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SKILLS CLOUD

Up-skilling the VET Sector to Cloud Computing

WP2: training scheme and assessment module

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KA220-VET-Cooperation partnerships in VET sector

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Module 1: Introduction to Cloud Computing for Education

Learning Objectives	What do you want to achieve by implementing this module?
	• To introduce the concept of cloud computing, cloud deployment model and cloud service models such as Public cloud, Private cloud and Hybrid cloud • To introduce the benefits of cloud computing for education, such as increased flexibility, scalability, cost-effectiveness, and accessibility. • To define a learning management system (LMS) and explain its role in education • To introduce popular cloud-based LMS platforms and their features, including course management, student engagement, and assessment functionalities • To explain the concept of cloud storage and its importance in education • To introduce cloud storage solutions commonly used in education, including Google Drive, Microsoft OneDrive, and Dropbox, IBM etc.

Learning Outcomes	What are the expected results of this module?
	By the end of this module, participants will be able to: • Define cloud computing, cloud deployment models, and cloud service models such as Public cloud, Private cloud and Hybrid cloud. • Explain the benefits of cloud computing in education. • Define the learning management system (LMS) and explain its role in education. • Define cloud storage solutions. • Explain the benefits of using cloud storage and file sharing in

	education.

Theoretical content	What are going to be the main theoretical contents of the module?
	Cloud computing is a model for delivering on-demand computing resources, including servers, storage, databases, software, and other services, over the internet. It enables users to access and utilize these resources without the need for local infrastructure or technical expertise. The concept of cloud computing is based on the idea of centralizing computing resources in data centers and making them available to users as a service. Compared to traditional on-premises IT, and depending on the cloud services you select, cloud computing helps do the following: Compared to traditional on-premises IT, cloud computing offers several benefits depending on the cloud services you select: • Lower IT costs: Cloud computing allows you to offload the costs and effort of purchasing, installing, configuring, and managing your own on-premises infrastructure. • Improved agility and time-to-value: With cloud computing, organizations can start using enterprise applications in minutes instead of waiting weeks or months for IT to respond to requests. It also empowers developers and data scientists to access software and infrastructure independently. • Scalability and cost-effectiveness: Cloud provides elasticity, allowing you to scale capacity up and down in response to spikes and dips in traffic. It also leverages a global network for better performance and user experience. There are three types of cloud computing: public cloud, private cloud, and hybrid cloud. Within these deployment models, there are four main services: infrastructure as a service (IaaS), platform as a service (PaaS), software as a service (SaaS), and serverless computing. The type of cloud deployment model and cloud service model you choose will vary depending on your existing IT investments, business requirements, and the outcomes you are hoping to achieve.

Deployment Models:

Public cloud

Public clouds deliver resources such as compute, storage, networks, develop-and-deploy environments, and applications over the internet. They are owned and run by third-party cloud service providers like Google Drive, Microsoft OneDrive, iCloud, etc.

Private cloud

Private clouds are built, run, and used by a single organization, typically located on premises. They provide greater control, customization, and data security but come with similar costs and resource limitations associated with traditional IT environments. Hybrid cloud Environments that mix at least one private computing environment (traditional IT infrastructure or private cloud, including edge) with one or more public clouds are called "hybrid clouds." They allow you to leverage the resources and services from different computing environments and choose which is most optimal for your workloads.

Main Services:

Infrastructure as a Service (IaaS): IaaS delivers on-demand infrastructure resources, such as compute, storage, networking, and virtualization. With IaaS, the service provider owns and operates the infrastructure, but customers will need to purchase and manage software, such as operating systems, middleware, data, and applications.

Platform as a Service (PaaS): PaaS delivers and manages hardware and software resources for developing, testing, delivering, and managing cloud applications. Providers typically offer middleware, development tools, and cloud databases within their PaaS offerings.

Software as a Service (SaaS): SaaS provides a full application stack as a service that customers can access and use. SaaS solutions often come as ready-to-use applications that are managed and maintained by the cloud service provider.

Function as a Service" (FaaS): Serverless computing in cloud service models is also called "Function as a Service" (FaaS). This is a relatively new cloud service model that provides solutions to build applications as simple, event-triggered functions without managing or scaling any infrastructure.

The benefits of Cloud Computing in Education

	Cloud computing has numerous benefits for education: **Accessibility:** Cloud-based educational resources are easily accessible to students and teachers, eliminating the need for physical textbooks and enabling remote learning. **Collaboration:** Cloud computing enables real-time collaboration among students and teachers, regardless of their physical location, fostering teamwork and knowledge sharing. **Connectivity:** Cloud-based learning systems enhance connectivity, benefiting marginalized students and working professionals who lack access to traditional educational facilities. **Flexibility:** Cloud computing saves time and effort for faculty and students, offering greater flexibility in terms of learning pace, remote access, and efficient collaboration. **Cost savings:** Cloud-based education systems can be cost-effective, reducing the need for expensive hardware and physical storage, and minimizing paper usage. **Data security and backups:** Cloud servers provide secure storage and automatic backups, ensuring data safety and availability even in unforeseen circumstances. **Learning Management System and its benefits in education** The learning management system (also known as LMS) definition refers to it as software that enables educational institutions to manage all aspects of the digital learning process. It is a centralized online education hub where educators can create and manage lessons, assign quizzes, and grade students. Moreover, it serves as an open communication channel between teachers, students, parents, and administrative staff. A cloud-based LMS makes it easy to manage courses from a single location. This eliminates the need to store course materials on individual servers, reducing costs and helping to improve student engagement. Also, it can save money by eliminating the need to install and maintain separate course management systems, and it can improve student engagement by making it easy for students to access course materials and participate in class discussions. **Cloud Storage and its benefits in education** Cloud storage is the storage of data in virtual pools created over a network by servers. There are various companies that operate large-scale data centers and provide space for storage. Cloud storage saves your files, and even if your computer malfunctions, your files remain unaffected. Physical storage encompasses multiple servers (sometimes in multiple locations), and the

	owner and administrator of the physical environment is typically a hosting company. These cloud storage providers are responsible for keeping the data available and accessible, as well as ensuring the physical environment is secure, protected, and operational. Individuals and organizations purchase or rent storage capacity from providers to store user, organizational, or application data. Educational institutions need to track each student's performance and overall progress, meaning they must implement crucial metrics within the system. For example, educators could assess student preparedness for exams based on average pages read, the number of research documents downloaded, and the types of books shared amongst peers. Shared file servers have the flexibility to accommodate these metrics. Southern Connecticut State University is using data centers collected from shared file servers to conduct longitudinal studies that span a student's freshman orientation to graduation. With this information, they may be able to create a tailored learning experience for individual students. The adoption of devices, like E-learning tools and apps, has made it possible for students to connect with each other, share ideas, and study for tests.

Concrete methods to transmit knowledge: **Activities N. 1**	What kind of practical activities (NFE) are you going to implement in order to transmit the knowledge?	
		Methods that will be used; - Roleplay: Participants will act as a search engine and a voice assistant. - Collaborative Learning: Participants will work and learn together. - Problem solving: Teams will attempt to solve word puzzles. - Brainstorming: Learners will reflect on the topic.
	Main Aim	- To define cloud computing - To introduce common cloud systems - To define the Learning Management System

