



Kids in Clouds project

Intellectual Output 1: Gap analysis Report

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Introduction

In order to investigate the use of cloud-based services in schools today, project partners created and distributed an on-line questionnaire for teachers. 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.

As a final result, report on Intellectual Output 1 of the *Kids in Clouds* project contains:

- a) general information about cloud-based services
- b) gap analysis: the use of cloud-based services in schools today vs. the possibilities of the technology in general
- c) conclusions for further project activities based on the gap analysis conclusions.

1. Cloud-based services

1.1. General characteristics of cloud-based services

Cloud-based services are infrastructure, platforms or software that are hosted by third-party providers and made available to users through the internet. Cloud services include a wide range of services delivered on demand to companies and customers over the internet. These services are designed to provide easy and affordable access to applications and resources, without the need for internal infrastructure or hardware. The companies that offer these computing services are called cloud service providers.

Before the inception of cloud-based services, businesses predominantly relied on the servers, databases, hardware, software, and other peripherals to take their businesses online. Companies had to buy these components to ensure that their website or applications reached the users. Besides, businesses also needed a team of experts to manage the hardware and software, and to monitor the infrastructure. While this approach was practical, it came with its unique issues, like the high cost of setup, complex components and limited storage space, to name a few.

Today, data is still predominately stored in hard drives of computers and servers (on-premise environment) which can store, process and retrieve a considerable amount of data quickly and conveniently. However, both hard drives and servers come with their limitations – with the rate at which today's businesses and industries are growing, the need for storage that can store and process increasingly more significant amounts of data is becoming a priority. This is the reason why cloud services are replacing on-premise solutions more and more.

A variety of organizations ranging from startups to government institutions are embracing cloud technology to create new apps and services, to store and back up data, for data recovery, for hosting websites and blogs, to stream audio and video, to deliver on-demand software services, to analyse data for patterns through the integration of advanced technologies as well as for making predictions.

Cloud services are fully managed by cloud service providers who provide users with the ability to store and retrieve data and run applications, managing them through configuration portals. This way cloud services are made available to users from the providers' servers, so there is no need for a company or user to host the applications on its own on-premises servers. Two of the best cloud providers available today are Amazon Web Services and Microsoft Azure.

Finally, the term *cloud services* refers to a wide range of services delivered on demand to companies and customers over the internet. These services are designed to provide easy and affordable access to applications and resources, without the need for internal infrastructure or hardware. Whether they are aware of it or not, most employees use cloud services throughout the workday, from checking email to collaborating on documents, because of the wide range of benefits of using cloud-based services.

1.2. Benefits of using cloud-based services

Key advantages of using cloud services include:

Better security

Ensuring that data is stored in a secure, durable place is one of the priorities for all businesses. The cloud provides highly secure storage for users' data, yet letting it be accessed anytime and anywhere that it is required. Also, data stored in the cloud is encrypted and secured so that it cannot be tampered with.

Speed

IT resources or services from the cloud are available almost instantaneously and ready for production virtually at the same time. This means that the products or services hit the market almost immediately.

Lowered costs

Many cloud services are provided on monthly or annual subscription basis, eliminating the need to pay for on-premises software licenses. This allows companies and users to access software, storage and other services without having to invest in the underlying infrastructure or handle maintenance and upgrades.

Scalability

Because the cloud service provider supplies all necessary infrastructure and software, there is no need for a user company to invest in its own resources or allocate an extra IT staff to manage the service. This, in return, makes it easy to scale the solution as user needs change – whether that means increasing the number of licenses to accommodate a growing work force or expanding and enhancing the applications themselves.

Accessibility

Cloud-based services allow the users to access the resources, data, services and applications as long as they are connected to the internet. So, to access all needed services and data the user only has to make sure that the internet connection is functioning. Even if the user is not connected to the internet, some tools and techniques will make it possible to access the cloud whenever needed.

Increased flexibility

With cloud services, the user can procure services on an on-demand, as-needed basis. If and when there is no longer a need for a particular application or platform, the user can simply cancel the subscription or shut down the service.



Mobility

Cloud services provide the possibility to work on the documents and data as well as storing them irrespective of their device. Documents and data are available because they are stored on a cloud or remote location. This also opens up possibilities for collaboration because it makes it easier to share information with others.

Disaster recovery

As the control is one of the factors that contributes to the success of a business, it is very important for a company to have a reliable disaster recovery strategy. Cloud-based services provide quick data recovery for all kinds of emergency scenarios from natural disasters to power outages.

1.3. Current use of cloud-based services

Today's computing landscape is witnessing a great transition. Many organizations and businesses are finding ways to migrate to the cloud for better storage opportunities, scalability and various other services that the cloud offers. According to the Statista, as a segment of IT services, cloud computing generated more than 300 billion U.S. dollars in revenue in 2020 and is showing very few signs of slowing down.

Eurostat conducts annual questionnaires on ICT usage in households and by individuals. One part of the research is the questionnaire on individuals who use cloud services. According to the Eurostat's research, in 2014 nearly one fifth (19 %) of individuals in the EU (27 countries) had used cloud services, meaning that they used internet storage space to save documents, pictures, music, video or other files. In 2019 this share increased to nearly one third (32 %) of individuals in the EU (27 countries) who had used cloud services in a described way.

In addition, Eurostat annually investigates ICT usage and e-commerce in small, medium and large enterprises. In 2014, 18 % of enterprises of all sizes in the EU (27 countries) had used cloud computing services, meaning that they had bought computing services used over the internet. In 2020 this share doubled – 36 % of enterprises of all sizes in the EU (27 countries) had used cloud computing services, the Eurostat's research brings up.

These researches show that the use of cloud services is continuously increasing, not only in business sector but also in households and by individuals. According to these trends, it is reasonable to assume that the usage of cloud-based services will continue to grow and that cloud services will continue with replacing the on-premises ICT solutions.

1.4. Importance of using cloud-based services

Based on the described Eurostat research it can be concluded that since cloud-based services started to replace on-premise solutions, its usage is constantly growing as well as the importance for business sector but also for individuals.

All key advantages of cloud-based services are equally important for business stakeholders as well as for individuals because everyone is seeking for simple but efficient ICT solutions. Cloud-based services allow individuals to run software programs without installing them on computers, to store and access multimedia content and to collaborate with other people much simpler.

Business stakeholders find cloud-based services not only cheaper and easier but also more reliable solutions for dealing with ICT challenges. According to Dell, companies that invest in big data, cloud, mobility and security enjoy up to 53 % faster revenue growth than their competitors. Moreover, 94 % of business stakeholders claimed that they saw an improvement in security after switching to the cloud and 91 % of them said that the cloud makes it easier to meet government compliance requirement.

Switching to the cloud enables business stakeholders to deal with ICT challenges much flexible, cheaper and more secure but the greater benefit of using cloud services for the companies is actually a faster revenue growth and mobility. In addition, through the cloud companies can offer conveniently accessible information to staff who travel and to freelance or remote employees. Therefore, it is not surprising that, according to Salesforce, organizations with employee satisfaction listed as a priority are up to 24 % more likely to expand cloud usage. Finally, cloud infrastructures support environmental proactivity, powering virtual services rather than physical products and hardware, cutting down on paper waste, improving energy efficiency and reducing commuter-related emissions (because employees can access data from anywhere with an internet connection).

In conclusion, cloud-based services are helping the society to cope with challenges such as managing big data, cyber-security and quality control but at the same time improving work-life balance and quality of life as well as making a positive impact on the environment.

1.5. Cloud-based services in education

Education sector could significantly benefit from using cloud-based services – by implementing them, it becomes possible to bring teachers and learners together on a single, unified platform. Educational organizations would not need to buy, own and maintain their own servers and data centres. Rather, they can leverage cloud computing to avail compute power, databases, storage and other services when they need them.

There are many major benefits of using cloud-based services in the field of education. With cloud-based software, it becomes possible for educational organizations to have virtual classrooms. The



concept reduces infrastructural costs to a considerable extent but also enables learners to learn from a teacher or an associate expert who teaches remotely. The potential of the cloud is unmatched when it comes to accessibility. Teachers and learners can easily access the course content, applications and data as well as to participate in group activities. Another benefit of using cloud-services in education are an extensive cost savings not only for providers (no need for owning the infrastructure) but also for learners who do not need to invest so much in printed materials which become outdated. Besides this, cloud computing also serves the benefit of secure data storing and matching growing number of users. Collaboration is much easier and brought to a new level while using cloud-based tools. Implementing cloud services in the field of education brings the opportunity for the teachers and learners to expand their horizons by changing the traditional learning methods.

