated to come in the next 10 years. The move towards cloud-based environment will tremendously impact our work environments, as well as in general the way we use ICT solutions on a daily basis. We have established that switching from working in on-premise to cloud-based environment creates significant obstacles for users, as it requires them to relate to high-tech solutions in a different way.

This is why interdisciplinary project *Kids in Clouds* aims to introduce children with cloud-based services as early as the first grade of the primary school. Its main objective is to deliver well-rounded, useful and transferable educational programs in cloud computing through development of educational modules for teachers and students. This is a project designed to meet challenges of the modern education system and challenging market needs, by providing an awareness-raising, holistic and flexible education in cloud computing.

The aim of this project is to introduce cloud-based environment to children at the beginning of their primary school learning path. At that point, children do not differentiate on-premise from cloud-based content and services – for them, these are simply tools to get things done. Sooner they encounter cloud-based services, easier it is for them to learn how to interact with them. According to our research, it was concluded that it is hugely important to teach children to get acquainted and comfortable in the cloud-based eco-system as early as possible, as this will be the environment they will live and work in already ten years from now.

2. Previous project results and accomplishments

2.1. Gap analysis: the use of cloud-based services in schools today vs. the possibilities of the technology in general

In order to investigate the use of cloud-based services in schools today, project partners created and distributed an on-line questionnaire for teachers, as part of Intellectual Output 1. For the purpose of creating the questionnaire of a high quality and international usability, project partners conducted secondary and primary research and gained insights into teachers' attitudes towards using digital technology and cloud-based tools in teaching. Results of the questionnaire served project partners as conclusions about today's usage of cloud-based services in schools and these results were compared with the possibilities of the technology in general in order to decide on further project activities.

Results of the on-line questionnaire filled in by 373 teachers from different European countries show that teachers assess their digital skills as above average, that teachers often use particular digital tools in teaching, that they are inclined to acquire new knowledge about digital tools and that they partially recognize the importance of student-centered learning enabled by using digital tools. Furthermore, results of the questionnaire showed that there are many free cloud-based tools that primary school teachers are not familiar with; therefore, they do not use them very often or they do not use them at all. However, teachers pointed out that they are not skilled in creating their own digital educational materials even though they like to use them, that they are not inclined to pay a license for a certain digital tool, that students often do not have IT equipment in classrooms for independent usage and that they and their students rarely use many available digital tools in the cloud.

In conclusion, gap analysis showed that teachers who participated in the questionnaire are aware of the benefits of using cloud-based technology and digital tools in teaching but they still sometimes hesitate to use particular cloud-based tools and create their own digital educational materials despite the possibilities of the technology in general.

2.2. Digital educational materials for teachers

Following the results of the gap analysis, project partners created digital educational materials for teachers, as part of Intellectual Output 2. Since it was concluded that there is a great need for empowering teachers for creating their own digital materials, project partners created digital educational materials which can help teachers to learn how to use cloud-based tools in order to create their own digital materials. Materials were created in a form of video tutorials that show how to use free online cloud-based tools for the purpose of creating interactive presentations, graphics, quizzes, games and similar content as well as using cloud-based tools in teaching.

Materials are available in three different languages – Bulgarian, Croatian and French. In total, there are more than 170 educational materials available in an open-source online repository which allows previewing and downloading materials on the official project website – https://www.kidsinclouds.eu/digital-educational-materials-for-teachers/ .Materials for teachers are prepared in a way that ensures their wide usage - namely, teachers of all subjects can use them regardless of their previous knowledge about the topic. These materials can help teachers to master the use of cloud tools and empower them to help students with mastering it too. Moreover, the aim was to test these materials in the next phase of the project – during the Intellectual Output 3.

2.3. Pilot 1 (educational materials for teachers) and recommendations on the implementation

Digital educational materials for teachers, created as part of Intellectual Output 2, were tested during the next phase of the project. Therefore, in order to integrate previously created educational materials for teachers into the learning environments of project partners, methodology for conducting the pilot process was established. Afterwards, pilots were organized and ran in schools which are partners of the *Kids in Clouds* project (Secondary School St. St. Cyril and Methodius, Primary School Horvati, College Jules Reydellet and Ludina Primary School. Algebra was responsible for establishing evaluation tools and evaluating the pilot process.

During the pilot, 37 teachers from Bulgaria, Croatia and France tested more than 70 digital educational materials published in the online repository of the project. This way, teachers have tested efficiency and practicality of educational materials and online repository, but they also expanded their knowledge about using cloud tools. Moreover, teachers tried to use particular cloud tools on their own and they tested some of their many functionalities. Practically, this means that pilot participants tried to create their own digital educational materials (presentations, quizzes, videos, infographics etc.)

After conducting the pilot with teachers, results of the evaluation process (questionnaires filled-in before and after the pilot) were evaluated. The evaluation revealed that majority of the teachers who tested educational materials thinks that materials are easy to use and that they explain the use of cloud tools in a simple way. Nearly 70 % of the teachers pointed out that they have expanded their knowledge about using cloud tools during the pilot. In addition, majority of the teachers emphasized that they will certainly use cloud tools more often in the future for preparing the lessons as well as during their classes. Half of the pilot participants are convinced that they will explore functionalities of the cloud tools more often from now on and based on that, that they will introduce new methods of teaching. Also, the evaluation showed that teachers have discovered successful cloud-methods that will contribute to increasing students' motivation and involvement during lessons, facilitate receiving feedbacks from students on their acquired knowledge and help in the process of developing students' digital skills.

As a final result, report on Intellectual Output 3 was prepared. The report contains insights gained during the process of piloting in each school, the results of the pilot process - evaluation of the pilot efficiency and success-rate of the produced digital educational materials for teachers as well as recommendations for teachers, based on the best practices of implementation of the cloud-computing in teaching.

2.4. Digital learning materials for children

In parallel with working on Intellectual Output 3 and running the pilot process, project partners launched their efforts in order to produce digital learning materials for children as part of Intellectual Output 4. Since the aim of the project is to introduce children with cloud-based services as early as the first grade of the primary school, one of the partners' main objectives was to deliver well-rounded, useful and transferable educational programs in cloud computing through development of educational modules for students.

In order to encourage students to use cloud-based tools and thus learn more easily, practically, effectively and interactively, partners created 52 interdisciplinary projects ready for implementation in learning environments of schools across Europe. These ready-to-use projects encompass teaching scenarios and all needed learning materials for students, which makes them very practical for teachers and students.

Materials are available in four different languages – Bulgarian, Croatian, English and French in an open-source online repository which allows previewing and downloading materials on the official project website – https://www.kidsinclouds.eu/digital-learning-materials-for-children/ Materials enable students (and their teachers) to work on different interdisciplinary projects covering wide range of subjects - Mathematics, Science, History, Geography, Literacy, Art, Music and many other interdisciplinary topics. Materials are prepared in a way to stimulate students' usage of cloud tools and embrace project-based learning. Finally, the aim of the next project phase (Intellectual Output 5) was to test these materials with students.

3. Pilot aim and methodology

3.1. The aim of the pilot process

The aim of the pilot process was to test the digital learning materials for children developed in the Intellectual Output 4 in encounters with the different target groups (students of different age and interests) and in different local, regional and national environments. The data about the effectiveness of learning during the pilot process was obtained.

After the pilot process and based on the obtained data, the following is established:

a) the results of the pilot process - evaluation of the pilot efficiency and success-rate of the produced digital educational materials for students

b) guidelines on pedagogical strategy for teachers, based on best practices of implementing the cloud-computing in teaching, noticed by pilot participants.