	Used tools	Computers/Tablets/Phones for research, Padlet.Com
	Material and preparation	**Materials:** - 4 bags - Cardboards, papers and laminated papers - Pen/Pencils/Markers - Ringbell - Cloud Shaped Cardboard - 4 Folders - 4 boxes - Letters - Pins - List of cloud computing terms and their corresponding definitions - **Preparation for Ice Breaking Activity;** - Prepare a list of cloud computing terms and their corresponding definitions for each group on an A4 sheet. List of cloud computing terms and definitions: - Cloud: A network of remote servers hosted on the Internet used to store, manage, and process data. - Virtual Machine: An emulation of a computer system that enables multiple operating systems to run on a single physical machine. - SaaS (Software-as-a-Service): A software licensing and delivery model where

		applications are hosted centrally and accessed via the internet. - Bandwidth: The maximum amount of data that can be transmitted over a network in a given period. - Encryption: The process of converting information or data into a code to prevent unauthorized access. - Big Data: Large volumes of data, often complex and unstructured, that cannot be easily processed or managed using traditional methods. - Infrastructure-as-a-Service (IaaS): A cloud computing model where virtualized computing resources, such as servers and storage, are provided over the internet. - Platform-as-a-Service (PaaS): A cloud computing model that offers a platform with tools and services for developing, testing, and deploying applications. - Public Cloud: A type of cloud computing that provides resources and services to multiple users over the internet, owned and operated by a third-party cloud service provider. - Private Cloud: A cloud infrastructure exclusively dedicated to a single organization or user, offering greater control and security. - Hybrid Cloud: A combination of public and private clouds, allowing data and applications to be shared between them. - Data Center: A facility that houses computer systems and associated components, such as servers, storage, and networking equipment, for storing, managing, and processing large amounts of data. - Scalability: The ability of a system or application to handle increased workloads by

		adapting and expanding its resources, such as processing power and storage capacity. - Multi-tenancy: A cloud computing architecture where a single instance of software serves multiple customers (tenants), while keeping their data isolated and secure. - Disaster Recovery: Strategies and processes put in place to quickly restore and recover data and systems in the event of a natural or man-made disaster. - Internet of Things (IoT): A network of physical devices, vehicles, appliances, and other objects embedded with sensors, software, and connectivity, enabling them to collect and exchange data over the internet. **Preparation for Main Activity;** - Prepare four separate sheets of paper with 15 relevant questions related to cloud computing. - Write the answers to these questions on cards and place them in four separate bags. - Ensure there are five more answer cards than the number of questions. - Write numbers on the back of the answer cards and mix them up. - Write numbers on the back of letters and place the letters in a box for each group. - Prepare incorrect letter cards (X, B, F, H, J, K, N, Q, W, and Z) and mix them with other letter cards. - Place a cloud-shaped piece of cardboard and a bell on the tabletop as a central point for activities. - Label folders with group names.

		Questions for the voice assistants: 1) What is Cloud Computing? 2) How does Cloud Computing differ from traditional computing models? 3) What are the key characteristics of cloud computing? 4) Why are key characteristics of cloud computing important? 5) How does cloud computing enable scalability and flexibility for education? 6) What are the main service models in cloud computing? 7) How do the main service models in cloud computing differ? 8) What are common cloud systems? 9) What are some popular cloud platforms for deploying and managing? 10) What is a Learning Management System (LMS)? 11) How is LMS used in education and training? 12) What are the key features of an LMS? 13) How do LMS benefit learners and educators? 14) How does an LMS facilitate the creation, delivery, and tracking of online courses? 15) How is data privacy and security addressed in Learning Management Systems? **Correct Answers:** 1) Cloud computing is a model of computing where resources are delivered over the internet and can be accessed on-demand.

		2) Cloud computing differs from traditional computing models in that it allows for the on-demand provision of computing resources over the internet instead of relying solely on local infrastructure. 3) The key characteristics of cloud computing are on-demand self-service, broad network access, resource pooling, rapid elasticity, and measured service. 4) The key characteristics of cloud computing are important because they enable flexibility, scalability, cost optimization, and efficient resource utilization. 5) Cloud computing enables scalability and flexibility for education by allowing educational institutions to easily expand or shrink their IT resources based on their needs. 6) The main service models in cloud computing are Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). 7) The main service models in cloud computing differ in terms of the level of abstraction and control provided to the users, with IaaS offering infrastructure resources, PaaS providing a platform for application development, and SaaS delivering ready-to-use software applications. 8) Common cloud systems include Amazon Web Services (AWS), Microsoft Azure, Google Cloud Platform (GCP), and IBM Cloud. 9) Popular cloud platforms for deploying and managing applications include AWS Elastic Beanstalk, Microsoft Azure App Service, and Google Cloud App Engine. 10) A Learning Management System (LMS) is a software application that enables the creation, delivery, and management of online learning experiences. 11) LMS is used in education and training to deliver online courses, track learner progress, facilitate communication, and manage learning resources. 12) Key features of an LMS include course management, content authoring, learner enrollment, assessment and grading, and collaboration tools. 13) LMS benefits learners and educators by providing

		anytime, anywhere access to educational content, personalized learning experiences, progress tracking, and communication channels. 14) An LMS facilitates the creation, delivery, and tracking of online courses by providing tools for course authoring, content organization, learner enrollment, and progress monitoring. 15) Data privacy and security in Learning Management Systems are addressed through measures like user authentication, data encryption, access controls, regular backups, and compliance with data protection regulations. **Incorrect answers:** 1) Cloud computing is a weather forecasting technique that predicts cloud formations in the sky. 2) Cloud computing involves harnessing the power of actual clouds to perform computational tasks, whereas traditional computing models rely on physical servers. 3) The key characteristics of cloud computing are rain, thunder, lightning, cumulus clouds, and cirrus clouds. 4) The key characteristics of cloud computing are not important at all; they are just fancy terms used to confuse people. 5) Cloud computing allows educational institutions to shrink their IT resources and make them less scalable, leading to more rigid and inflexible systems. The numbers behind the answers should not be in order and should be done with separate sequencing for each bag.
	Session Description	The game can be played by 8-16 participants.

		Ice Breaking (10 mins) - Divide the participants into groups of 4-6 people, ensuring there are at least 8 people in total. - Provide each group with a list of cloud computing terms and their corresponding definitions. - Explain to the participants that they will be creating their own cloud computing names based on these terms. Each person will choose a cloud computing term and create a unique name for themselves. For example: John chooses "Java Virtual Machine" and becomes "Java John." Sarah selects "Security" and becomes "Secure Sarah." - Once everyone has chosen their cloud computing names, have each person introduce themselves to the group using their new name and provide a brief explanation of the cloud computing term they selected. - Encourage participants to ask questions and engage in discussions related to cloud computing as they learn about each other's names. - After each person has introduced themselves, you can facilitate a group discussion by asking open-ended questions about cloud computing in education, such as: ● How do you think cloud computing can enhance the learning experience in schools? ● What are some potential challenges or concerns related to implementing the cloud computing in educational institutions?

		Main Activity (30 mins) - Divide participants into 4 groups, each consisting of 1 voice assistant and 2 search engines. - Guided by the instructor, voice assistants take turns reading the questions. - Search engines search for answers in the bag and place them in a folder. - Once all questions are completed, search engines take the folder to the cloud-shaped cardboard, pinning it and ringing the bell. - Voice assistants retrieve the folder and match numbers on the back of the answers with letters in their box. - Some numbers (incorrect answers) correspond to incorrect letters. - After matching numbers with letters, they reveal a unique word for their group (Cloud Computing, Cloud Storage, Cloud Systems, or Cloud Service). - If search engines filed the wrong answer card, the number won't match the letter, and the word won't be revealed. - After solving the word, they arrange the letters in sequential order, file them, and return to the cloud-shaped cardboard, pinning them and ringing the bell. - The first group to finish wins. - If they cannot reveal the word, they need to check their answers again. The instructor judges the matching of numbers with letters to prevent voice assistants from matching wrong numbers. Wrap Up (10 mins)

		- Divide participants into 4 groups - Instruct each group to research on the web for their unique word within a time limit of 5 minutes. - Once the word is determined, each group comes up with a descriptive sentence about their word. - Write the sentence on cardboard and hang it on the wall, creating a collective "Terminology Wall" that includes contributions from all groups. - Encourage participants to share their words and sentences with the rest of the groups, fostering knowledge exchange and collaboration. Reflect on the collective "Terminology Wall" as a visual representation of the diverse cloud computing concepts explored during the activity.
	Debriefing	The facilitator shares the link to Padlet.com with participants to share their thoughts by asking open-ended questions at the end of the activity. If there are any concerns, areas that they did not understand, or places that need improvement or correction, the facilitator addresses them based on the feedback received from the participants. The questions are; - What did you learn about cloud computing through these activities? Can you define cloud computing in your own words now? - How do you think the knowledge or skills gained from this activity can be applied in other contexts?