So, using cloud-based services in the education sector enables improving the teaching process. Moreover, learners are engaged with cloud services which allows them to master its usage. Consequently, learners – who will be employees in the future, will successfully manage using various cloud-based services and tools which are increasingly used in the business sector.



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

2.1. The aim and the objective of the *Kids in Clouds* project

Before drafting the *Kids in Clouds* project, a desktop research was conducted and based on this research and trends described in the previous section, 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, adaptation of contents and methods according to envisaged needs of the target groups, creation of didactic tools and production and recommendations on innovative education approaches. 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 the 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 as early as possible to get acquainted and comfortable in the cloud-based eco-system, as this will be the environment they will live and work in already ten years from now.

2.2. The aim and preparation for the gap analysis

In order to create educational modules for teachers and students on cloud computing, it was firstly necessary to investigate the current usage of cloud-based services in schools but also if there are any issues and challenges which teachers and students encounter when approaching cloud services. So, the gap analysis was actually a starting point in the project because it investigated on to what extent are cloud-based services in use in schools at the moment. The method used to investigate it was an on-line questionnaire for teachers.



In order to properly prepare an on-line questionnaire, Algebra and project partners (College Jules Reydellet, Primary School Horvati, SU St. St. Cyril and Methodius and Ludina Primary School) had collected already existing secondary data as part of a secondary research and primary data as part of a primary research. The aim was to structure the questionnaire based on the teachers' and project partners' experiences as well as on information about using cloud services in the schools that were currently at our disposal. This was a strategy to create an internationally usable questionnaire of a high quality which examines ways and frequency of using cloud-based services in schools today. The questionnaire was also structured in a way that can reveal which issues occur regarding using cloud services in schools, if there are any.

After conducting an on-line questionnaire, it was possible to draw conclusions about the usage of cloud-based services in schools today. Also, these conclusions served project partners to finalize the gap analysis comparing the current state with possible usage of cloud services in schools as well as the possibilities of technology in general.

2.3. Secondary research as a preparation for the on-line questionnaire

Firstly, project partners started to gather already existing secondary data, meaning that they collected information about general learning outcomes and their cloud-based components. For this purpose, project partners reached recognized schools and educational experts in their countries. According to the project partners' findings, French, Croatian and Bulgarian curriculums do not particularly highlight cloud-based services and its usage in teaching process of non-ICT subjects. The use of digital technology is of course part of learning outcomes of the subjects which belong to the ICT domain. So, cloud computing, its usage and benefits are part of the learning outcomes in subjects like IT. On the other hand, cloud-based services and tools are not specially represented in the observed French, Croatian and Bulgarian curriculums of non-ICT subjects.

In Croatia, "ICT usage" is defined as a cross-curricular topic which has its own curricula and this represents a respective step forward because the curricula specifically prescribes which ICT topics should be presented to students of a particular age. In addition, curriculums of each subject highlight which learning outcomes should be related to ICT usage as a cross-curricular topic or achieved by using ICT in the learning process.

So, according to the examined curriculums, project partners concluded that ICT is implemented in the learning process of different subjects. Teachers and students can use ICT as well as cloud services and tools during various lessons of different subjects even though curriculums do not precisely define how, with what intensity and at what level they should do it. Moreover, according to the examined curriculums, cloud-based services, which are part of ICT domain, students do not encounter before the age of 12. To be specific, Croatian curricula for cross-curricular topic "ICT usage" mentions using cloud services for the first time while describing learning outcomes for students of the 6th grade of primary school. These findings of project partners' secondary research confirmed the need for encouraging students to use cloud services and tools as early as the first grade of the primary school to be ready for using it on their future work place. To encourage



students to use cloud at the very beginning of their educational path, the key roles have the teachers who also should be empowered to do so, project partners concluded.

2.4. Primary research as a preparation for the on-line questionnaire

The second phase of preparations for creation of the on-line questionnaire was a primary research that consisted of conducting interviews with teachers and analysing teachers' answers. These interviews provided project partners with teachers' experiences based on their everyday work with students. The main topics of the interviews were possibilities of using cloud-based tools in teaching, students' dexterity while using cloud services and tools as well as benefits of using cloud in schools and potential obstacles that occur while using it. In total, Algebra team conducted interviews with selected teachers and educational experts with more than 10 to 15 years of experience in teaching.

Interviewees were both teachers who work in schools in cities as well as teachers who work in rural areas. The latter approach was applied to ensure interviewees' even geographical distribution. This was especially important while discussing the quality of Internet connection and school IT equipment in general. It was concluded that the urban geographical location of the school does not imply better IT equipment in the school. Moreover, it is concluded that the geographical location of the school cannot be a criterion by which abundance of school IT equipment can be inferred. This implicated that the questionnaire should include questions about IT equipment in classrooms for students and teachers as well as questions about Internet connection, since its presence and quality are the key for using cloud services and tools. Besides, it was decided that the questionnaire will include questions about how digital technology is used in classrooms – do only teachers use it or students work on their devices independently.

During the interviews, the teachers were asked to comment on how often they use digital technology and cloud-computing in their everyday work with students. All interviewees pointed out that they use digital technology in teaching very often, meaning that their students use digital technology in almost every lesson in order to achieve particular learning outcomes – whether these outcomes are related to ICT or not. Furthermore, teachers were asked to assess how often their colleagues use digital technology in teaching. Interviewees stated that it varies and depends not only on available IT equipment in classrooms but also on teachers' skills in using digital technology. For creation of the questionnaire, this meant that the questionnaire should include questions about frequency of using digital technology and cloud-based services and tools in teaching as well as teachers' estimation of their own digital skills and computer literacy. Combining answers on these two sets of questions, project partners could further decide how to approach to creating educational modules for teachers and students on cloud computing.

Further on, the teachers were asked to point out which cloud-based platforms and tools they and their students use in teaching. According to the summed answers, all interviewees pointed out that there are many cloud platforms and tools available and that sometimes teachers find it difficult to choose which one they will be using in teaching. Also, interviewees said that their



experience shows that the best recipe is to use one cloud platform and many cloud tools. This means that it is less confusing when teachers and students use one platform for holding classes in real time, communication and sharing documents instead of many platforms. For this purpose, all interviewees pointed out that *Microsoft Teams* is a practical solution. According to the experiences, after real classroom is simulated only on one platform, students can use many cloud tools for solving tasks, quizzes, creating presentations and so on. Interviewees concluded that teachers often choose to use tools that do not require paying a license and that most important thing that is missing when talking about cloud services in schools is teachers' know-how about using them. According to described experiences, it was concluded that the questionnaire should include questions about teachers' tendency to explore digital tools, frequency of using particular cloud services and willingness to gain new knowledge about using cloud services.

In addition, interviewees were asked to comment, based on their experiences, how students react on using digital technology and cloud services during lessons. Interviewees did not point out any negative reaction – they said that students like to work in digital environment and interactive content. Moreover, they said that using many different digital and cloud tools can only motivate students and captivate their attention as well as assure play based-learning. The latter is in line with previous statements about using many cloud tools but just one cloud platform as a good recipe. Sometimes, when using a particular cloud tool for the first time, students need help with mastering its usage. This is why it is important that teachers have already mastered it. It was concluded that the questionnaire should include questions about possibilities, advantages and disadvantages of digital tools.

Furthermore, interviewed teachers gave comments about what would help teachers and empower them to use digital technology and cloud services more often. According to the interviewees' answers, teachers find courses and tutorials very useful and would like to participate in some kind of educational format in order to familiarize themselves with the tools that are simple, useful and allow them to evaluate students' work. So, based on these opinions, it was decided that questionnaire will examine teachers' willingness to acquire new knowledge about using digital and cloud tools as well as, if they are interested in, which educational format would they prefer.

As a final topic of the interviews, teachers shared their experiences related to teaching during 2020 when restrictions related to COVID-19 occurred. Interviewed teachers did not encounter great difficulties during remote learning, since they have been using digital and cloud tools often, even before the pandemic. Interviewees stated that difficulties encountered only teachers who did not use digital and cloud tools in teaching very often prior to the remote learning period. Not only teachers, but also students who were not familiarized with digital and cloud tools had some difficulties during remote learning period. COVID-19 crisis caused many unexpected situations and those who had their digital skills more developed were able to cope better with them. This was actually an opportunity for everyone to reassess their opinions towards digital technology and this is why questionnaire also examined how teachers managed with using digital technology during the remote learning period.