The main objective of the pilot process was twofold. On the one hand, it will support partners in their efforts in planning, implementing and evaluating innovative and efficient approaches in learning about the cloud. On the other hand, it will contribute to the popularization of the cloud as a tool among the wider audience of educators and students.

3.2. Institutions in which the pilot process was implemented

The pilot process was implemented in the following institutions:

- Secondary School St. St. Cyril and Methodius (Smolyan, Bulgaria)
- Primary School Horvati (Zagreb, Croatia)
- College Jules Reydellet (Reunion France)
- Ludina Primary School (Velika Ludina, Croatia).

Project partners mentioned above participated actively in the Intellectual Output 5 by running the pilot process in their own institutions. Algebra created the questionnaires for the evaluation of the results of the pilot process, supported other project partners, participated in the organizational activities as well as in analyzing the results and creating the final report.

3.3. Target groups of the pilot process

Teachers and students in the project partners' institutions were the ones who participated in the pilot process and tested created digital educational materials for children, which identifies them as target groups of the pilot process. Students were one target group because created digital educational materials are supposed to be used by students. On the other hand, teachers were the other target group because they led the teaching process during the pilot, provided guidance to the students, but also evaluated the whole process.

Each school which is partner in the project had to include a minimum of 10 students and 2 teachers in the pilot process. This way, project partners ensured including minimum of 40 students and 8 teachers in the pilot, in total.

3.4. Content of the pilot process

Digital educational materials for children were the content that was tested during the pilot process. Each of the 52 materials is prepared in a form of a document, published on the online repository, that encompass:

a) teaching scenario that enables teachers to implement interdisciplinary project-based learning with students, with detailed guidelines for conducting each activity

b) innovative learning objects that enable pupils to work on small-scale interdisciplinary projects using cloud-based tools only by opening provided link.

Digital educational materials show how to practically teach and learn with the help of cloud-based tools while working on interdisciplinary projects that tackle learning content and objectives related to Mathematics, Science, History, Geography, Literacy, Art, Music and many other interdisciplinary topics.

Before running the pilot, each institution studied the online repository with the materials in order to select the most suitable materials to be piloted, according to the interests and needs of the teachers and students included in the pilot process. Each school which is partner in the project had to test minimally 1 digital educational material for children during the pilot process. The reason behind this is the fact that each digital educational material is prepared in a way to work with students for 4 school hours, and sometimes even more.

3.5. Running the pilot process

Each school which is partner in the project organized running the pilot internally according to the following guidelines:

- pilot process had to be conducted face-to-face
- pilot process could be organized as an extra-curricular activity (it was not obligatory to include the pilot into institution's regular curricula
- pilot process had to be fully conducted, meaning that pilot process in each institution lasted minimally 4 school hours (all at once or it could be split into several days).

The pilot process participants had to carry out all following steps:

- conducting the survey before the pilot process
- testing the digital educational materials for students
- conducting the survey after the pilot process.

COVID-19 restrictions were favorable during the pilot process implementation, which was positive and enabled face-to-face piloting.

4. Results of the survey conducted before the pilot process

When it comes to splitting the responsibility for each task within Intellectual Output 5, Algebra prepared questions for the online survey in English and project partners translated them to their national languages. Afterwards, Algebra created online questionnaires in Bulgarian, Croatian and French using the Google Forms and pilot managers in each school were in charge of distributing the questionnaire to the teachers who participated in the pilot. All teachers had to fill in the questionnaire before testing the digital educational materials with students.

The aim of this questionnaire was to investigate the teachers' tendency to use digital technology and cloud-computing in teaching before the pilot process, as well as to find out how often they teach using the interdisciplinary and project-based approach. Additionally, aim of the questionnaire filled-in before the pilot process was to find out how often students use digital technology and tools independently during the lessons and after class (at home) for the purpose of learning and/or solving individual tasks/projects. This is why the questionnaire was specially designed to be filled-in by the teachers but in the same time to gather information about both teachers' and students' usual *modus operandi*.

In total, 11 teachers and 186 students from Bulgaria, Croatia and France participated in the pilot process. When it comes to the specific subjects that teachers teach – 1 pilot participant is a History teacher, 1 is an ICT teacher, 1 is Biology teacher, 1 of them teaches Bulgarian language, 1 teaches Croatian language, 3 of them teach Mathematics and 3 of them teach Foreign language (English).

Teachers who participated in the pilot were asked to estimate how often do they teach using the interdisciplinary approach. Minority of the teachers (10 %) pointed out that they teach this way very often. It can be concluded that majority of the teachers use interdisciplinary approach often (27 %) and sometimes (27 %) during their teaching (Figure 1).

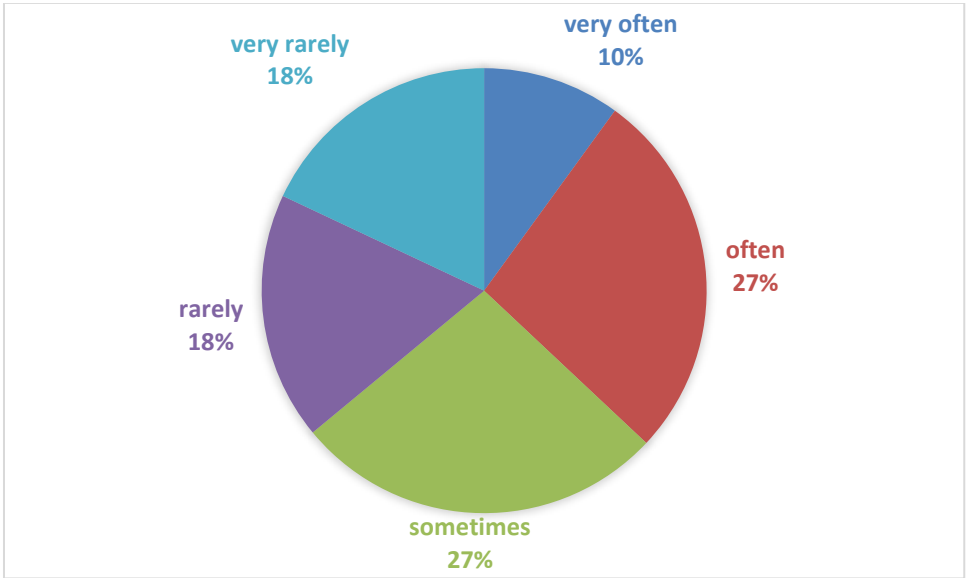

Figure 1. Frequency of pilot participants' teaching based on the interdisciplinary approach

Furthermore, teachers were asked how often they conduct project-based learning with students. As it can be seen from Figure 2, majority of teachers (65 %) use this way of teaching sometimes – meaning, nor often nor rarely.