		- How did the roles of voice assistants and search engines contribute to the activity? Did everyone have an opportunity to participate and contribute? - What was the most interesting or memorable part of the activities for you? Why? Padlet link: https://padlet.com/niceaproject/introduction-to-cloud-computing-for-education-b79dcqkkh616kaml Password for Padlet: CloudComputing

Concrete methods to transmit knowledge: **Activities N. 2**	What kind of practical activities (NFE) are you going to implement in order to transmit the knowledge?	
		Methods that will be used; - Collaborative Learning : Groups will work and learn together - Problem Solving : Groups will attempt to answer the questions - Station Method: Groups will take turns
	Main Aim	• To explain the benefits of cloud computing in education • To define the learning management system (LMS) and explain its role in education

		• To define cloud storage solutions • To explain the benefits of using cloud storage and file sharing in education
	Used tools	Computers/Tablets/Phones for research, Menti.Com
	Material and preparation	Materials: - Timer - Cardboards - Pen/Pencils - Tablets/Computers/Phones Preparation for Main activity; - Divide the participants into 4 groups of roughly equal size. - Set up 4 tables each labelled with a number or name corresponding to the group. - Assign one person from each group to be the "writer" who remains at their assigned table throughout the activity. - Prepare a list of specific questions for groups, one for each table. - Print out the assigned questions and place them on the respective tables. - Ensure each participant has access to a smartphone, tablet, or computer with internet connectivity. - Provide participants with cardboards

		Questions for groups: 1) What are some benefits of cloud computing in education? 2) How would you define a Learning Management System (LMS) and explain its role in education? 3) What are cloud storage solutions, and how do they work? 4) What are the benefits of using cloud storage and file sharing in education?
	Session Description	The activity can be done with 8-12 participants. Main Activity (40 mins) - The participants are divided into 4 groups. - Each group designates one person to remain at the writer and stay at their assigned table. - A specific question is assigned to each table for the participants to answer. - Participants, working as a group, use their phones/tablets/computers to conduct research and write down the answers to the question for 5 minutes. - After 5 minutes, the groups rotate to the next table. - The new participants at each table continue writing down answers to the questions. - These steps are repeated until all participants have visited all the tables. - Once everyone returns to their initial table, they use drawings, photos, and emojis on the cardboards that has been used to prepare a presentation for their group question within 10

		minutes. - Each group presents their transformed presentations to the other groups within 10 minutes. Wrap Up (10 mins) - Gather all the participants in a central area - Explain that the wrap-up activity will involve sharing insights and reflections on the topic of cloud computing based on the group presentations. - Ask each group to highlight one key takeaway or interesting finding they discovered during their research and presentation process. - Encourage other groups to listen actively and take notes on the insights shared. - After each group presents, open the floor for a brief discussion by asking questions related to the presented insights. For example: ● What are the potential benefits of incorporating cloud computing in education? ● What challenges or considerations should be taken into account when implementing cloud computing solutions? ● How can cloud computing contribute to innovation and collaboration within education? ● What are some potential ethical or security concerns related to cloud computing? - Facilitate a dynamic discussion by allowing participants to share their thoughts, ask questions, and engage in dialogue. - Summarize the key insights and ideas that emerged from the group presentations and the

		subsequent discussion.
	Debriefing	The facilitator shares the link to Mentimeter.com with participants to share their thoughts by asking open-ended questions at the end of the activity. If there are any concerns, areas that they did not understand, or places that need improvement or correction, the facilitator addresses them based on the feedback received from the participants. The questions are; - Did this activity change your perception of the importance of preserving information or collaboration? - What are some key takeaways or lessons learned from this activity? - What do you think about the importance of cloud systems in education? - Which cloud storage solutions are you currently using and which ones will be added? Mentimeter Link : https://www.menti.com/al7yk9o4cx9i

Module	What is the source from which you gathered the information about the form?
References	- Adaptive and Distance Learning *https://en.wikipedia.org/wiki/Adaptive_learning* - Benefits of the Cloud Computing in Education *https://www.infosysbpm.com/blogs/education-technology-services/cloud-c*

	omputing-benefits-in-education.html#:~:text=Cloud%20computing%20in%20education%20enhances,to%20succeed%20in%20today%27s%20world - Cloud Computing definition https://www.ibm.com/topics/cloud-computing - Different types of Cloud Computing Services https://cloud.google.com/discover/types-of-cloud-computing - The benefits of using cloud-based LMSs in education https://www.theedadvocate.org/the-benefits-of-a-cloud-based-lms/#:~:text=A%20cloud%2Dbased%20Learning%20Management,costs%2C%20and%20improve%20student%20engagement - The benefits of using cloud storage and file sharing in education https://news.elearninginside.com/the-benefits-of-using-a-share-file-server-in-education/

Evaluation methods	How are you going to evaluate the level of understanding among the target group of the training?
	Participants will be sent a survey via Google Forms at the end of the activities. The survey will consist of a total of 10 questions. There will be 7 rating scale questions and 3 open-ended questions. For each rating scale question, participants will be asked to evaluate it on a scale of 1 (strongly disagree) to 5 (strongly agree). This way, both quantitative and qualitative data will be collected from participants. Questions: Rating Scale Questions (On a scale 1 to 5): 1) How would you rate your overall satisfaction with the activities? 2) How would you rate the relevance of the activities in relation to the topic of cloud computing? 3) To what extent do you agree that the activities enhanced your understanding of cloud computing concepts?

	4) How effectively did the activities engage you in active participation and learning? 5) How would you rate the clarity of instructions provided during the activities? 6) Do you feel that the activities provided a valuable opportunity to apply and reinforce your knowledge of cloud computing? 7) How likely are you to recommend these activities to others interested in learning about cloud computing? Open-Ended Questions: 8) Please share any suggestions or improvements for the activities or content. 9) In your opinion, what was the most valuable aspect of the activities related to cloud computing? 10) Can you provide any examples of how the activities have influenced your understanding or perspective on cloud computing? Google Forms Link : https://forms.gle/Emhtse6Xb8M4vnkP8

Module 2: Cloud-Based Collaborative Tools for Education

Learning Objectives	What do you want to achieve by implementing this module?
	The main aim of this module is to help the target group understand the main Cloud-based tools available for education: • VET learners and providers will understand the benefits of using cloud platforms to enhance educational experiences, the module aims to highlight the sharing of resources, feedback and learning-oriented tools mimics collaboration between students and teachers and ultimately increases learning outcomes • Understanding the main Cloud-based collaboration tools for education that are free to use: Google Workspace for Education Fundamentals (Classroom, Google Meet, Google Docs, Google Sheets and Google Forms) and Office 365 Education (Exchange, SharePoint, OneDrive, Forms, Stream and Sway) • Understanding Cloud-based communication main tools, such as video conferencing and chat platforms: Google Meet and Zoom • Creating and managing an online classroom using cloud-based tools by selecting the product more suitable for the teacher and students' needs • Hands-on experience with using cloud-based collaboration tools for group projects and assignments

Learning Outcomes	What are the expected results of this module?
	At the end of this module, both VET learners and VET providers will be able to understand the different possibilities offered by cloud computing for education, will know the main tools available and will be able to select these tools according to their needs. More specifically, the outcomes are as follows: • VET learners and VET providers will be able to understand the different components of Google Workspace for Education Fundamentals, how to access to them and how to access to free online tutorials • VET learners and VET providers will be able to understand the different

	components of Office 365 Education, how to access to them and how to access to free online tutorials • VET learners and VET providers will be able to manage a virtual classroom on Google Meet • VET learners and VET providers will be able to manage a virtual classroom on Zoom

Theoretical content	What are going to be the main theoretical contents of the module?
	Google Workspace for Education Fundamentals Google Workspace for Education is a set of Google tools and services that are tailored for schools and homeschools to collaborate, streamline instruction, and keep learning safe. Google Workspace for Education offers multiple options: 1. Google Workspace for Education Fundamentals: Gives you tools to aid teaching and learning, such as Classroom, Google Meet, Google Docs, Google Forms, and Google Chat. 2. Google Workspace for Education Standard: Same tools as Education Fundamentals but with advanced security features and enhanced administration controls. 3. Teaching and Learning Upgrade: Adds enhanced video-communication capabilities, Classroom add-ons, and other features and tools to your Education Fundamentals or Education Standard edition. 4. Google Workspace for Education Plus: Includes all the features in Education Standard and Teaching and Learning Upgrade with additional features for certain services, such as attendance tracking in Google Meet. Education Fundamentals is free to all qualifying institutions. Education Standard, Teaching and Learning Upgrade, and Education Plus are all paid subscriptions. Here is the step by step guide on how to access to Google Workspace for Education **Google Classroom**

Google Classroom is a suite of online tools useful for both teachers and students. It allows teachers to set assignments and add materials to their lesson, it allows students to submit homeworks, it provides assessments and offers a number of useful tools for interaction. The announcements are a great example of an interaction tool, they can be sent to the whole class and can be adjusted in different ways depending on the needs. Also, Classroom allows teachers to invite parents and guardians to sign up for email summaries with a student's upcoming or missing work.