2.5. Conducting an on-line questionnaire

Based on the results of secondary and primary research, Algebra team created an on-line questionnaire for teachers. The questionnaire consisted of 30 questions and it was prepared in cloud-based tool – *Google Forms*. Four versions of the questionnaire were prepared – in Bulgarian, Croatian, French and English. So, every project partner distributed questionnaire in its national language and in English. This way, wider distribution extent of the questionnaire was assured, as project partners could distribute it outside of their national borders. Project partners were distributing the questionnaire during February 2021 and the first half of March 2021 using school's and private social media profiles, posting the questionnaire in various Facebook groups for teachers and via various communication platforms (WhatsApp, Viber, Messenger) relying on professional and personal relations with other schools and teachers.

After the questionnaire distribution phase was finished, total number of 373 responses in all languages were aggregated and responses in Bulgarian, Croatian and French were translated to English because for the next phase – the analysis, the responses had to be unified.

2.6. Analysis of the on-line questionnaire

Concerning the demographic characteristics of the teachers who filled in the questionnaire, most of them aged from 41 to 50 (36,04 %). The next most represented group consists of teachers aged from 51 to 60 years (29,54 %). More than fifth (21,95 %) of the respondents are young teachers aged from 31 to 40 years and 11,11 % of the respondents are younger than 30 years. So, most of the respondents who filled in the questionnaire are middle age teachers.

Furthermore, most of the respondents are teachers with significant teaching experience – 29,54 % of them have been teaching for 16 – 25 years and more than a quarter of respondents stated that they have 26 – 35 years of teaching experience. Younger respondents have less teaching experience – 39,29 % of respondents stated that they have less than 5, 6 – 10 or 11 – 15 years of teaching experience, which is in accordance with the described demographic characteristics of the respondents.

Geographically, most of the teachers who filled in the questionnaire teach in the schools which are located in Smolyan, Bulgaria (9,21 %), Zagreb, Croatia (6,5 %), Sofia, Bulgaria (5,42 %), Velika Ludina, Croatia (5,15 %) and Saint-Denis, France (4,37 %). Countries from which the responses have been collected are Croatia (47,97 %), Bulgaria (47,15 %), France (4,34 %), Serbia (0,27 %) and Bosnia and Herzegovina (0,27 %). This is in line with the fact that project partners are educational institutions from Bulgaria, Croatia and France and therefore, most of the teachers who filled in the questionnaire teach in these countries. The fact that responses are collected from a few other countries, testifies that project partners reached teachers from outside their borders.

In addition, most of the teachers who filled in the questionnaire teach in a school that are located in the urban areas (73,17 %). On the other hand, 19,51 % of the respondents stated that they teach



in school which is located in rural area. The rest of the respondents work in schools located in urbanized surroundings of the cities or they teach in more than one school and every school is located in different type of area.

Further on, while filling in the questionnaire teachers picked the age of their students. Nearly one third (31,44 %) of the respondents work with students aged from 7 – 10 and 29 % of the respondents work with students aged 11 – 14. Although the questionnaire was designed for both primary and high school teachers, most of the teachers who filled in the questionnaire teach younger students.

Also, teachers who participated in the survey pointed out which subject or subjects they teach. The lists of subjects were designed to meet the needs of each educational system, meaning that for example the questionnaire in Bulgarian included all subjects which are taught in Bulgarian primary and high schools. According to the summed results, most of the teachers who filled in the questionnaire teach Primary Subjects (25,75 %), Foreign language (13,55 %) and Mathematics (8,67 %). These results do not surprise since these subjects have the largest weekly load, therefore most of the teachers on the labour market teach these subjects.

According to the questionnaire results, most of the respondents (28,18 %) have computer or laptop, projector and speakers in the classroom where they teach and they can use it during lessons. In addition, 26,02 % of the teachers who filled in the questionnaire have all above mentioned equipment with addition of a smart board. More than fifth (21,14 %) of the respondents have only computer or laptop and projector as equipment which is available for them in the classroom where they teach, but it can be concluded that this equipment is also sufficient for conducting many teaching methods based on digital technology. Also, these questionnaire results reveal that a satisfactory amount of IT equipment is available for teachers who were part of the survey.

On the contrary, results of the questionnaire show that nearly half of the teachers who filled in the questionnaire (46,07 %) pointed out that in the classroom where they teach students do not have computers, laptops or tablets available to them. According to the results, 33,60 % of the teachers pointed out that one computer, laptop or tablet is available to each student in the classrooms where they teach and 13,55 % of the teachers pointed out that one computer, laptop or tablet is shared by several students. This shows that students of different schools do not have equal amount of IT equipment available for them – nearly half of them have devices only for their usage, and more than third of them do not have any kind of device for using during classes.

As part of the questionnaire, teachers were asked how often their students use personal smartphones during classes for learning purposes. It is indicative that most of the respondents (36,59 %) stated that this happens very rarely and only 7,32 % of the respondents pointed out that this happens very often.

Proceeding with the set of questions related to the IT equipment, the respondents evaluated the quality and speed of the Internet service in the school where they teach, using a scale from 1 to 6. Most of the teachers (29,54 %) who filled in the questionnaire graded Internet service in the school where they teach with 4, and 27,37 % of the respondents with 5. It can be concluded that

quality and speed of the Internet service in the schools where teachers who participated in the survey work, is slightly above average. Extreme grades, the worst and the best, are used in a following way: 1 – 3,79 %, 6 – 13,55 %.

General questions about teachers and their experience as well as questions about IT equipment available for teachers and students were followed with questions about using digital technology in everyday work with students. In this part of the questionnaire, 60,16 % of the teachers who filled in the questionnaire pointed out that they often use digital technology in their everyday work with students. More than fifth (20,05 %) of the respondents stated that they mostly rely on digital technology in teaching, 18,97 % of the respondents sometimes use digital technology in teaching and 0,81 % of the respondents do not rely on digital technology at all in their everyday work with students. Moreover, 32,79 % of the respondents use digital technology in about 80 % of their lessons and 26,29 % of the respondents use digital technology in each lesson. In conclusion, this means that teachers who took part in the survey use digital technology in teaching pretty often and that teaching methods which include using digital technology are widely accepted among this particular group of teachers.

One of the questionnaire goals was to investigate state of teachers' digital skills and computer literacy. Teachers who filled in the questionnaire estimated their own digital skills and computer literacy on a scale from 1 to 6. Most of the respondents (41,19 %) graded themselves with a grade 5, and 28,73 % of the respondents estimated their digital skills and computer literacy as excellent, assigning themselves the highest grade (6). This means that 69,92 % of the respondents estimated that their digital skills and computer literacy are well above average. Other grades are represented in a way: 1 – 0,81 %, 2 – 0,81 %, 3 – 4,61 %, 4 – 23,85 %.

Proceeding to the next two questions, the questionnaire aimed to investigate the extent to which students use digital technology in classes independently, meaning that they use digital and cloud tools on their devices. Teachers who filled in the questionnaire were asked to estimate how often they use digital technology in classes in order to project their computer display to students. Most of the respondents (34,96 %) do it very often, and 26,29 % of the respondents do it often. So, it can be concluded that teachers are very likely to use their devices to project their computer display to students. This is commendable because it allows students to see how digital and cloud tools could be used, but this approach is not student-centred, since it does not allowed students to take an active role and work independently. Of course, different approach is not possible if teachers are the only ones in classes who have devices. On the other hand, teachers who filled in the questionnaire were asked to estimate how often they use digital tools in classes in a way that students work on their devices independently. Most of the respondents (20,87 %) estimated that their students very rarely work on their devices independently. As concluded before, most of the respondents stated that computers, laptops or tablets are not available to students in the classrooms where they teach. Therefore, it can be concluded that students rarely use digital and cloud tools independently on their devices partially due to lack of IT equipment for students.

Since *Microsoft Teams* was pointed out as a useful platform, the teachers were asked if, at the school where they work, they have access to *Office 365* services funded by school (18,7 % of the respondents), school gets access to *Office 365* services for free (68,29 % of the respondents) or



they do not have access to *Office 365* services (13,01 % of the respondents). Additionally, teachers marked if, at the school where they work, their students have access to *Office 365* services funded by school (15,72 % of the respondents), school gets access to *Office 365* services for free (66,12 % of the respondents) or they do not have access to *Office 365* services (18,16 % of the respondents). According to the questionnaire results, most of the teachers and students have access to *Office 365* which school gets for free. According to this fact, most of the teachers and students do not have problems accessing *Office 365* services and tools for free – whether it is funded by school or the school gets it for free.