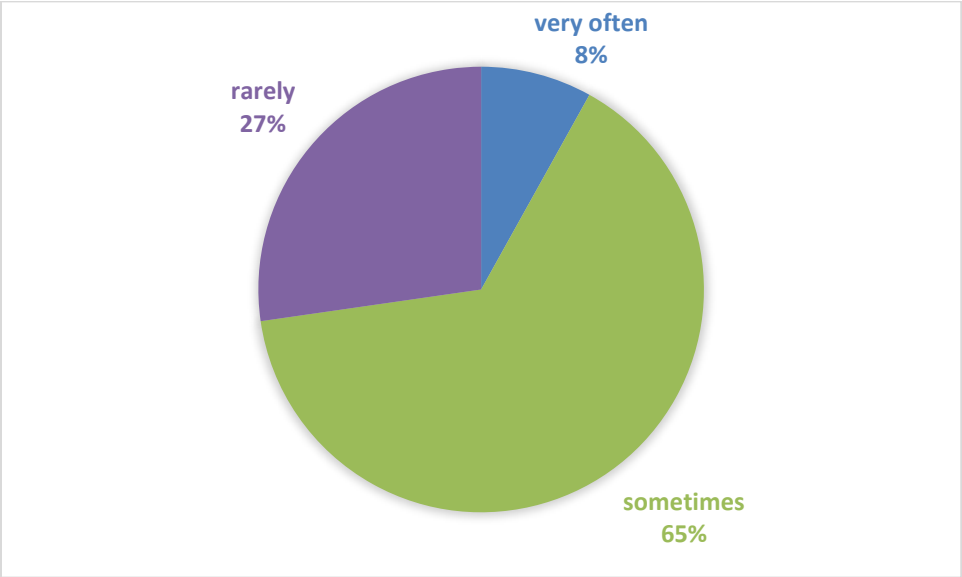

Figure 2. Frequency of pilot participants' teaching based on project-based learning

The reason for questioning frequency of teaching relying on the interdisciplinary approach and project-based learning is the fact that digital educational materials, which were tested during the pilot process, follow these pedagogical methods. So, initial intention was to examine whether teachers usually teach this way in order to compare these results with the ones we acquired from the survey conducted after the pilot process.

On a scale from 1 to 5, majority of the teachers estimated their own digital skills and computer literacy with grade 4 (55 %). In addition, 27 % of them estimate their described knowledge with grade 5, and 18 % with a grade 3. None of them graded their digital skills and computer literacy with grades 2 and 1.

In order to examine students' habits, ways of learning and frequency of using digital technology and tools for the purpose of learning and/or solving individual tasks/projects, teachers who participated in the pilot were asked to assess how students learn during the lessons and at home. From the questionnaire results (Figure 3) it can be concluded that so far students did not use digital technology and tools very often in order to acquire new knowledge and skills, but they rather use them occasionally. When comparing learning environments in school (during the lessons) and at home, it can be concluded that students use digital technology and tools for the learning purposes more often when they are in school (during lessons) than at home. Reasons to this may vary – from different socio-economic status of the students and IT equipment that they have at home to different motivation level at school and at home. Nevertheless, this reveals that schools are great environment for further promotion of using digital technology and tools among students as well as great opportunity for students to embrace new learning habits.

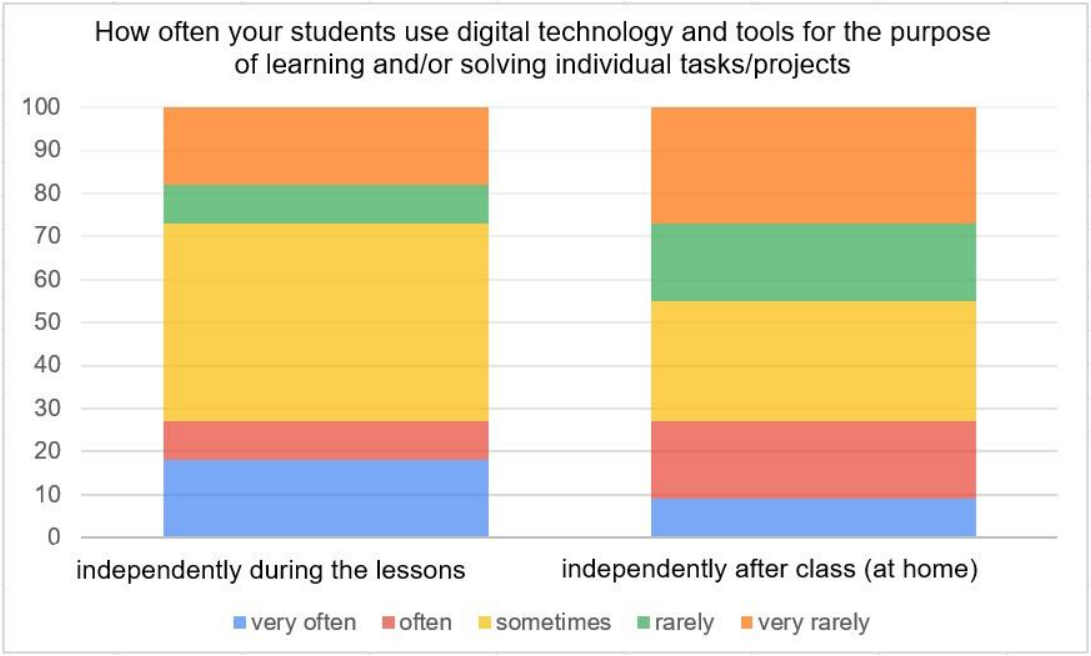

Figure 3. Pilot participants' estimation of frequency of students' usage of digital technology and tools for the purpose of learning and/or solving individual tasks/projects

Finally, before running the pilot, teachers were asked to estimate the extent to which they agree with different statements about using digital technologies and tools in teaching (Figure 4).

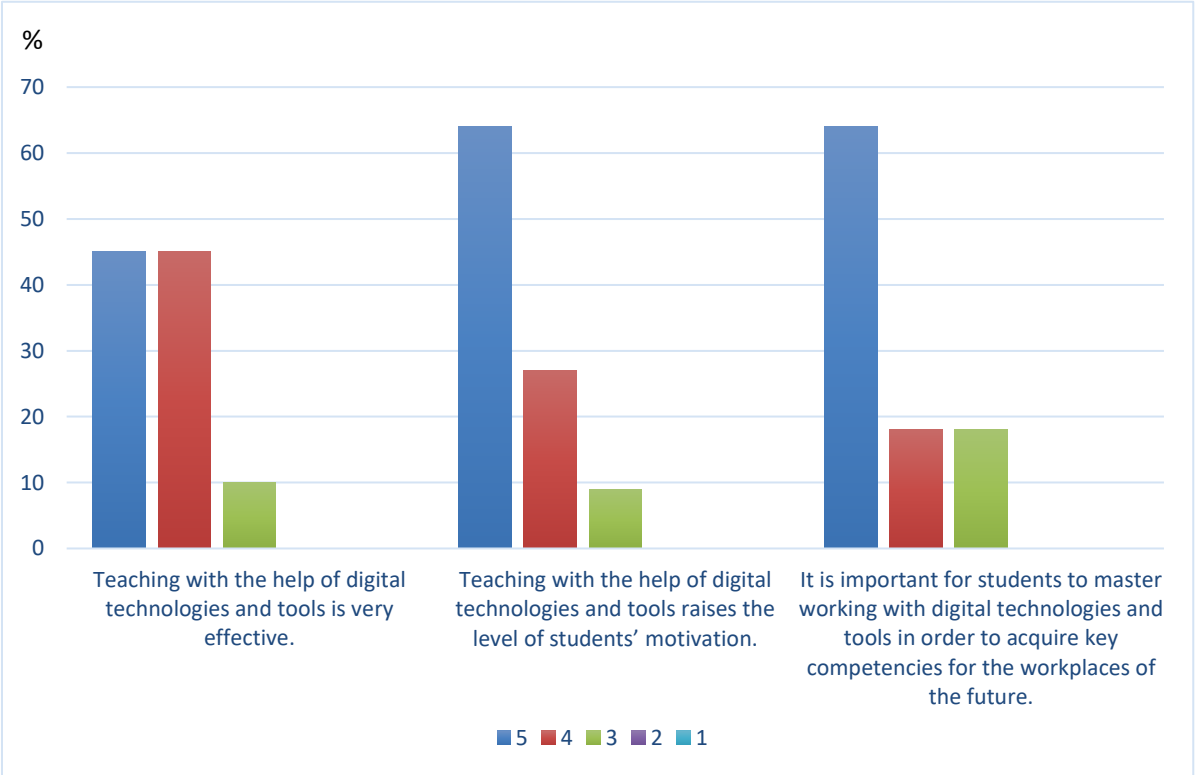

Figure 4. Extent (1-5) to which pilot participants agreed with certain statements before the pilot