In addition, to avoid plagiarism, Google offers an originality report function that allows teachers to check against other student papers from the same school.

Google Classroom was born as a way to eliminate paper in classrooms and make digital learning possible. The use of this tool is now widespread and more and more schools have rapidly implemented paperless education.

Classroom works with Google Docs, Sheets, Slides, Sites, Earth, Calendar and Gmail and can be supplemented by Google Hangouts or Meet for live teaching or questions.

Since Google Classroom is online-based, you can access it from pretty much any device with a web browser. There are device specific apps for the likes of iOS and Android, while it also works on Mac, PC, and Chromebooks.

A big advantage of Google is that on most devices it is possible to do work offline, uploading when a connection is found. This all allows teachers and students to use Google Classroom since they can connect with it via any personal device.

Here is the official free guide to use Google Classroom for teachers

Here is the official free guide to use Google Classroom for students

For more practical information, you can visit this website.

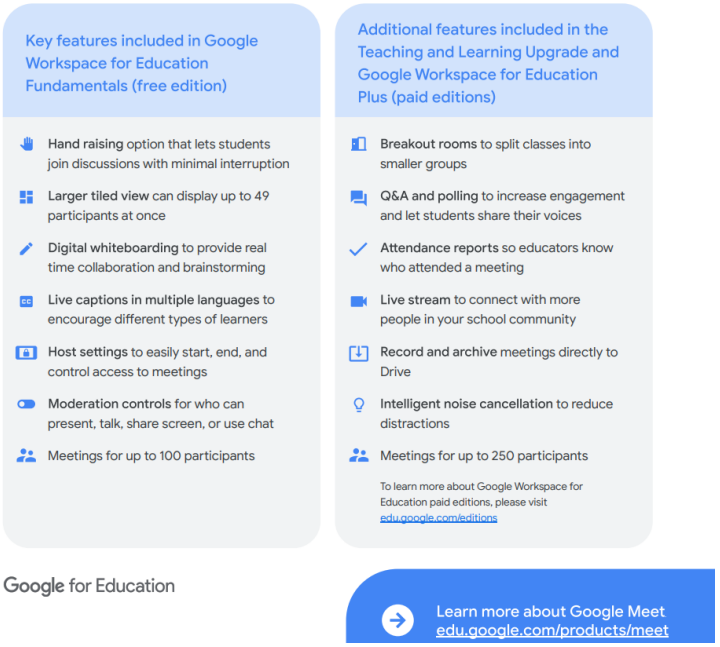
Google Meet

Google Meet connects teachers and students with video for classes, parent-teacher conferences, professional development and more. Included in Google Workspace for Education, Meet integrates seamlessly with other products like Classroom, Slides, Docs, and Gmail.

The free version of Google Meet has many options available, from general features that help the management of the class, to specific tools for

moderators and admin, plus engagement and inclusivity features.

Google Meet is evolving and adding new features to give educators more control over their video meetings and boost engagement in virtual classes.



In regard to moderators' features, they let teachers manage attendees and content quickly, easily, and securely.

Moderators have lock capabilities they can activate when needed:

- Decide who can share their screen to keep sessions focused
- Lock the chat feature to limit side conversations
- Mute individual participants or quickly mute all participants at once to keep lessons on track

Also, moderators can take charge of meeting requests that come from inside or outside of the school domain. No need to worry about anonymous attendees and when leaving a meeting, the moderator can end it for all participants, ensuring no students linger after the teacher left.

Here is the official free guide to use Google Meet

Google Docs

Google Docs allows students and teachers to create and edit text documents

	right in the web browser, no special software is required. Multiple people can work at the same time, everyone can see people's changes as they make them, and every change is saved automatically. Over the years, many teachers using Google Docs appreciated its many functionalities and wrote articles and reviews about them, suggesting ways to use the tool in the classroom. Without any doubt, one of the best use of Google docs is editing students' work and providing ongoing feedback. Further, Google Docs's revision history allows teachers to see the changes made to a document to help see the student's process. Using the revision history option is as easy as clicking the File menu and selecting "See revision history." Sharing lessons is another great function of Google Docs. Using a shared Doc list available through Google Docs, clicking on "create a folder for your grade level to share resources" to share it with the whole school. It is also possible to find lessons through the list, to use and adapt in different classrooms. Google docs is also useful to communicate with parents. In fact, Google suggests using spreadsheets to share with parents that track student homework (it recommends giving each student an anonymous number to be shared with parents). Further, Google highlights the ability to translate documents into other languages with just the click of a button. Teachers can write documents to parents who speak a different language by simply clicking "Translate Document". Not to mention that this modality of communication takes the stress away completely from sign-up sheets. The tool "Template Gallery" gives hundreds of templates for different uses, like course syllabus, design a student certificate, formalize teaching notes, or plan a project. Another useful feature is the "Suggesting Mode". When the teacher and students are collaborating on a project, or doing peer evaluation, it's possible to suggest changes, without actually making any. To enter the mode, first look in the toolbar with an editing pencil icon, click on the arrow next to the pencil icon and select "Suggesting." Only the author of the document has the power to approve or disapprove any suggested changes. For education purposes, a great tool to use is the "Browse Education Add-ons". To access the Adds-on Store, click Add-ons > Get Add-ons from the menu. Select "Education" from the dropdown list: a massive extensions of tools will be available for the user, most are free. For example, EasyBib Bibliography Creator allows you to generate citations quickly. Easy Accents is a great tool to insert accents for different languages directly from the sidebar in Google Docs.

In addition, Google Docs

Here is the official free guide to use Google docs

Google Sheets

Google Sheets is a cloud-based spreadsheet tool useful for both teachers and students. It allows teachers to create spreadsheets useful for lesson planning and editing for students, who can quickly receive documents and resources. Google Sheets is useful for organising and reviewing educational activities, allows students to create quizzes and much more.

Students can work together on projects and see changes in real time, while the teacher can monitor progress.

As with Excel, Sheets allows formulas to be entered so that cells can automatically calculate results based on what is entered in other fields.

Despite being cloud-based, you can work offline and any changes you make are saved online as soon as you get a new connection.

One of the most useful aspects is the presence of several templates that can provide a starting framework. For teachers, there are many options to choose from online, which can be used and edited as desired. This is also a great way to share it with students, allowing each of them to edit a copy so that the original remains unchanged.

Among the most important functions of Google Sheets is the possibility of building a grade book (from scratch or from available templates). The online grade book can be opened at any time, as needed. Although Google Classroom already offers grade-based automation, this method allows more creative freedom. For example, one can use the data to create charts and graphs, for the class or for individual students, to see at a glance what progress has or has not been made. In addition, Sheets automates the grading process by avoiding hand calculations.

Google Sheets can also be used as Resource Point, structuring the sheet with assignments, reference books, and links to rich media such as videos. This is not only useful for organization for teachers but it's also great for students as a point of reference so they can see everything they need in one place.

Here is the official free guide to use Google Sheets

Google Forms

Google Forms is a very useful tool for teachers, a free online platform that integrates perfectly with Google Classroom.

Google Forms is a quick and easy way to create quizzes to share with students or other teachers, who can modify them according to the subject. This tool is also all cloud-based, so distributing anything you create is as easy as sharing a link.

Forms also offers numerous templates and a selection of pre-filled options for generating quizzes, assessments, worksheets and more.

Here is the official free guide to use Google Form:

Office 365 Education

Microsoft Office 365 Education is a Cloud-based package of tools developed by Microsoft to make education easier and faster for students.

Office 365 Education provides school staff, teachers and students with free e-mail services, sites, online document editing and archiving, instant messaging and web conferencing.

Office 365 Education is a special version designed especially for educational institutions, schools and universities. This version includes contact scheduling and management, Exchange-based e-mail, video and audio conferencing and chat with Microsoft Lync, instant messaging and SharePoint for intranet-based collaboration. With this software, users can also access the Microsoft Office web application and update online versions of OneNote, PowerPoint, Excel and Word, which they can use to view, edit and create documents.

Among the most positive aspects is the ability to access the package from anywhere, enabling teachers and students to optimise communications.

Exchange

Microsoft Exchange is an email server that runs on Windows Server operating systems. Exchange works with web-based mail clients like Microsoft Outlook, which can connect to and manage email from a variety of sources. In fact, Outlook is really optimized for Exchange and only works best when you're using

an Exchange account.