Even though 69,92 % of the respondents estimated that their digital skills and computer literacy are well above average, teachers were asked to assess how long they prepare for the lessons during which they will be using digital tools. More than half of the respondents (56,91 %) pointed out that they prepare longer for a lesson during which they will be using digital tools than for a lesson during which they will not be using them. More than third (36,04 %) of the respondents stated that they need the same amount of time for preparation both lessons during which they will be using digital tools and not. Only 7,05 % of the teachers who participated in the survey stated that they prepare shorter for lessons during which they will be using digital tools. This means that more than half of the teachers who participated in the survey are not skilled enough in using digital tools, therefore they need more time for preparation of the lesson which includes using digital tools.

Except for investigating frequency of using digital tools in teaching, the aim of the questionnaire was to examine which possibilities of the digital tools teachers use most often, which represents a qualitative component of the research. Most of the teachers (35,50 %) who filled in the questionnaire marked that they use digital tools in order to: test students' knowledge, receive feedbacks from students on their acquired knowledge, distribute materials to students as well as to receive completed assignments from students. These possibilities of the digital tools were actually all options that were proposed in the questionnaire, which means that most of the respondents recognize different purposes and benefits of using digital tools.

Besides teachers' ICT skills, the questionnaire also investigated students' ICT skills. Teachers who participated in the survey were asked to assess how often they have to help their students to master the use of digital tools. Only 5,96 % of the respondents pointed out that they do it very rarely, 20,05 % marked that they do it very often and most of the respondents (46,34 %) stated that they do it often. This is very important since teachers are the only ones who can help students master the use of digital tools during lessons if needed, which means that teachers also have to be skilled in this field. Moreover, results of the questionnaire show that not only teachers but also students should be empowered to improve their ICT skills in order to use digital tools and cloud services flawlessly and in a more effective way.

Since one of the primary research conclusions was that major changes and challenges occurred in education system due to the COVID-19 virus pandemic, teachers who filled in the questionnaire were asked to assess how the COVID-19 pandemic affected their daily preparations for lessons and teaching. More than a half of the respondents (55,56 %) stated that they managed great with the use of digital technology, 38,75 % of the respondents had to partially improve their digital



skills, 4,88 % of the respondents had to improve them significantly and only 0,81 % of the respondents stated that COVID-19 pandemic situation forced them to learn the basics of using digital technology. These results are in line with teachers' estimation of their general ICT skills.

More than a half of the respondents (50,41 %) pointed out that they are very inclined to explore digital tools which they could use in teaching. To examine the qualitative side of teachers' willingness to explore digital tools, part of the questionnaire investigated ways of teachers' learning about digital tools so far. Results of the questionnaire show that teachers are inclined to attend webinars, use instructions prepared by companies that created digital tools, exchange experiences with colleagues as well as research independently. Most of the teachers (41,19 %) who filled in the questionnaire pointed out that they find educational courses about using digital technology in teaching very useful. Finally, results of the questionnaire show that teachers' willingness to improve their knowledge about using digital tools in teaching is significant and that they would like to acquire new skills and knowledge in different ways.

Teachers were also asked about their readiness to pay a license for using a very practical digital tool. According to the results, 20,87 % of the respondents stated that they are willing to pay a license and 79,13 % of the respondents pointed out that they would rather search for free a digital tool. So, in accordance with the results it can be concluded that teachers prefer to use free digital tools which do not require paying a license.

To gain qualitative insights to teachers' attitudes towards digital tools, teachers were asked to point out which are, in their opinion, three most important advantages and disadvantages of using digital tools in teaching. Following advantages were pointed out as three most important: creating visually attractive presentations of the teaching content, enabling learning through play and raising students' motivation. Three most important disadvantages of using digital tools in teaching which were pointed out are that certain tools require paying a license, that teachers must master the functionalities of the tools in order to be able to help students and that technical obstacles, when occur, make it impossible to teach. According to the questionnaire results, teachers who participated in the survey recognize that usage of digital tools in teaching raises students' motivation and enables them to acquire new knowledge and skills through play. This way of using digital tools in teaching is student-centred since students are able to work, create and broaden horizons independently. On the other hand, creating visually attractive presentations of the teaching content, which was pointed out as the most important advantage of using digital tools in teaching, does not represent high level of students' interactivity with the content nor the independency with using digital tools. As earlier questionnaire results showed, teachers are not willing to pay licenses for using digital tools and as one of the biggest disadvantages of using digital tools in teaching they pointed out technical obstacles, which, when occur make it impossible to teach. Of course, when technical difficulties occur, teachers have to improvise instantly and find another way to successfully finish the lesson with students, which can make them uncomfortable. What is most important, teachers are aware that they have to be skilled in using digital tools in order to help students using the tools which also makes them uncomfortable. This actually points out that teachers have to be empowered to master using digital tools in teaching in order to help students with its usage and to work in the digital environment while teaching without any concerns.



At the end of the questionnaire, teachers could find a list of 83 available digital tools on which they marked the extent to which they use listed digital tools. Teachers marked if they use a particular cloud-based tool often, sometimes or never. According to the questionnaire results, there are a lot of available cloud-based tools which are not often used by teachers. This is confirmed by the fact that more than 66 % of the listed tools are often used by only less than 10 % of teachers who filled in the questionnaire. To name a few of these tools which are not often used in teaching – *Quizlet, Prezi, Mentimeter, EdPuzzle, Plickers, Socrative, GoToMeeting, Vimeo, FlipGrid, Poster My Wall, Flipsnack, StoryBoardThat, Bubbl, Popplet, Classcraft, Miro, FlexClip, ProProfs, Actionbound* etc.

2.7. Gap analysis conclusions

Results of the on-line questionnaire filled in by 373 teachers 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-centred learning enabled by using digital tools. 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 shows 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.



3. Conclusions for further project activities based on the gap analysis conclusions

Based on the questionnaire results and gap analysis conclusions, project partners were able to establish conclusions for planning and organizing further project activities – creating educational materials for teachers and students about using cloud-based tools.

According to the students' age, most of the teachers who participated in the survey teach students aged from 7 to 14 and most of them teach Primary Subjects, Foreign language and Mathematics. This is the reason why educational materials on using cloud-based tools will be created for teachers who teach students aged from 7 to 14 and for students aged from 7 to 14. Also, once created, educational materials will show how cloud-based tools can be used in teaching Primary Subjects, English as a foreign language, Mathematics, Primary language and History. This decision is based not only on the questionnaire results but also on the project team members' expertise.

Since it was concluded that IT equipment in schools is available for teachers but not so often for students, project partners decided that educational materials will be prepared in a way which allows presenting developed materials to students by teachers in schools using teachers' equipment. Afterwards, in schools where the equipment is available to students they will continue their work on materials at school. In schools where the equipment is not available to students, they will continue their work on materials at home where equipment is available to them and Internet service is more reliable.

The questionnaire showed that teachers like to use ready-made digital educational materials because they are not skilled in creating their own materials. This is why project partners concluded that there is a great need for empowering teachers for creating their own digital materials and teaching them how to create them quickly and easily.

The questionnaire showed that teachers often attend webinars in order to acquire new knowledge about digital tools. Based on that, project partners decided to prepare and record a series of webinars for teachers. Topics of the webinars will be both educational (e.g. how to use particular cloud-based tool in teaching History etc.) as well as psychological (e.g. stress-management, how to quickly overcome technical obstacles while using digital technology etc.).

Project partners will create educational materials only for using free digital tools in the cloud.

Since there are lot of available digital tools in the cloud which teachers do not use very often, project partners will create educational materials for teachers in order to show them how to use these rarely used digital tools in the cloud for enriching their lessons. The only exception is *Microsoft Teams* – tool which is often used but has many possibilities, therefore project partners decided to include it in the further project activities. The table below shows cloud-based tools which were identified as the tools that were not often used by teachers so far and therefore these tools will be included in the process of creating digital educational materials.