According to questionnaire results, teachers strongly agree (45 %) or agree (45 %) that teaching with the help of digital technologies and tools is very effective. Additionally, majority of the teachers (64 %) strongly agrees with the statement that teaching with the help of digital technologies and tools raises the level of students' motivation. Also, majority of the teachers (64 %) strongly agrees with the idea that it is important for students to master working with digital technologies and tools in order to acquire key competencies for the workplaces of the future. It is very indicative that none of the teachers pointed out that disagrees with these three statements. Based on that, it can be concluded that teachers who participated in the pilot were already aware of the possibilities that digital technologies and tools could bring to education and learning process, even before their participation in the pilot process. Nevertheless, it was important to examine this because it shows teachers' motivation for promoting the usage of digital technology in teaching, which is respectively higher than the average one. In addition, these results will be compared to the ones acquired from the survey conducted after the pilot process.

In conclusion, results of the survey conducted before the pilot process revealed few crucial prerequisites for meaningful implementation of the pilot process:

Situations before the pilot	Possibilities that pilot can bring
Teachers who participated in the pilot did not teach very often based on interdisciplinary approach and project-based learning before the pilot process.	This opens up the possibility for teachers to embrace new pedagogical strategies after the pilot process.
Majority of the teachers who participated in the pilot estimated their digital skills and computer literacy higher than average.	This means that, when it comes to ICT, teachers are skilled enough to guide students and help them learn using different digital technologies and tools and thus effectively coordinate pilot process as well as show value of ICT in learning process to students.
Students who participated in the pilot use digital technology and tools for the learning purposes more often when they are in school (during lessons) than at home.	This shows that schools are great environment for further promotion of using digital technology and tools among students as well as great opportunity for students to embrace new learning habits.

5. Conducting the pilot process

5.1. Secondary School St. St. Cyril and Methodius

In the Secondary School St. St. Cyril and Methodius, the pilot process was conducted from 10th October – 15th October 2022. The pilot manager was teacher Nadya Stankova, member of the *Kids in Clouds* project team, who ensured proper implementation of all steps which were defined as mandatory within the pilot process.

The following teachers[1] participated in the pilot process:

- Teacher 1 – Bulgarian Language and Literature teacher
- Teacher 2 – English Language teacher
- Teacher 3 – Mathematics teacher

The following digital learning material for children was tested during the pilot process (with its link to access on the online repository):

- Live Geometry_BG
- https://www.kidsinclouds.eu/wp-content/uploads/2022/09/Live-Geometry_BG.pdf

To the activity of testing created digital learning materials for children, Secondary School St. St. Cyril and Methodius involved 50 students. The students aged 12-13 years and, according to the teachers' testimonies, are usually interested in using digital technologies and they like to use cloud-tools. This is why students were more motivated and well engaged in the pilot process. Additionally, teachers who participated in the pilot noticed that students worked very well in teams when they were using digital and cloud tools during the lessons.

5.2. Primary School Horvati

In the Primary School Horvati, the pilot process was conducted from 5th October – 11th October 2022. The pilot manager was teacher Suzana Delić, member of the *Kids in Clouds* project team, who ensured proper implementation of all steps which were defined as mandatory within the pilot process.

The following teachers[1] participated in the pilot process:

- Teacher 1 – Croatian Language and Literature teacher
- Teacher 2 – Mathematics teacher

[1] Names of the teachers are gathered and stored by Project Coordinator, but are removed from this document in respect with the GDPR provisions.

The following digital learning materials for children was tested during the pilot process (with its link to access on the online repository):

- United in diversity_CRO
- https://www.kidsinclouds.eu/wp-content/uploads/2022/09/United-in-diversity_CRO.pdf

- Nature Love_CRO
- https://www.kidsinclouds.eu/wp-content/uploads/2022/09/Nature-Love_CRO-2.pdf

To the activity of testing created digital learning materials for children, Primary School Horvati involved 70 students – 38 of them aging 13-14 years and 32 of them aging 11-12 years. According to the teachers' testimonies, almost all students were extremely interested in using technology and they believe that it is very applicable to use it for educational purposes as well. As a consequence of Covid-19 pandemic and online classes, students are very familiar with the use of technology during their lessons. However, thanks to the pilot students found out about some new interesting tools. Additionally, teachers pointed out that students found very interesting working on interdisciplinary projects and that this raised their motivation.

5.3. College Jules Reydellet

In the College Jules Reydellet, the pilot process was conducted from 23rd September – 10th October 2022. The pilot manager was teacher Audrey Wikinson, member of the *Kids in Clouds* project team, who ensured proper implementation of all steps which were defined as mandatory within the pilot process.

The following teachers[2] participated in the pilot process:

- Teacher 1 – English Language teacher
- Teacher 2 – English Language teacher
- Teacher 3 – Biology teacher

The following digital learning material for children was tested during the pilot process (with its link to access on the online repository):

- Eat well, live well_FR
- https://www.kidsinclouds.eu/wp-content/uploads/2022/09/Eat-well-live-well_FR.pdf

To the activity of testing created digital learning material for children, College Jules Reydellet involved 52 students. The students aged 12-13 years and, according to the teachers' testimonies, they were very interested and motivated in using digital technologies. Very important fact about the students' group is that majority of them had never used cloud tools before the pilot process.

[2] Names of the teachers are gathered and stored by Project Coordinator, but are removed from this document in respect with the GDPR provisions.

However, students embraced them very quickly and they also reacted very positively to the interdisciplinary approach – it made learning fun for them.

5.4. Ludina Primary School

In the Ludina Primary School, the pilot process was conducted on 12th October 2022. The pilot manager was the principal Tomislav Pavlović, member of the *Kids in Clouds* project team, who ensured proper implementation of all steps which were defined as mandatory within the pilot process.

The following teachers[3] participated in the pilot process:

- Teacher 1 – Mathematics teacher
- Teacher 2 – IT teacher
- Teacher 3 – Croatian Language and Literature teacher
- Teacher 4 – History teacher

The following digital learning material for children was tested during the pilot process (with its link to access on the online repository):

- From Ford to Tesla_CRO
- https://www.kidsinclouds.eu/wp-content/uploads/2022/09/From-Ford-to-Tesla_CRO.pdf

To the activity of testing created digital learning material for children, Ludina Primary School involved 14 students. The students aged 13-14 years and, according to the teachers' testimonies, they all often use digital technology in school and in their free time. All students who have participated in the pilot process attend optional Informatics classes. They are familiar with a lot of cloud tools which they use in their regular classes, such as Mathematics, Croatian language, History etc.

Students were quite interested in participation in the pilot process. They liked using different cloud tools and doing different learning activities. The students reacted very well to a slightly different approach to teaching in the form of project activities. They were more motivated to work than in regular classes. The students used historical sources and analysed texts with increased interest. They were happy to present their work to other students. While filling in the poll on using modern technology they commented on what they could not live without and compared their answers. They also felt encouraged to discuss about fuel consumption and its environmental influence, which shows that pilot positively affected their critical thinking about contemporary global issues.

[3] Names of the teachers are gathered and stored by Project Coordinator, but are removed from this document in respect with the GDPR provisions.