Microsoft Exchange is an email service offered by Microsoft that's most often used by businesses and academic institutions. It's a highly scalable solution that can support a huge number of users, and is designed from the ground up to keep email in sync between the server and end-user clients. Exchange delivers not just email but also a global address book of contacts, calendaring, meeting scheduling, and task management.

Here is the official free guide to use Microsoft Exchange

SharePoint

Thanks to SharePoint, users can use Office 365 to create a complete learning environment in which they can manage projects, share information, publish schemes of work, projects and announcements. In this way, you get the flexibility and power your educational institution needs.

SharePoint makes it possible to create a class site and provide students with features such as document libraries for course materials, shared calendars for lesson plans, discussions, and announcements.

Teachers can also create their own personal libraries inside or outside the class site to store materials and documents useful to the class.

It also allows students to complete assignments online and mark them for grading or take quizzes within the class site. You can also configure SharePoint Learning Kit if you want a free option for the e-learning component.

Another interesting feature for teachers concerns the ability to receive evaluations about learning materials. Students can offer ratings and tags-this real-time feedback about the material allows the most useful content to be found easily by other students. It also allows the teacher to know what works and what doesn't, so they can modify it.

Parents are also included in the functionality: with SharePoint VLE, parents can have their own access and view information about their children, from attendance reports to grades and report cards. SharePoint can also allow them to view lesson plans and class calendars.

Depending on the level of the educational institution, it may be useful to provide students with access to e-mail. In this case, SharePoint integrates with Exchange to provide students with an e-mail address.

In the event, on the other hand, that an instant messaging service is sought, SharePoint integrates with Lync, a solution for students to work together virtually, and a way for teachers to support students outside of regular class

hours.

Here is the official free guide to use SharePoint

OneDrive

OneDrive for education enables teachers, students and administrators to access all their work in the cloud. It allows them to store and protect files, share them with others inside or outside the school, and access them from anywhere and with any device. The drive is even active in offline mode, files can be saved for viewing or editing when there is no connection, changes are then automatically synchronized when the device reconnects to the Internet.

OneDrive also solves storage space issues. With the OneDrive Files On-Demand feature, teachers and students can securely access and work on all files stored in OneDrive without downloading them directly to their computers.

It is also possible to set specific permissions for who can access certain links, set expiration dates (for teachers who do not want students to access files or folders beyond a certain date) or passwords (for teachers who want to protect grades or exams, or for students who want to send their work outside of school for review). Blocking file downloads also prevents recipients from saving files on their own computers.

The integration with Office also allows teachers and students to receive a document and be co-authors, choosing from a range of tools to annotate, highlight and comment on the content in real time. You can use @mentions to flag comments and activities to other reviewers, and you can track version history to restore previous versions of files if necessary.

With "Request OneDrive Files" feature, anyone with a request link can upload files without viewing or accessing the folder, thus ensuring that the material the requestor has saved in the folder is protected.

Both students and school staff can take advantage of the feature. For example, a principal can create a link where teachers can upload standardized test results or a department head can share a link to request lesson plans for review.

Students working together on group projects can use the link to collect group members' notes and keep project materials organized.

With the "Add to OneDrive" feature, on the other hand, teachers and students can add links to folders that others have shared with them in OneDrive, Teams or SharePoint. This way, all of their content is brought together in one place, so they can access everything they need to prepare for classes.

Teachers and students can also upload files to shared cloud libraries they have added to their OneDrive. These files are synchronized with the SharePoint cloud libraries, which means that the files are also accessible through Teams, if the school uses it. Anyone who has gained access to a moved file retains that permission and receives a notification with a link to the new location.

Here is the official free guide to use OneDrive

Forms

Forms is a web-based Microsoft application that helps teachers easily create quizzes, assess classroom progress, gather feedback from students and parents, and customize instructional materials for each student.

Teachers can use Microsoft Forms to quickly assess student progress and get real-time feedback by creating quizzes to design and share with the class.

Quizzes can be created with a variety of question types, different score values can be set, or students can be directed along different learning paths.

Forms allows you to view points and student feedback after completing the quiz, includes rich, real-time analytics that summarize responses for the educator and results for individual students. Quiz results can be exported to Microsoft Excel for more in-depth analysis.

Here is the official free guide to use Microsoft Forms for education

Stream

Microsoft Stream is a video platform available in all Microsoft 365 Education plans. Stream offers the functionality of a video server: you can play a video and adjust the playback speed, it allows you to save video through its integration with Microsoft 365 (you just need to upload a video file to Teams, OneDrive or SharePoint and the file is ready to be shared or embedded securely from the Stream home page).

Microsoft Stream is not just a secure video distribution solution that conveniently stores files. It also helps educators teach by facilitating activities such as securely sharing video with small groups of students, classes, or families outside of school; optimizing video for students using mobile devices and for those watching from computers; recording both webcam and capturing what is happening on a computer screen (screencast); Monitor whether or not

specific students have watched a video and for how long; Provide assistive tools such as transcripts and subtitles to viewers; Create and share live Teams recordings for students absent from class or for educators who miss a faculty meeting.

Here is the official free guide to use Microsoft Stream

Sway

Microsoft Sway is an alternative function to PowerPoint as a presentation tool that enables collaborative work. The system is free on the Web, while for Microsoft Office users there are increased control and customization features available.

The idea behind Sway is to offer an extremely simple setup that allows anyone to create presentations in collaborative mode as well.

Microsoft Sway, in its most basic form, is a presentation tool. It uses slides to create a narrative flow that can be presented or flowed by the viewer at their own rate. This makes it ideal for classroom presentations and learning at home.

The convenience of Sway also lies in the many templates provided, thanks to which it is very easy to start creating a presentation right away.

Once the presentation is created, there is a share button in the upper right corner that allows you to create a link to the URL. The person sharing can decide if others can simply view the presentation or if they can have the option to edit it, which is useful for creating a collaborative project that groups of students can work on together.

The teacher can also create a template, duplicate it, and allow students to make any necessary changes before sharing it with other members of their work group to add their input.

It is also possible to change the way the presentation is navigated, either vertically or horizontally depending on whether a smartphone or computer is used.

Here is the official free guide to use Microsoft Sway

Google Meet : how to manage a classroom

Google Meet can be used in the classroom for various purposes, like conducting a live lecture, incorporating Jamboard, making virtual homeworks

	more interactive, working on projects together and so on. Here is free instructions for using Google Meet **Zoom : how to manage a classroom** Zoom is a free and easy-to-use online tool for organising meetings and lessons. Anyone can use Zoom by downloading the application or by using the web version. Here is free instructions for using Zoom for teachers

Concrete methods to transmit knowledge: **Activities**	What kind of practical activities (NFE) are you going to implement in order to transmit the knowledge?	
		Peer to peer quizzes - Collaborative Learning: Groups will work and learn together - Problem Solving: Groups will test each other - Station Method: Groups will take turns
	Main Aim	- To test the knowledge acquired around Google Workspace for Education : tools available and main use - To explain the benefit of using Google Workspace for Education for both students and teachers - To test the knowledge acquired around Office 365 Education : tools available and main use - To explain the benefit of using Office 365 Education for both students and teachers The activity involves participants developing questions on

		the topics covered in the module with the aim of testing each other's developed skills.
	Used tools	Blackboard Markers and pens Sheets of paper Clock/Timer to take the time
	Material and preparation	- Arrange a room with chairs and if possible tables divided into groups according to the number of participants, in front of the work area there should be a blackboard for each group to present their questions and write down their results - Provide all groups with paper and pens - In case of a final tie, the moderator will use the 3 questions below to determine the winner. There are 30 seconds to answer, the first who gives the correct answer gets one point. At the end, the group with more points wins. 1. What are the 5 main tools that Google for Education provides to students and teacher? answer: Classroom, Google Meet, Google Docs, Google Forms, and Google Chat 2. True or False: Microsoft One Drive has an integration with Office that allows teachers and students to receive a document and be co-authors, choosing from a range of tools to annotate, highlight and comment on the content in real time. answer: True 3. True or False: Google Classroom only works online, you must have internet connection to upload contents. answer: False, on most devices it is possible to do work offline, uploading when a connection is found. This all allows teachers and students to use Google Classroom since they can connect with it via any personal device

	Session Description	In this activity, participants are divided into 2 or more groups (each group 3 or 4 people). Each group has to write 5 questions about the topics covered during the training module, such as Google Workspace for Education Fundamentals and Office 365 Education. Questions can be "true or false" or can be with open answers, it's important that each question covers a different topic. Time for this first activity is 15 minutes. If the moderator notices that groups need more time, the activity can last longer. Each group is invited to present their questions to the rest of participants: they will read the question and each group will write the answer on a piece of paper. They have 1 minute to answer. After it, each group will read their answers: if the answer is correct, the group will gain a point (+1), if there are mistakes the score will be negative (-1). The group presenting the questions write on the blackboard the score of the rest of participants ,the moderator is also in charge of taking points and noting which questions were mistaken. At the end of the quiz, the group with more points will be the winner. If there is a tie, the moderator will use the final 3 reserve questions to determine the winner: each group will have 30 seconds to answer each question posed, the first who gives the correct answer gets one point.
	Debriefing	The activity concludes with a collective review of the results of the quiz. The moderator will have noted the wrong questions and will take the opportunity to repeat the topics that generated the most doubt. Participants will also be invited to expound on any remaining doubts.