Table 1. Cloud-based tools which will be included in the process of creating digital educational materials

NAME OF THE TOOL	LINK	PURPOSE OF THE TOOL
TOOLS FOR INTERACTIVE VISUALISATION		
Genially	https://www.genial.ly/	creating interactive presentations, graphics, images, games, training materials...
Flex Clip	https://www.flexclip.com/	creating videos (video presentations)
Flipsnack	https://www.flipsnack.com/	creating visually attractive scripts/notes/mini-textbooks (includes importing and editing PDF documents)
MindMeister	https://www.mindmeister.com/	creating mind maps and collaborating
Adobe Spark	https://spark.adobe.com/sp/	creating graphics, collages, videos and animations
TOOLS FOR CREATING QUIZZES AND ASSIGNMENTS		
Mentimeter	https://www.mentimeter.com/	creating presentations with quizzes (includes adding features) with instant feedback in a form of charts
Quizizz	https://quizizz.com/	creating different types of quizzes and setting options like live quiz, homework quiz etc.
Wizer.me	https://www.wizer.me/	creating interactive worksheets with feedback for teachers and students
Actionbound	https://en.actionbound.com/	creating games which are 'scavenger hunts' alike
ProProfs	https://www.proprofs.com/	creating customized quizzes with feedback for teachers and students; collaboration features
TOOLS FOR CLASSROOM MANAGEMENT AND CURRICULA GAMIFICATION		
ClassDojo	https://www.classdojo.com/	building classroom community and gamifying classroom management; platform in which teachers award students for showing specific skills and behaviours; teachers set up skills and behaviours which they want to encourage/discourage
PLATFORM FOR COLLABORATION		
Microsoft Teams		creating teams (classrooms), assigning tasks, monitoring deadlines, communication, holding lessons in real time

Project partners will be creating educational materials for teachers and students about using cloud-based tools bearing these conclusions in mind.

Appendix

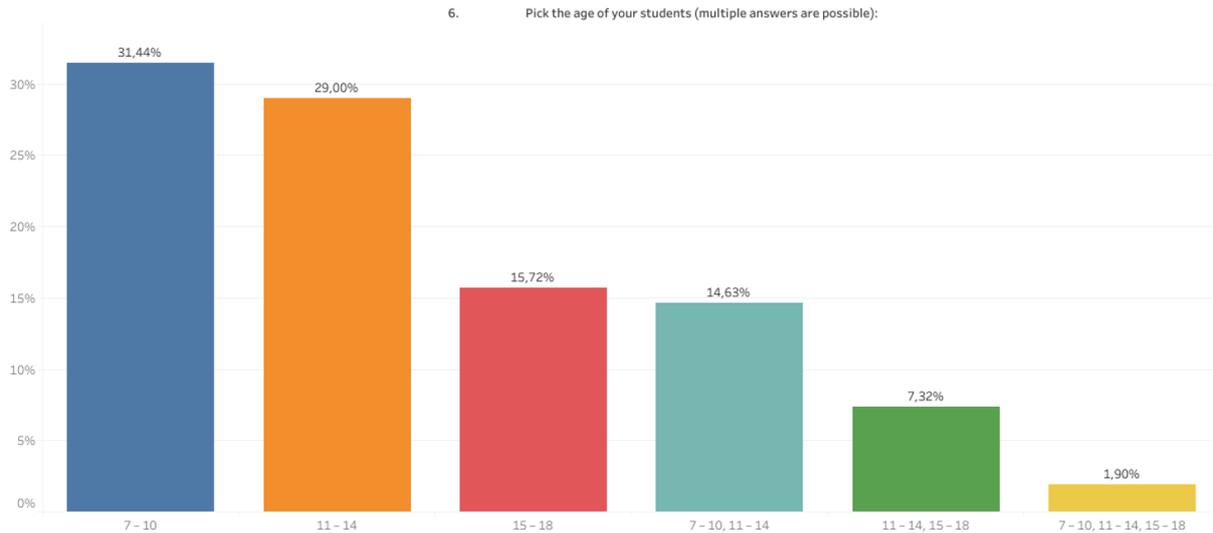


Figure 1. Age groups of respondents' students

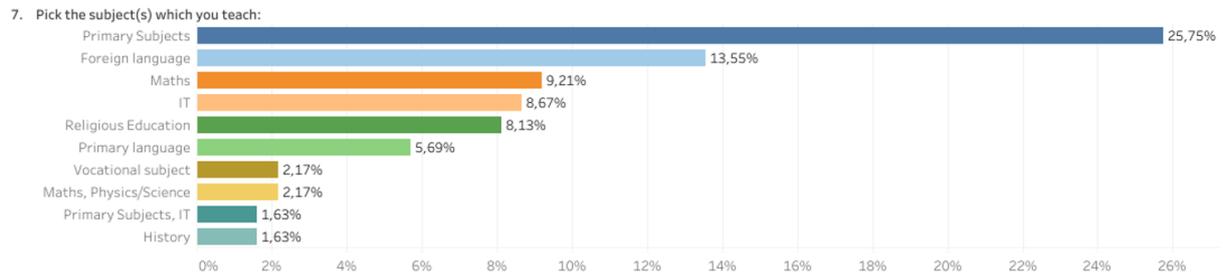


Figure 2. Subjects which respondents teach (top 10 answers)

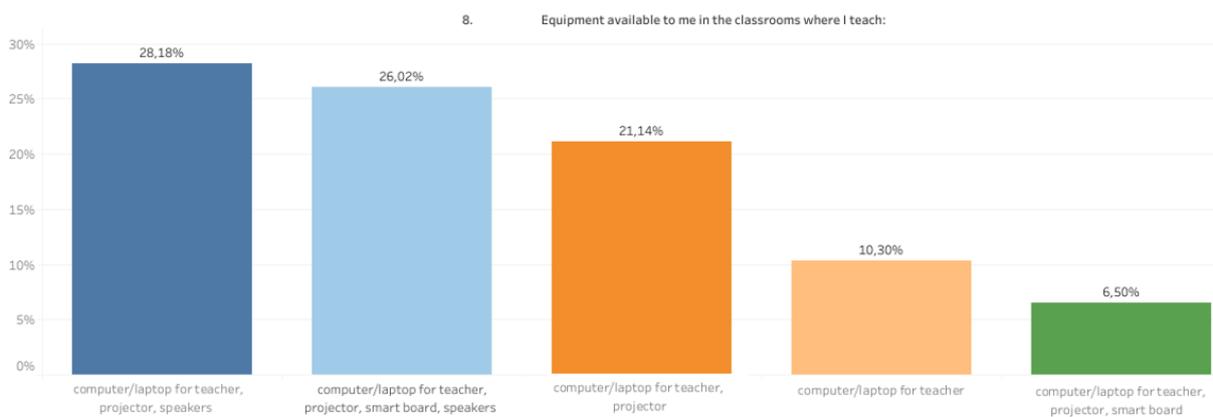


Figure 3. IT Equipment available to the respondents in the classrooms where they teach (top 5 answers)

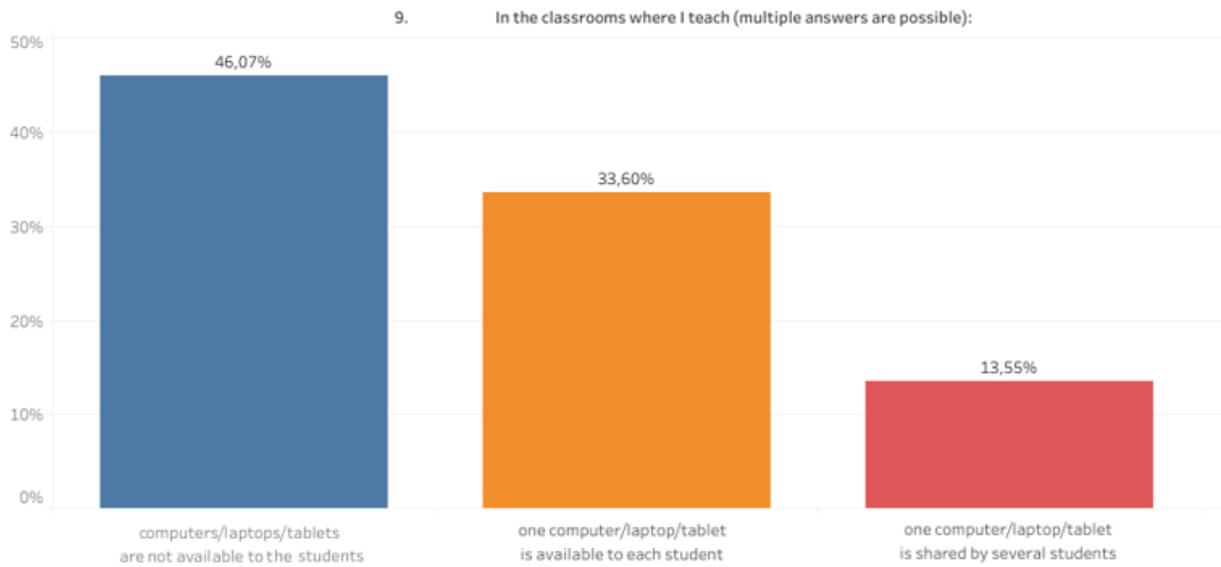


Figure 4. IT Equipment available to the students in the classrooms where respondents teach (top 3 answers)