6. Results of the survey conducted after the pilot process

When it comes to splitting the responsibility for each task within Intellectual Output 5, Algebra prepared questions for the online survey in English and project partners translated them to their national languages. Afterwards, Algebra created online questionnaires in Bulgarian, Croatian and French using the Google Forms and pilot managers in each school were in charge of distributing the questionnaire to the teachers who participated in the pilot. All teachers had to fill in the questionnaire after testing the digital educational materials with students.

The aim of this questionnaire was to investigate the participants' opinion about the quality of the tested materials and to assess the user experience of the online repository. Additionally, participants were asked if pilot process made them think about embracing new pedagogical strategies and teaching methods. Additionally, since the questionnaire was specially designed to be filled-in by the teachers but in the same time to gather information about both teachers' and students' *modus operandi*, the aim was to find out more about students' reactions to using cloud tools during learning process. As stated before, 11 teachers and 186 students from Bulgaria, Croatia and France participated in the pilot process.

6.1. Teachers' evaluation of the pilot process

After filling in the survey before the pilot process, teachers in each school have chosen the digital educational material for children which they tested with their students in the following days. Since created digital educational materials encompass teaching scenarios (for teachers) and many learning objects in cloud tools (for students), teachers and students had all materials necessary for teaching as well as for acquiring a certain set of skills on particular interdisciplinary project topic. Once they finished teaching and working with students as part of the pilot process, teachers filled in the online survey.

In the first part of the survey teachers evaluated their overall impression of the materials which they have tested with students, answering on a set of questions that asked them to indicate to what extent they agree with particular statements. Teachers expressed their opinions with the help of 1 – 5 scale, where 1 indicated strong disagreement and 5 strong agreement with the statement.

For the start, teachers who participated in the pilot were asked to evaluate the practicality of the digital educational materials that they tested with students. Majority of the teachers (55 %) strongly agrees with the statement that the repository with educational materials is easy to use. In general, online repository contains all created digital educational materials for students, divided by languages. Each material has its name, and clicking on the particular link – each document opens. Project partners' idea was to create easy-to-use repository and results of the survey shows that this intention was accomplished. Since materials encompass teaching scenarios which describe all students' and teachers' activities in detail, teachers were asked if the materials intended to help teachers during the implementation of classes are practical. Majority of the teachers (64 %) finds these supporting materials for teachers very practical (Figure 5).

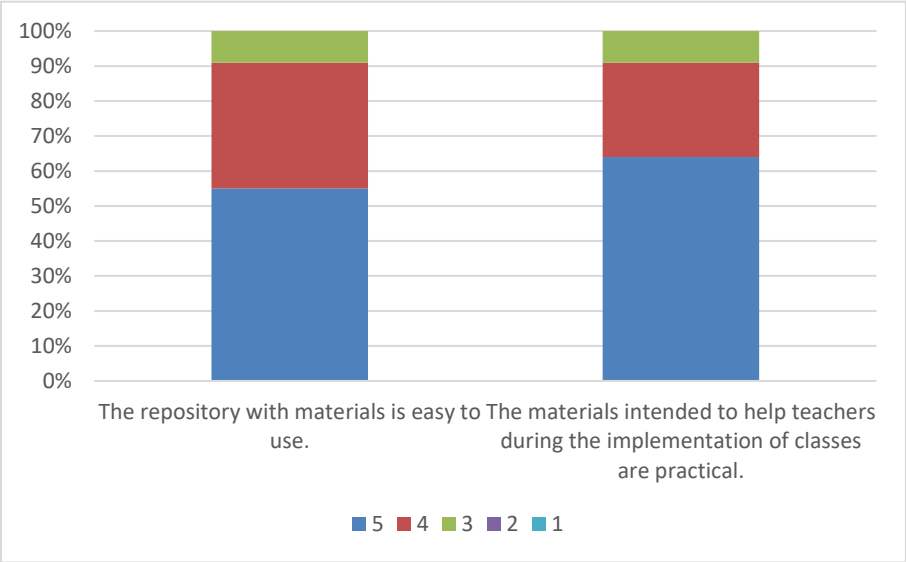

Figure 5. Pilot participants' evaluation of the practicality of the educational materials 1

Furthermore, since teaching scenarios have to guide teachers and navigate them through learning content and teaching process, teachers who participated in the pilot were asked to evaluate if created materials intended to help teachers during the implementation of classes are well structured. Majority of the teachers (64 %) strongly supports the thought that materials are well structured (Figure 6). Once user enters the online repository with created materials, options of previewing and downloading the document with all materials are offered. Inside that document, beside the teaching scenario, many links on prepared learning object for students can be found. Learning objects are accessible only by clicking on the particular link. Majority of the teachers who participated in the pilot (64 %) finds this user process very easy-to-use and practical for students (Figure 6).

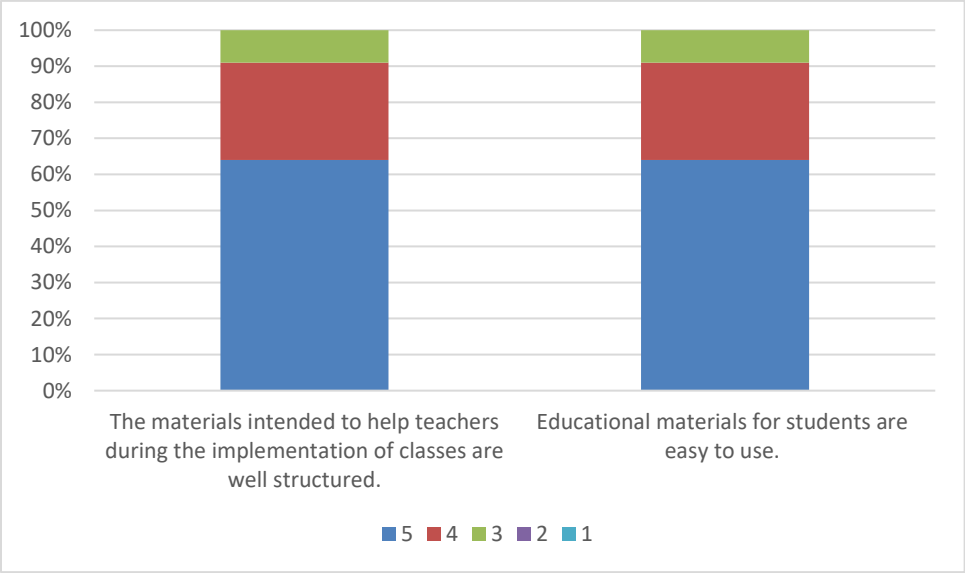

Figure 6. Pilot participants' evaluation of the practicality of the educational materials 2

As seen from the Figure 7, majority of teachers (82 %) who tested educational materials with their students, pointed out that tested educational materials enable students to acquire relevant knowledge and skills. Furthermore, 91 % of the teachers strongly agreed with the statement that educational materials encourage students to use digital technology and tools. It can be concluded from these survey results that educational materials for students created as part of the project strongly support students on their learning paths but also that push students towards more frequent usage of digital tools and technology.