Concrete methods to transmit knowledge: **Activities N. 2**	What kind of practical activities (NFE) are you going to implement in order to transmit the knowledge?	
		"Memory Box"

		- Brainstorming session: Participants will share ideas and knowledge gained - Collaborative Learning: Participants will work and learn together
	Main Aim	- To test the knowledge gained around Google Workspace for Education 's tools : Classroom, Google Meet, Google Docs, Google Forms, and Google Chat - To test the knowledge gained around Office 365 Education's tools : Exchange, SharePoint, OneDrive, Forms, Stream and Sway - To illustrate the different uses for education of the cloud systems above - To define the benefit for students and teachers in using the cloud systems above
	Used tools	Blackboard or large sheet paper Pens or pencils Paper sheets Cardboard box and papers with features of platforms covered during the module Clock / Timer
	Material and preparation	- The moderator prepares a series of papers on which he/she writes a feature/functionality of one of the cloud platforms explained in the module (below the list of features). The papers should be placed in the cardboard box and left on the table in front of the work area. Features to place on papers (not to write the cloud platform in capital letters, is the answer): 1. It allows teachers to set assignments and add materials to their lesson, it allows students to submit homeworks, it provides assessments and offers a number of useful tools for interaction - CLASSROOM 2. It allows teachers to invite parents and guardians to sign up for email summaries with a student's

		upcoming or missing work - CLASSROOM 3. It connects teachers and students with video for classes, parent-teacher conferences, professional development and more - GOOGLE MEET 4. A useful feature is the “Suggesting Mode”. When the teacher and students are collaborating on a project, or doing peer evaluation, it’s possible to suggest changes, without actually making any - GOOGLE DOCS 5. Ability to translate documents into other languages so that teachers can write documents to parents who speak a different language by simply clicking "Translate Document" - GOOGLE DOCS 6. One of the best options is building a grade book (from scratch or from available templates). The online grade book can be opened at any time, as needed - GOOGLE SHEETS 7. Very useful for organising and reviewing educational activities, allows students to create quizzes and much more - GOOGLE FORMS 8. It's a highly scalable solution that can support a huge number of users, and is designed from the ground up to keep email in sync between the server and end-user clients - EXCHANGE 9. Students can offer ratings and tags-this real-time feedback about the material allows the most useful content to be found easily by other students. It also allows the teacher to know what works and what doesn't, so they can modify it - SHAREPOINT 10. Parents can have their own access and view information about their children, from attendance reports to grades and report cards, they can also view lesson plans and class calendars - SHAREPOINT 11. It allows them to store and protect files, share them with others inside or outside the school, and access them from anywhere and with any device - ONEDRIVE 12. It is possible to set specific permissions for who

		can access certain links, set expiration dates or passwords to files and folders - ONEDRIVE Tteachers and students can add links to folders that others have shared with them also in different cloud platforms, so that all of their content is brought together in one place - ONEDRIVE 13. It allows you to view points and student feedback after completing the quiz, includes rich, real-time analytics that summarize responses for the educator and results for individual student - MICROSOFT FORMS 14. Quiz results can be exported to Microsoft Excel for more in-depth analysis - MICROSOFT FORMS 15. It also helps educators teach by facilitating activities such as securely sharing video with small groups of students, classes, or families outside of school - STREAM 16. Monitor whether or not specific students have watched a video and for how long - STREAM 17. Provide assistive tools such as transcripts and subtitles to viewers - STREAM 18. It uses slides to create a narrative flow that can be presented or flowed by the viewer at their own rate - SWAY 19. It's an alternative function to PowerPoint as a presentation tool that enables collaborative work - SWAY 20. Free and easy-to-use online tools for organising meetings and lessons- GOOGLE MEET & ZOOM - Prepare a room with chairs and possibly tables, a blackboard or a large sheet of paper displayed in front of where the group of participants will sit. Provide all participants with sheet papers and pens.
	Session Description	The moderator will pull one piece of paper out of the box at a time and read it aloud. He/She will also write the contents on the board in front of everyone, while participants have 1 minute to think about which platform illustrated in the form that feature/function belongs. The

		answer should be written on their paper and kept secret until the end of the game. The moderator proceeds to read all the pieces of paper and mark the various features on the board, while the participants answer privately. At the end of this first phase, each participant in turn reads the answer he or she has given, while the moderator notes the scores. Each positive answer is one point while each negative answer is score zero. When an error is encountered, it is an opportunity to see together the subject of any doubts. At the end of the game, the moderator counts the scores of each participant to determine the winner(s).
	Debriefing	The activity concludes with a collective review of all features written on the board. The board will serve as the final review of all modules done. Participants will share their doubts about the topic and the moderator will include any possible missing information.

Module	What is the source from which you gathered the information about the form?
References	- https://www.makeuseof.com/use-google-classroom-quick-start-guide/ - google_meet_one_pager_q320.pdf - https://edu.google.com/intl/ALL_us/workspace-for-education/meet/ - https://edu.google.com/intl/ALL_us/for-educators/product-guides/docs/?modal_active=none - 10 Ways to Use Google Docs in the Classroom - WeAreTeachers - 32 Ways to Use Google Apps in the Classroom - Presentazioni Google - What is Google Sheets How Does It Work for Teachers? | Tech & Learning (techlearning.com) - Google Sheets Training | Teacher Center | Google for Education - What Is Microsoft Exchange? Here's What You Need to Know (businessinsider.com)

	- Six Ways to Use SharePoint as a Learning Platform (cmswire.com) - OneDrive for education connects teachers and students in the new world of remote learning | Microsoft EDU - How to use Microsoft Stream for secure video sharing in the classroom | Microsoft EDU - What is Microsoft Sway and How Can it Be Used to Teach? | Tech & Learning (techlearning.com) -

Evaluation methods	How are you going to evaluate the level of understanding among the target group of the training?
	A final questionnaire online will be shared with Google Forms to collect participants' opinions and assess their overall understanding and satisfaction with the training module. The parameters assessed in the questionnaire will cover the following points: - Do you feel satisfied with the completed module? - How much do you think your skills regarding cloud tools for education have improved? - Do you think the final assessment activities were helpful in checking your level of knowledge learned? - Do you think you will use the cloud tools outlined in the module in your immediate future? - If yes, what cloud tools will you use specifically? If not, please explain why. - Are there any suggestions or feedback you would like to provide to improve the training activities proposed in the module?

Module 3: Cloud-Based Content Creation for Education

Learning Objectives	What do you want to achieve by implementing this module?
	The learning objectives of the module are as follows: • Overview of cloud-based content creation tools, such as Canva and Adobe Creative Cloud: the learning module aims to equip learners with the skills to effectively utilize cloud-based content creation tools, enabling them to design visually appealing graphics, videos, and other digital assets. • Understanding the benefits of cloud-based content creation for education: understand the advantages of cloud-based tools in facilitating collaboration, accessibility, and seamless sharing of educational content. • Hands-on experience with creating educational content using cloud-based tools: explore practical techniques for utilizing cloud-based platforms to enhance teaching and learning experiences, and to equip participants with the knowledge and skills to effectively utilize cloud-based tools for creating engaging and interactive educational content, fostering learner-centered experiences that enhance student engagement and facilitate effective knowledge acquisition.