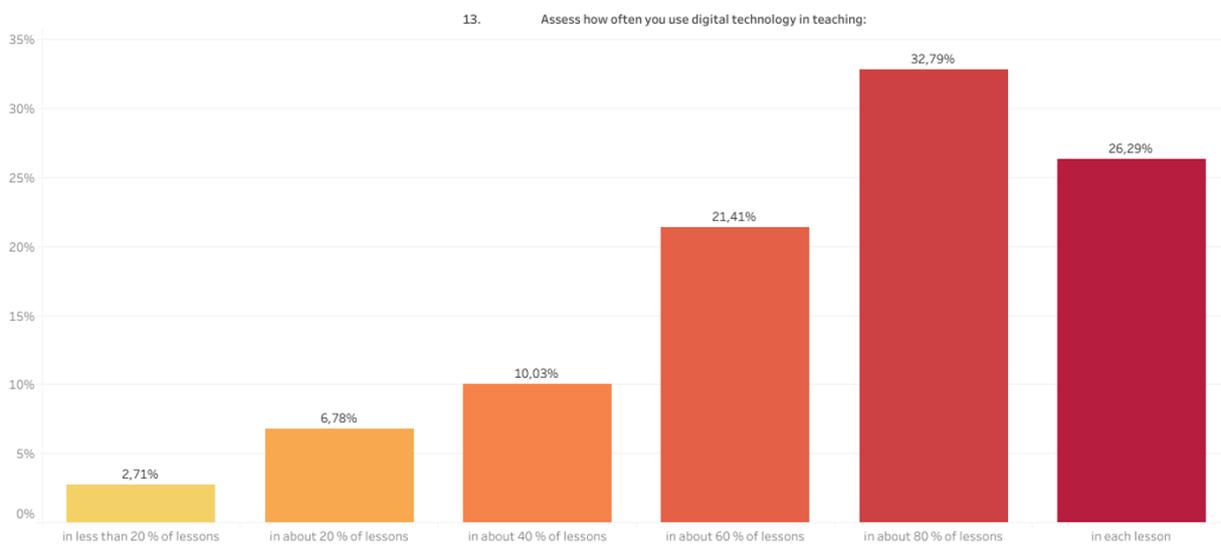


Figure 5. Frequency of using digital technology in teaching assessed by the respondents

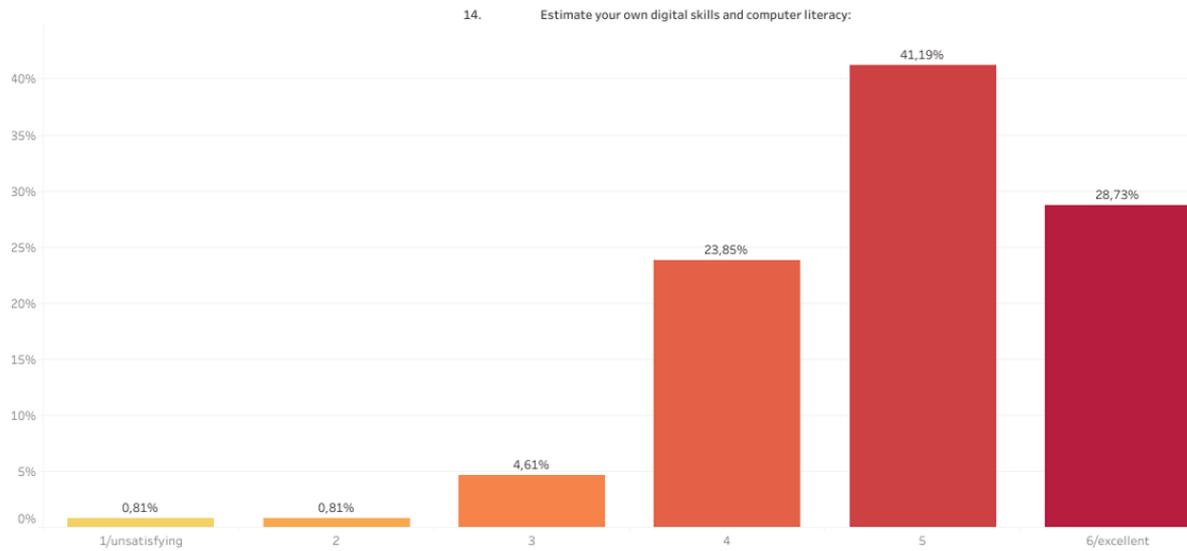


Figure 6. Assessment of the respondents' digital skills and computer literacy

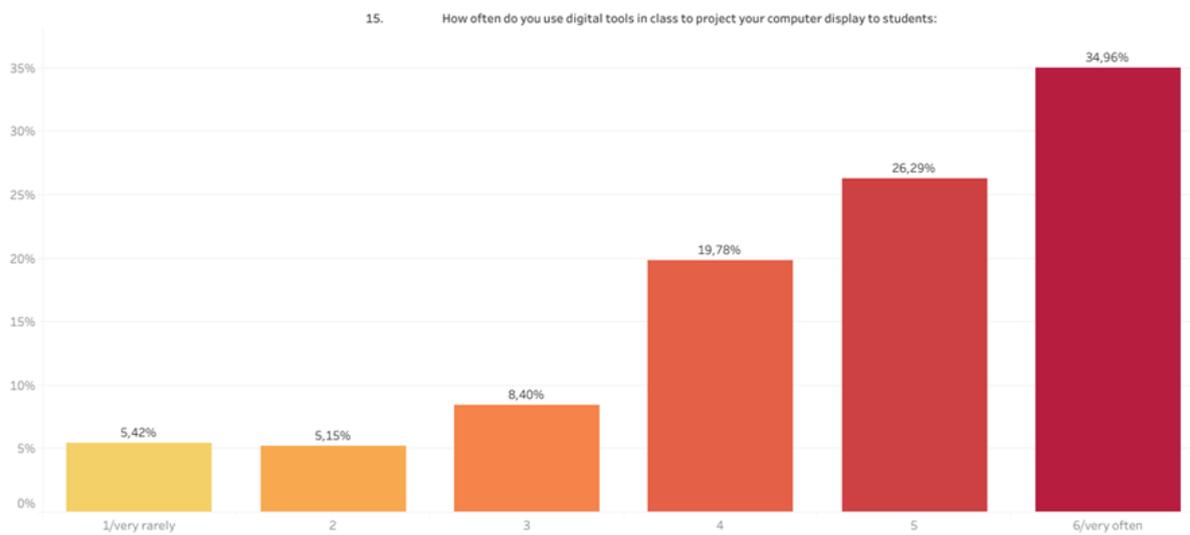


Figure 7. Frequency of using digital tools in classes to project respondents' computer display to students assessed by the respondents