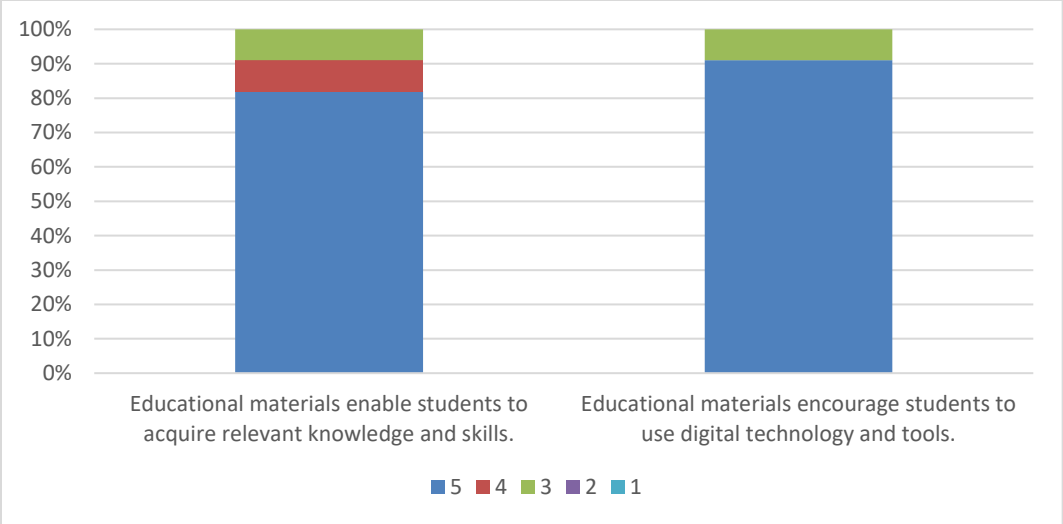

Figure 7. Pilot participants' evaluation of pedagogical potential of the educational materials 1

In addition, teachers who participated in the pilot were asked to evaluate certain methodical strategies used during pilot (Figure 8). As pointed out previously, pilot process was conducted by implementing an interdisciplinary approach and project-based learning to teaching process because created educational materials were designed in a way to stimulate these methodical strategies. It can be concluded that majority of the teachers (82 %) think that interdisciplinary approach to learning has a positive effect on the development of students' critical thinking.

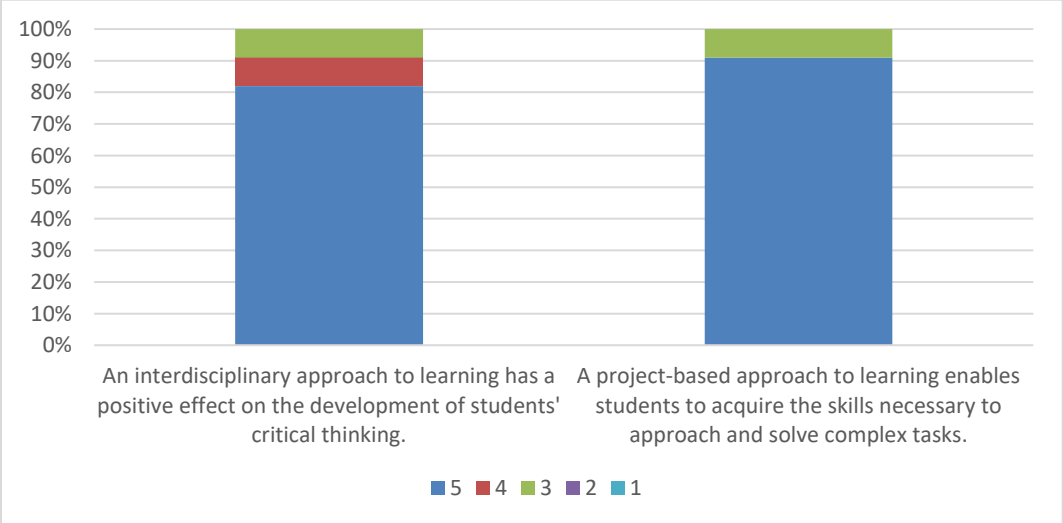

Figure 8. Pilot participants' evaluation of methodical strategies used during pilot

Following to that, majority of the teachers (91 %) pointed out that they strongly agree that project-based approach to learning enables students to acquire the skills necessary to approach and solve complex tasks (Figure 8).

Moreover, teachers who participated in the pilot were asked about their point of view when it comes to embracing new teaching methods in their teaching. It is very significant that 82 % of the teachers strongly agreed that they have expanded their knowledge about possibilities of using digital tools in teaching by testing the materials with students. Also, 91 % of the teachers pointed out that testing the materials with students encouraged them to introduce new methods of teaching and working with students from now on (Figure 9).

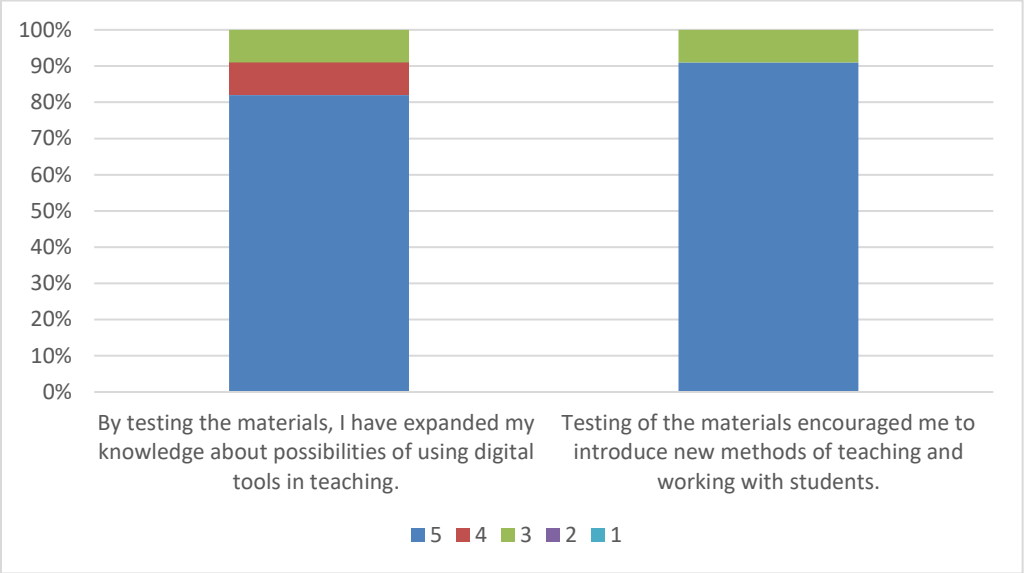

Figure 9. Pilot participants' points of view about implementing new teaching methods in teaching

In order to examine the level to which teachers have been influenced by the pilot process, they answered on a set of questions related to acquiring pedagogical strategies used during pilot in their future lessons (Figure 10).

Firstly, majority of teachers (91 %) pointed out that they will encourage students to use digital tools during classes very often in the future. From this data it can be concluded that teachers were satisfied with the dynamic of the teaching and learning process that included and stimulated students' usage of digital tools, because majority of them are very inclined to teach this way in future. Secondly, teachers were asked whether they will teach using an interdisciplinary approach in the future. The results of the questionnaire showed that 55 % of the teachers will teach this way very often in the future, 36 % of them often and 9 % of them sometimes. Even though results of the survey showed that majority of the teachers (82 %) think that interdisciplinary approach to learning has a positive effect on the development of students' critical thinking, they are not so determined to teach this way very often in the future. The explanation to this may be found in the fact that interdisciplinary approach usually requires additional preparation work from the teachers (because sometimes this means that teachers will have to teach about topics beyond their core knowledge), cooperating with teachers of different subjects (which has to be organized)

and last but maybe the most important – minority of national curricula support this way of teaching, which means that implementing interdisciplinary teaching on a regular basis would require structural educational changes. Having said that, it can be concluded that it is very praiseworthy that more than half of the teachers who participated in the pilot would still teach using the interdisciplinary approach very often in the future, despite all the aggravating circumstances. The similar situation is with the project-based teaching – 55 % of the teachers pointed out that they will teach this way in future very often and 45 % often. It can be concluded that participation in this pilot shifted teachers a step closer to implementing new and different pedagogical strategies to their everyday teaching.