Learning Outcomes	What are the expected results of this module?
	The expected learning outcomes of the module are as follows: • Learners will gain a comprehensive understanding of cloud-based content creation tools, enabling them to effectively utilize platforms like Canva and Adobe Creative Cloud to create visually appealing and professional-quality digital content. • Learners will understand how cloud-based content creation enhances educational experiences by fostering collaboration, enabling access to resources anytime and anywhere, and promoting seamless sharing and feedback, ultimately enhancing student engagement and learning outcomes. • Learners will have gained the ability to leverage cloud-based tools to create engaging educational content, enhancing their instructional design skills and enabling efficient collaboration in remote or distributed learning environments. They will be equipped to employ diverse multimedia elements and interactive features to deliver

	effective and accessible educational experiences.

Theoretical content	What are going to be the main theoretical contents of the module?
	Below, we have chosen to deal with the subject through an in-depth look at the characteristics of two fundamental and useful cloud-based content creation tools, the discussion of which allows us to get an idea of the scope and effectiveness that the introduction of these new methodologies can have on the level of student learning. **CANVA** Canva is a cloud-based content creation tool. Canva is a user-friendly platform that allows users to design various types of visual content, including social media graphics, presentations, posters, and more. Canva offers a range of key features and tools that simplify the content creation process. Its drag-and-drop editor enables easy manipulation of design elements. Pre-designed templates provide a starting point for various types of designs. Users can edit images and texts, access a vast library of design elements, and collaborate with others in real-time. Canva Pro offers advanced branding options and animation effects. Overall, Canva empowers users to create professional-looking designs with intuitive tools and ample creative resources. In Canva, users have a wide range of customization options to personalize their designs and create visually appealing content. They can choose from a diverse color palette, select from a vast collection of fonts, and access pre-designed layouts and templates for various types of content. Canva also provides an extensive library of stock photos, illustrations, icons, and shapes that can be resized and edited to fit the design. Users can adjust transparency and layer different elements to create overlays and visual effects. Canva's Brand Kit feature allows for consistent branding by storing logos, fonts, and color palettes in one place. With these customization options, users can make their designs unique, visually engaging, and aligned with their branding. Canva provides learners with the ability to apply design principles to create visually appealing content. They can utilize color theory to choose harmonious color schemes that evoke the desired mood or message. Typography options allow learners to select fonts and styles that enhance readability and convey the intended tone. Canva's layout tools help learners arrange design elements in a balanced and organized manner, considering principles such as alignment and contrast. By understanding and applying these design principles within Canva, learners can create visually engaging educational content. Moreover, Canva is an important tool for educational purpose, too. Canva's cloud-based platform offers accessibility and flexibility, allowing educators and

students to create and work on design projects from various devices and platforms. With Canva, learners can seamlessly access and edit their assignments anytime, anywhere, as long as they have an internet connection. This flexibility empowers students to work at their own pace and accommodate their individual learning styles, promoting a more inclusive and personalized educational experience.

In Canva, seamless sharing and distribution of educational content are made simple. Users can easily share their designs by granting access to others, allowing collaboration and feedback. Additionally, Canva offers various export options, such as PDF or image files, facilitating the dissemination of resources to students or sharing work with a wider audience through email, social media, or learning management systems. This streamlined sharing process enhances the accessibility and reach of educational content created using Canva's cloud-based platform.

Canva offers both a free version and a premium version known as Canva Pro.
In terms of subscription plan there are three different:

- Canva free (the basic version)
- Canva Pro (have the access to premium contents)
- Canva for Teams (all the features of Canva Pro, plus the chance to collaborate with other on projects using the same account)

In terms of features, down below the main differences from the free and the Pro version:

A. Free Version: The free version of Canva provides access to a wide range of design templates, images, and basic editing tools. It allows you to create designs for social media posts, presentations, documents, and more. However, some advanced features are restricted to the Pro version.
B. Canva Pro: Canva Pro includes all the features available in the free version and offers additional premium features, including:
    - Unlimited access to millions of premium stock photos, images, illustrations, icons, and other assets.
    - Advanced design tools such as the ability to resize designs easily, create custom templates, and upload custom fonts.
    - Branding features like the ability to create and save brand kits, which enable you to maintain consistent branding across your designs.
    - Collaboration tools that allow you to work with team members or clients on shared projects.
    - Additional storage capacity for saving and organising designs.
    - Priority customer support.

Down below are the links to some useful guides to using Canva:

1. **A step-by-step guide to designing from scratch** https://www.canva.com/learn/a-step-by-step-guide-to-designing-from-scratch/
2. **How to Use Canva: A Beginner's Guide** https://www.canva.com/learn/how-to-canva-beginners-guide/
3. **CANVA USER GUIDE** https://d31kydh6n6r5j5.cloudfront.net/uploads/sites/158/2020/06/Canva-Userguide.pdf
4. **CANVA Plans and Pricing** https://www.canva.com/pricing/

Here are some video tutorial participants can watch to get some basic knowledge about the tool:

- **How To Use Canva For BEGINNERS! (Canva Tutorial 2020)** https://www.youtube.com/watch?v=zJSgUx5K6V0&pp=ygUPY2FudmEgdHV0b3JpYWwg
- **Canva Video Editor - COMPLETE Tutorial for Beginners!** https://www.youtube.com/watch?v=AlrC-XaKwew
- **20 CANVA TIPS AND TRICKS // Canva Tutorial For Beginners** https://www.youtube.com/watch?v=_XOWhA1dK7Y

MIRO

Miro is a cloud-based collaborative whiteboarding platform that can be utilised in educational content creation to enhance student engagement and foster collaboration.
Miro is equipped with essential features that enable collaborative visual ideation and content creation. With its real-time collaboration capabilities, multiple users can work simultaneously on the same board, making it ideal for team projects and virtual classrooms. The infinite canvas provides ample space for creative exploration, allowing users to expand their ideas limitlessly. Miro offers a range of versatile tools, including sticky notes, shapes, and templates, which facilitate the creation of diagrams, mind maps, wireframes, and more. Additionally, Miro integrates seamlessly with popular tools like Slack and Jira, enabling smooth workflow integration and enhancing productivity.

Miro is a versatile cloud-based collaborative whiteboarding platform that offers various applications in educational settings. Educators and students can leverage Miro to enhance learning, foster creativity, and facilitate visual communication. For virtual classrooms, Miro can serve as an interactive whiteboard where teachers can share course materials, brainstorm ideas, and engage students in real-time activities. It allows for collaborative note-taking, visualising complex concepts, and organising group projects. In group projects, Miro provides a virtual workspace where students can collectively brainstorm ideas, create mind maps, and develop project plans. They can use sticky notes, shapes, and connectors to map out their thoughts and collaborate synchronously or asynchronously. Miro is also valuable for facilitating brainstorming sessions, allowing participants to contribute ideas, organise

	them, and visualise connections. It provides a dynamic and interactive environment for generating and refining concepts, fostering creativity and collaboration. In remote collaboration, Miro enables students to work together seamlessly, regardless of their physical locations. They can co-create presentations, diagrams, and visual materials, share feedback through comments, and engage in discussions in real-time. Overall, Miro empowers educators and students to engage in visual thinking, problem-solving, and effective communication. It promotes active participation, encourages collaboration, and enhances the learning experience in diverse educational contexts. Miro's cloud-based platform ensures easy access and compatibility across devices. Students and educators can use Miro on any device with an internet connection, including computers, tablets, and smartphones. This flexibility allows for seamless transitions between devices, enabling collaborative learning experiences anytime and anywhere. Whether in the classroom or at home, users can engage with educational content using the device of their choice. Miro offers both a free version and different premium ones, depending on your needs. About the price, Miro offers different pricing plans for teams and businesses. The exact pricing details can vary depending on factors such as the number of users, billing frequency, and additional features required. The free version of Miro is available at no cost, while the premium versions have associated fees. About the differences in features, Miro offers a range of features in its premium plans that may not be available in the free version. Some notable differences include: ● Board Limit: The free version of Miro has a limit on the number of boards you can create, while premium plans often provide unlimited boards. ● User Limit: The free version typically has restrictions on the number of team members who can collaborate on boards simultaneously. Premium plans often allow for more users, and some plans offer unlimited team members. ● Integrations: Premium plans often provide access to a broader range of integrations with popular tools and services. These integrations can include project management platforms, cloud storage services, and communication tools. ● Advanced Security: Premium plans may offer enhanced security features such as Single Sign-On (SSO) integration, advanced access controls, data encryption, and compliance with specific industry standards. ● Support: Paid plans often come with priority support, providing faster response times and additional assistance compared to the free version. ● Advanced Features: Premium plans may offer additional features like