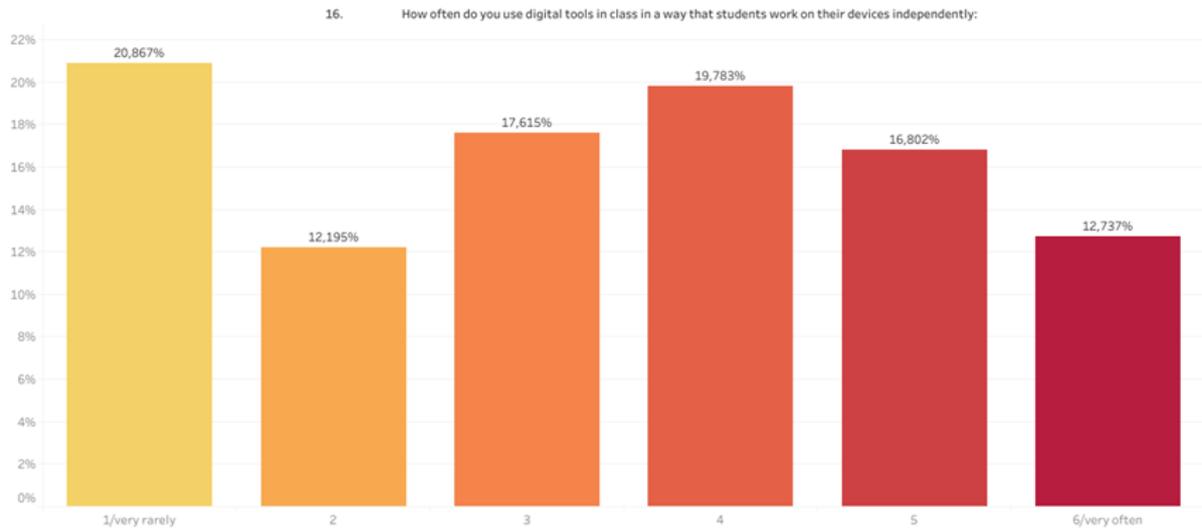


Figure 8. Frequency of students' independent usage of digital tools in classes assessed by the respondents

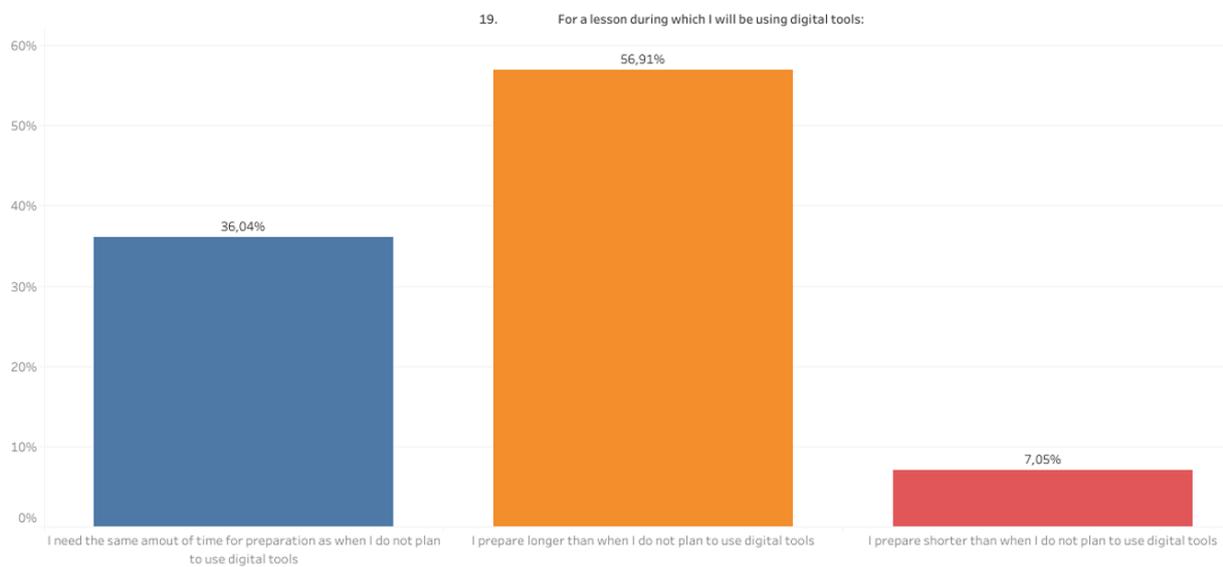


Figure 9. Time needed for preparation for lessons during which digital tools will be used assessed by the respondents

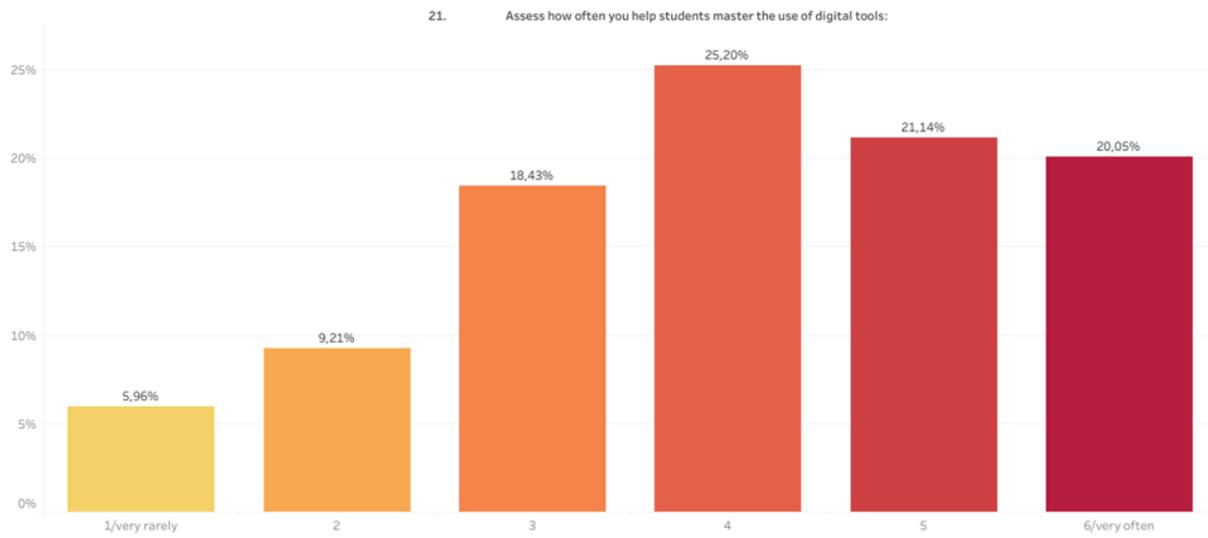


Figure 10. Frequency of situations in which teachers help students master the usage of digital tools assessed by the respondents

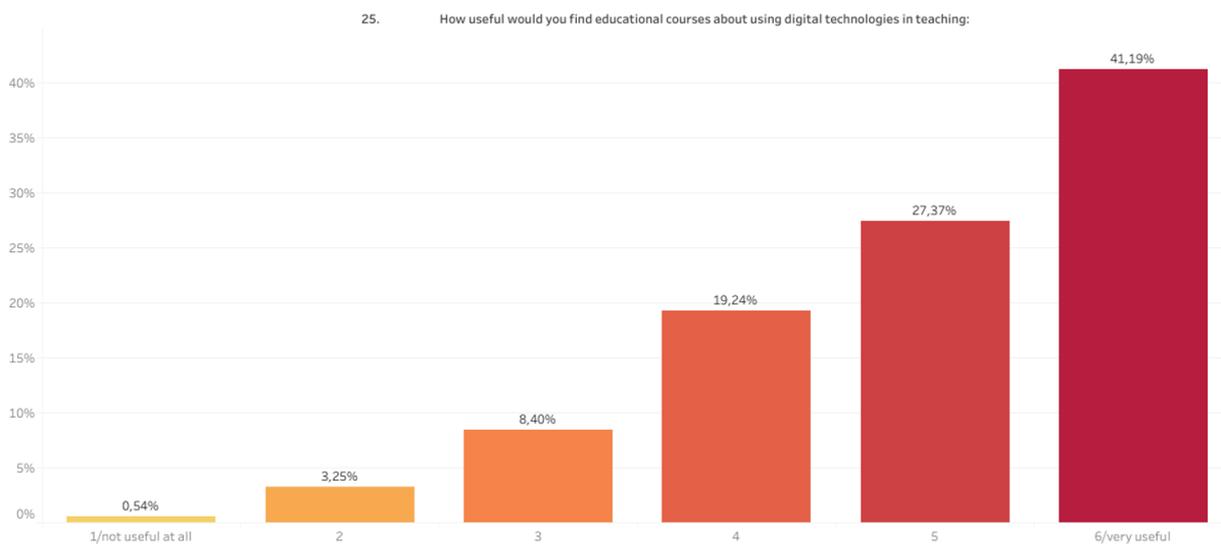


Figure 11. Respondents' attitudes towards usefulness of educational courses about using digital technology in teaching