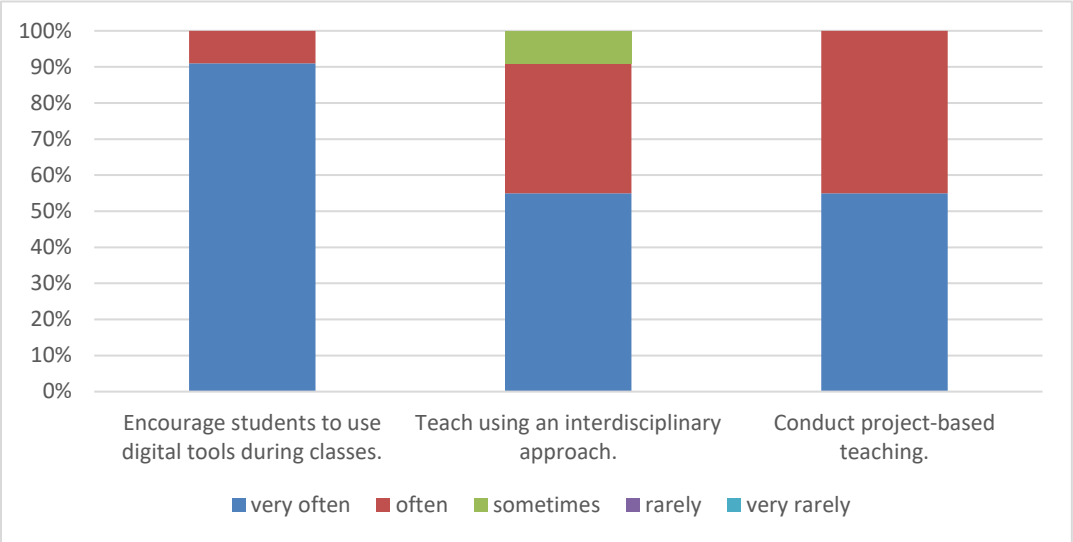

Figure 10. Pilot participants' points of view about implementing pedagogical strategies used during pilot in their future lessons

Finally, after running the pilot, teachers were asked to estimate the extent to which they agree with different statements about using digital technologies and tools in teaching (Figure 11).

According to questionnaire results, teachers strongly agree (82 %) or agree (18 %) that teaching with the help of digital technologies and tools is very effective. Additionally, majority of the teachers (91 %) strongly agrees with the statement that teaching with the help of digital technologies and tools raises the level of students' motivation. Also, majority of the teachers (73 %) strongly agrees with the idea that it is important for students to master working with digital technologies and tools in order to acquire key competencies for the workplaces of the future. It is very indicative that these results show that teachers who participated in the pilot support using digital technologies and tools in teaching even more after they went through the pilot process with their students. Results of the questionnaire before the pilot also showed that teachers were aware of the potential of using digital technologies in teaching. Nevertheless, after teaching their students about some interdisciplinary topics that implied project-based learning and using digital and cloud-based tools, teacher support digitalization of the education process even more.

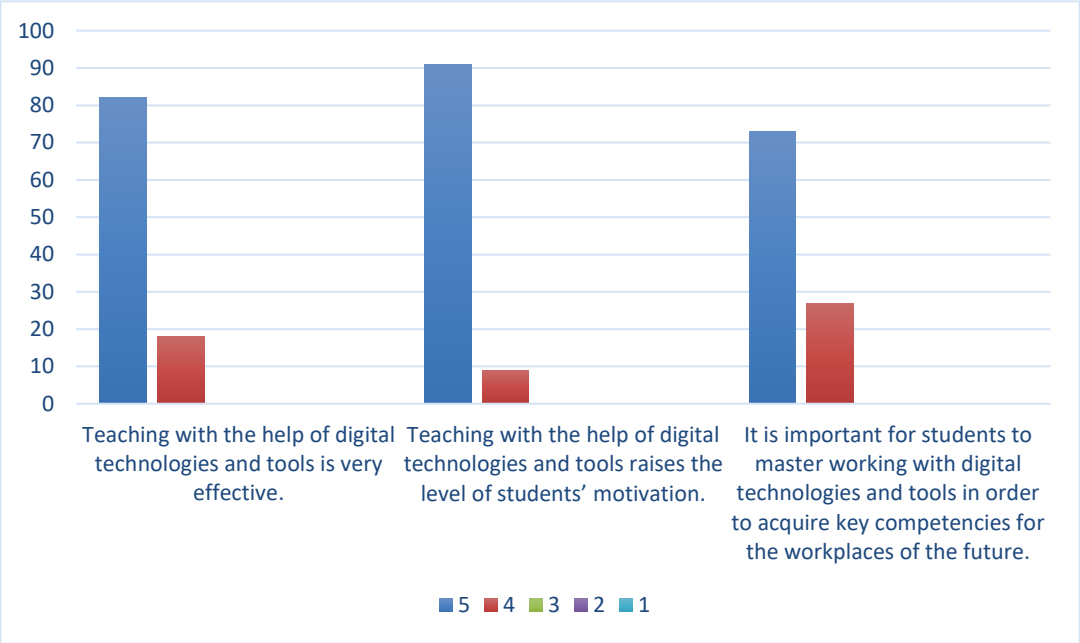

Figure 11. Extent (1-5) to which pilot participants agreed with certain statements after the pilot

6.2. Students' evaluation of the pilot process

As pointed out earlier, the survey was specially designed to be filled-in by the teachers but in the same time to gather information about both teachers' and students' *modus operandi* during the pilot process. The aim of this was to find out more about students' reactions to using cloud tools during learning process, level of their motivation and overall impression of the pilot.

Students' reactions regarding the frequent use of digital tools during the pilot process were examined. In the survey, teachers were asked to assess how students coped with using the tools, what was the level of their motivation for learning and how they reacted to such a way of learning. From the teachers' statements below, it can be concluded that students were more motivated to learn when digital tools got their lessons more interactive and that hey managed well with using digital and cloud tools:

- Students were more motivated to work. Some of them independently researched other tools to complete the tasks.
- The students sometimes did better with the use of digital tools than I did. When I did not know what to click, they already said what I needed to do and were happy to learn and help.
- Students reacted positively to working with digital tools. Additionally, working in groups enabled students who had some difficulties with using new tools to master the new tool and complete tasks with the help of other students.
- They found it interesting, instructive and different from the usual.

- Students are familiar with digital tools. They find them intuitive and easy to use. Learning in a digital environment motivates them, they adopt and learn new things more easily. Learning this way is a pleasure for them!
- I noticed better students' confidence while learning with the help of digital and cloud tools and their interest really increased.

Moreover, teachers were asked to briefly describe how motivated and active the students were during the implementation of interdisciplinary project-based learning and how intensively the students acquired knowledge while learning this way. From the teachers' statements below, it can be concluded that thanks to the interdisciplinary project-based learning, students were engaged in the learning process more than usually and consequently acquired more knowledge than usually:

- Project-based teaching is great – students were more motivated than in regular classes because there was no classic division into subjects, but different and interesting activities were carried out.
- Students were more engaged in learning about all the content while working on interdisciplinary topics because they found some crucial information or topic, important to today's society in almost all discussed topics. It really made them to think critically and discuss their thoughts.
- The students were very motivated and interested in the presented topic. The acquisition of knowledge was very intensive because it happened through research and work on practical tasks that students perform themselves.
- Students were more active during the learning process, effectively acquired new knowledge, had fun and applied what they have learned.
- Specially interesting fact is that, unlike usually, each of the student was engaged and actively working during lessons.
- In general, the students all adhered to the interdisciplinary project. They were very pleased to see that what they learned in one subject was useful for another subject, and that motivated them a lot. I am sure they learned a lot more, and better, with this approach.
- Thanks to the interdisciplinary crossing of knowledge, the students seem to have acquired the knowledge better. All the students were active and worked.
- The students liked the interdisciplinary aspect, I think it motivated them. The use of the digital tools made them participate more, they were more active. The knowledge was acquired in a very satisfactory way.