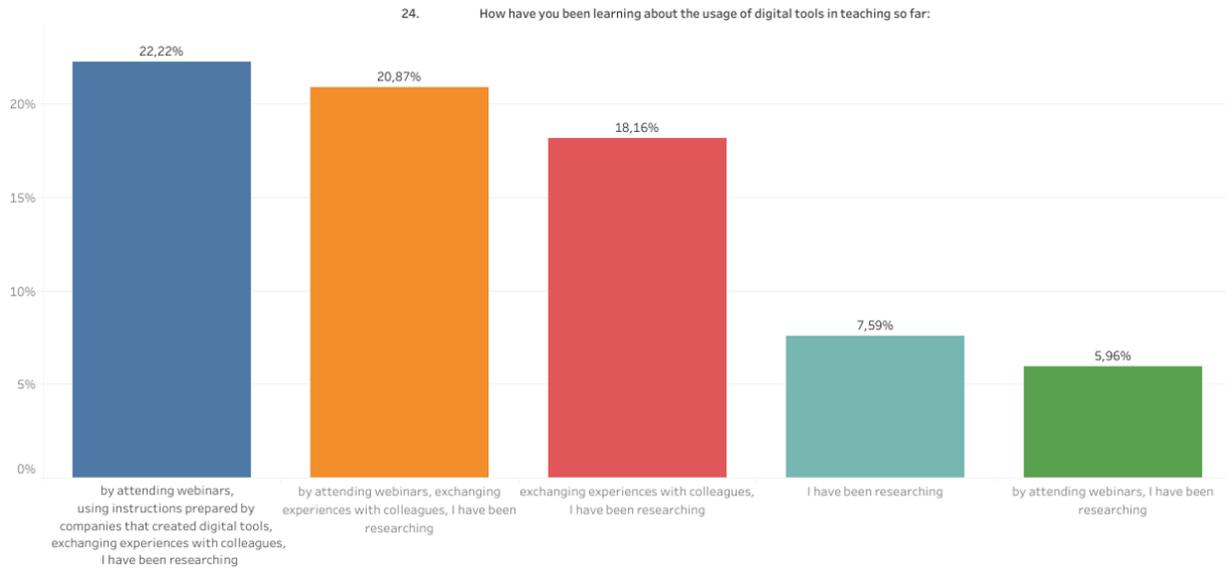


Figure 12. Respondents' former ways of learning about the usage of digital tools in teaching

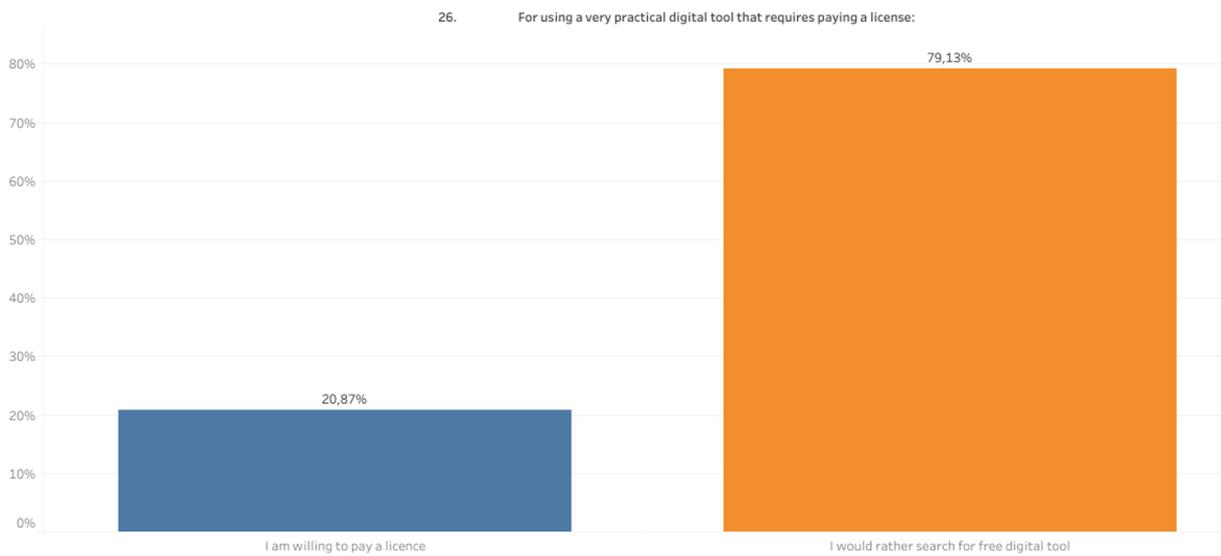


Figure 13. Respondents' willingness to pay a license for using a very practical digital tool

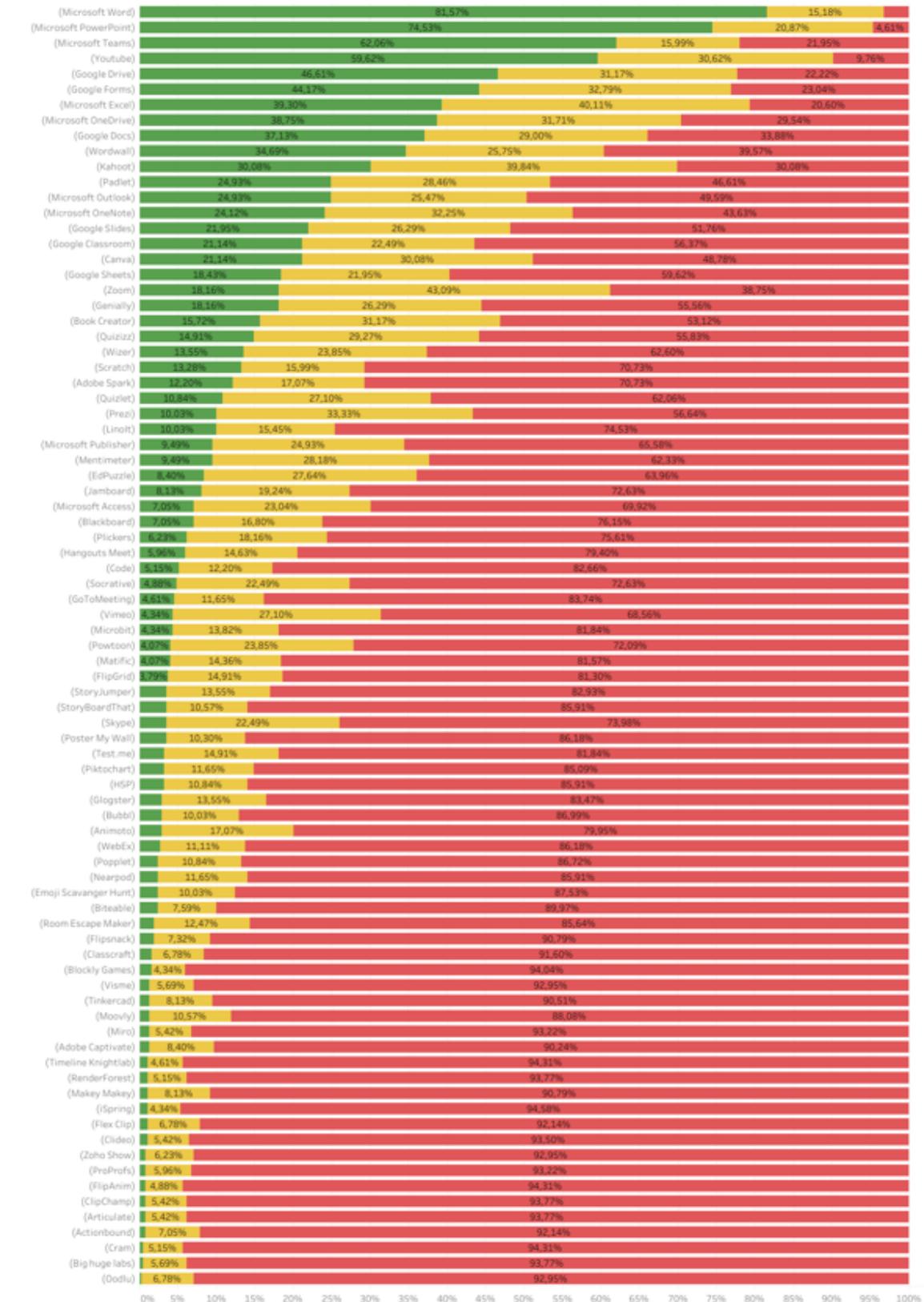


Figure 14. Frequency of using particular digital and cloud tools assessed by the respondents



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