Finally, teachers were asked to share some of their overall impressions related to the implementation of an interdisciplinary project with students using many digital tools:

- This was an excellent approach to different problems because it is much better to teach through interdisciplinary projects than through classes divided by subjects – students' reactions showed.
- Team work and work on informative texts in learning objects prepared in cloud-tools had an extremely positive impact on the development of students' reading literacy. In addition, the tasks led them to strengthen their self-confidence during public presentations of acquired knowledge and to cooperate during their research tasks.
- I think that the implementation of the project during the pilot was very interesting for the students, but also for the teachers who implemented the activities. Certain activities required more time for teachers, primarily familiarization with certain tools so that students can successfully complete all tasks within the stipulated time. In the end, it was worth it.
- Lessons become more interesting to students. Using digital tools made the learning process more fun for students, and finally they acquired new knowledge more easily.
- It was very interesting and motivating for the teachers as well as for the students. Since we used many cloud tools, the student did not get bored and they got the chance to discovers other skills. Different digital tools are also very interesting in terms of providing a feedback for students. On the other hand, it is very time-consuming when neither the teacher nor the students mastered these tools, and it is therefore necessary to ensure solid training beforehand.
- Very positive experience – we plan to repeat it and gradually integrate this way of teaching/learning throughout the whole school year in order to improve my teaching and increase the motivation and skills of the students.
- The diversity of digital tools has enabled a greater number of students to find what they are looking for. Indeed, some tools were more intuitive than others, or more creative.

In conclusion, results of the survey conducted after the pilot process revealed few crucial conclusions related to:

- quality of tested digital educational materials for children
- possibilities for changing pedagogical strategies and enriching teaching methods with the use of digital (cloud) tools and conducting project-based interdisciplinary teaching process

Identified possibilities that meaningful pilot could bring	Pilot participants' attitudes after the pilot process
Teachers who participated in the pilot did not teach very often based on interdisciplinary approach and project-based learning before the pilot process. This opened up the possibility for teachers to embrace new pedagogical strategies after the pilot process.	As shown from the survey results and their comparison (before and after the pilot), teachers who participated in the pilot were encouraged to embrace new pedagogical strategies in future, thanks to the pilot process.
Majority of the teachers who participated in the pilot estimated their digital skills and computer literacy higher than average. This means that, when it comes to ICT, teachers were skilled enough to guide students and help them learn using different digital technologies and tools and thus effectively coordinate pilot process as well as show value of ICT in learning process to students.	Since pilot process was conducted without any obstacles noted, specially when it comes to using ICT, it can be concluded that teachers managed to guide students while they were using digital tools. Moreover, teachers pointed out that working in teams allowed skilled students to help their colleagues who were struggling with managing digital tools. This is a very good pilot outcome because developing team-work skills is crucial for students' future.
Students who participated in the pilot use digital technology and tools for the learning purposes more often when they are in school (during lessons) than at home. This shows that schools are great environment for further promotion of using digital technology and tools among students as well as great opportunity for students to embrace new learning habits.	Many teachers during the evaluation phase of the pilot pointed out that they will strive to adapt current teaching methods in their schools and bring some innovations in future by promoting project-based learning, interdisciplinary approach and using digital technologies. This might help with innovating teaching practice and current school curricula as well as with helping students to embrace new learning habits.

7. Guidelines on pedagogical strategy for teachers

Based on the pilot process results and best practices noticed during implementation of the cloud-computing in teaching by pilot participants, guidelines on pedagogical strategy for teachers were created.

Majority of the cloud-based tools are easy to use and can be used on any computer, tablet or phone. Furthermore, majority of the cloud-based tools are free (at least to a certain extent), which makes it simple, practical and free way to innovate your teaching.

Familiarise yourself with the cloud tools and their functionalities - make sure you can handle them before using them in class.

Once you will have a clear picture on what certain cloud tools can bring to your teaching, choosing the appropriate one(s) for your lesson. Two basic cloud tools functionalities are: visualisation of the teaching content and bringing interactivity to your lesson. Choose among these or combine them for achieving the best outcome.

If you are only starting to bring digital technology to your lessons, try with integrating digital and cloud tools into your traditional teaching methods. Try to implement using digital tools partially to your lessons and check what this brings to you and your students. You can always upgrade afterwards, based on your students' feedback.

If your students are not very skilled with using digital technology, give them enough time to familiarize themselves with the tools before using them very intensively and regularly. Otherwise the students will be more focused on the tool instead of on the learning process. Therefore, try this approach step-by-step, try with using very few tools and bring it to another level only after your students will be ready. This process might affect positively on your students' confidence, because students are well aware when they master doing something new and interesting.

Once your students get to know how to learn with the help of digital technology and tools, it will be very important to find perfect balance for your students. Cloud tools are fun, but you are using them in teaching in order to help students learn and acquire skills. The right balance for using digital and cloud tools in lessons must be found to make sure teachers and students are still focusing on the teaching/learning process.

Cloud tools can be used at different phases of your lesson – in planning, in teaching as well as in evaluating students' assignments and providing feedback. If you are not using cloud tools for any of these purposes, it might look like you would lose a lot of time in order to start doing it now. Actually, it would be investment of your time and effort. Many cloud tools offer the possibility of copying, sharing and collaborating on content. This means that you would easily

convert your materials once you prepare them or you could use some materials created by any other teacher worldwide. You could also find your motivation for creating the content only by checking already available content in cloud tool's libraries. That is a whole new perspective when you put it that way.

If you decide that your students will use cloud tools during the lesson, many opportunities arise. Besides using the tools on their own, students can be part of the team - divide students in small groups. This way you will enable them to work on particular activity with their colleagues and in the same time: acquire knowledge related to the lesson, become more skilled in using ICT as well as develop their team-work and communication skills.

You might not expect that ICT and using cloud tools in teaching could help students with particular tasks such as developing reading literacy and interpreting information. However, if presented in an appealing way, students might be more interested in reading some text and interactive quizzes or worksheets might be helpful with interpreting specific information and considering their meaning. Digital tools can also help students in searching for data, analysing and presenting it. This way, majority of teaching content can be tackled by students – individually, in teams, in school, at home, as part of regular classes, project-learning or an extracurricular activity.

By using the cloud tools, your students can recognize the value of displaying data graphically and presenting information visually. It is a reasonable assumption that majority of your students will have to present their ideas and work in their future jobs. Therefore, it would be very useful for them to start building their skills related to preparing their presentations but also with presenting their work with the help of different tools.

Giving feedback to the students about their acquired knowledge is very important part of the teaching process. However, teachers often struggle to get feedback on their teaching in order to know how effective the teaching process was and how students managed during the lesson. Cloud tools can be very helpful with this – not only that you can grade your students but you can set up different polls and quizzes and examine different aspects of your teaching.

Finally, teachers often struggle with raising students' motivation for participating in the lesson and overall learning process. Since ICT is all around us and students use it on a daily basis (and it can be expected that they will use it more and more in future) it might be a solution to start using cloud tools more often in order to raise students' motivation.