	advanced collaboration tools, templates, presentation mode, voting and prioritisation features, timeline and Gantt charts, and advanced analytics and reporting. Down below are the links to some useful guides to using Miro: 1. **How to Use Miro: Everything You Need to Know** https://www.makeuseof.com/how-to-use-miro/ 2. **What is Miro and How to Use Miro for Virtual Collaboration** https://www.innovationtraining.org/what-is-miro-and-how-to-use-miro-for-collaboration/ 3. **Miro Basics: Guide for New Participants** https://miro.com/miroverse/miro-basics-guide-for-new-participants/ 4. **How to use Miro** https://blog.gitnux.com/guides/how-to-use-miro/ Here are some video tutorial participants can watch to get some basic knowledge about the tool: ● **Miro Mind-Mapping: Full Review (2018)** https://www.youtube.com/watch?v=Bnvn2H7gS_g ● **Full Miro Tutorial: 38 Miro Tips for Beginners in 2021!** https://www.youtube.com/watch?v=cqPEXDAdXtI ● **The COMPLETE MIRO Board Tutorial 2022 - Beginners to Advanced** https://www.youtube.com/watch?v=E2pStKSgmUA

Concrete methods to transmit knowledge: Activities	What kind of practical activities (NFE) are you going to implement in order to transmit the knowledge?	
	Tiltle	Theoretical presentation and project-based learning
	Main Aim	**Workshop Objectives:** ● Understand the fundamentals of cloud-based content creation tools. ● Gain hands-on experience with popular tools like Canva and Adobe Creative Cloud. ● Develop skills to design visually appealing graphics, videos, and other digital assets. ● Explore creative techniques and best practices for effective content creation. ● Foster a collaborative learning environment for sharing ideas and experiences.

	Timeframe	Duration: 2 hours and 20 minutes
	Used tools	Laptops; flipchart and markers.
	Material and preparation	Different topics to be prepared before. Theoretical presentation by using PowerPoint slides Here are some video tutorial participants can watch to get some basic knowledge about the tools: • **How To Use Canva For BEGINNERS!** (Canva Tutorial 2020) https://www.youtube.com/watch?v=zJSgUx5K6V0&pp=ygUPY2FudmEgdHV0b3JpYWwg • Canva Video Editor - COMPLETE Tutorial for Beginners! https://www.youtube.com/watch?v=AlrC-XaKwew • **20 CANVA TIPS AND TRICKS // Canva Tutorial For Beginners** https://www.youtube.com/watch?v=_XOWhA1dK7Y • **Miro Mind-Mapping: Full Review (2018)** https://www.youtube.com/watch?v=Bnvn2H7gS_g • **Full Miro Tutorial: 38 Miro Tips for Beginners in 2021!** https://www.youtube.com/watch?v=cqPEXDAdXtI • **The COMPLETE MIRO Board Tutorial 2022 - Beginners to Advanced** https://www.youtube.com/watch?v=E2pStKSgmUA
	Session Description	**Workshop Agenda:** Introduction and theoretical knowledge presentation (20 minutes) Provide an overview of cloud-based content creation tools and their importance in modern design. Discuss the key features and functionalities of popular tools like Canva and Miro. For the presentation's key points see the theoretical framework exposed before. Explain design principles and concepts relevant to creating visually appealing graphics, videos, and digital assets, focusing on the relationship of these elements to student learning. Don't forget to highlight best practices for

		efficient content creation workflows in the cloud. You can also use the videos linked before. Practical Session 1 (60 minutes) Divide participants into small groups (2-3 members per group) and give each group a topic to develop. Possible topic to be used might be: - Effective Classroom Management Strategies - Differentiated Instruction and Personalized Learning - Technology Integration in Education - Assessment and Feedback Techniques - Culturally Responsive Teaching Practices - Promoting Critical Thinking and Problem-Solving Skills Provide each group with laptops or access to computers with pre-installed cloud-based content creation tools. Assign a design task or project for each group to work on (e.g., creating a social media graphic, designing a promotional video). Encourage participants to explore the tools, experiment with different features, and apply the theoretical knowledge they learned. Encourage creativity and experimentation while designing digital assets using the cloud-based tools. Provide guidance and support to participants as needed. Group Discussion and Peer Review (30 minutes) Have each group present their completed design projects to the rest of the workshop participants. Encourage feedback and constructive criticism from both facilitators and peers. Foster discussions on design choices, challenges faced, and lessons learned during the hands-on practice session. Recap and Q&A (30 minutes) Recap the key takeaways from the workshop, emphasizing the practical skills gained. Facilitate an open Q&A session to address any remaining doubts or questions. Provide additional resources, such as tutorials, online communities, and reference materials for further self-study.

	Debriefing	Recap and Q&A

Concrete methods to transmit knowledge: Activities N. 2	What kind of practical activities (NFE) are you going to implement in order to transmit the knowledge?	
	Title	Experiential and interactive learning
	Main Aim	The main aim of this workshop is to show the differences produced on the impact of learning level between a learner-centered experiences, fostered by the increased use of cloud-based content creation tools, and that of the frontal lecture, where student interaction is limited. Therefore, this workshop aims to highlight the contrasting effects of learner-centered experiences, facilitated by the widespread utilization of cloud-based content creation tools, and traditional frontal lectures, which often restrict student interaction. By examining these approaches, participants will gain insights into how student engagement, knowledge retention, and critical thinking skills are influenced, ultimately emphasizing the importance of innovative instructional methods in today's educational landscape.
	Timeframe	Workshop Duration: 1 hour and 40 minutes
	Used tools	Laptop to make the presentation; 1 smartphone/laptop per group in order to join the quiz challenge; flip chart and markers
	Material and preparation	-Preparation of the presentation. -Preparation of the quiz on one of the available platform.
	Session Description	**Workshop Agenda** Title: Learner-Centered Experiences vs. Frontal Lectures Module topic presentation (20 minutes)

		Makes a presentation (you can help you out by using the theoretical information provided above) on cloud-based tools and their significance in modern education. Explain the benefits of cloud-based content creation tools, such as increased accessibility, collaboration, and flexibility in delivering educational content. Showcase examples of engaging and interactive educational content created using cloud-based tools, such as interactive presentations, multimedia resources, and collaborative projects. **It is important in this phase that you make a presentation as boring and frontal as possible.** Challenge Activity (30 minutes) 1. Divide participants into teams and introduce a quiz competition focused on cloud-based tools and their educational applications. 2. Use an interactive quiz platform, such as Lumi or Mentimeter, to create a series of engaging multiple-choice questions related to cloud-based content creation and learner-centered experiences. 3. Encourage teams to work collaboratively, discuss their answers, and earn points for correct responses. 4. Award prizes to the winning team, fostering a fun and competitive atmosphere while reinforcing the knowledge gained during the workshop. Introduction to the workshop's main objective (10 minutes) **Only after this second activity you can introduce to the workshop's main objective**: to compare the impact of learner-centered experiences facilitated by cloud-based content creation tools (second part of the workshop) with that of traditional frontal lectures (the first part). You will emphasize in this phase the importance of learner interaction and engagement in the learning process. By showing both the teaching style, you make learners understand themselves which method is more effective. Interactive discussion (30 minutes) At this point, the final interactive discussion is really important. You have to raise questions like: how did you learn more about the workshop's topic? Did you find more useful and engaging the first or the second teaching style? You will also:

		• Facilitate a guided discussion by posing questions that encourage participants to compare and contrast learner-centered experiences with frontal lectures. • Encourage participants to reflect on their own learning experiences and discuss the impact of increased student interaction, engagement, and content interactivity. • Prompt participants to share their observations and insights regarding the potential benefits and challenges of adopting learner-centered approaches supported by cloud-based tools.
	Debriefing	Wrap-Up and Reflection: Time: 10 minutes • Summarize the key takeaways from the workshop, emphasizing the benefits of learner-centered experiences and cloud-based content creation tools. • Encourage participants to reflect on how they can apply the knowledge and skills gained in their own teaching practices. • Provide resources and references for further exploration of cloud-based tools and learner-centered approaches in education.

Module	What is the source from which you gathered the information about the form?
References	Facilitator experience and SALTO Youth (https://www.salto-youth.net/)

Evaluation methods	How are you going to evaluate the level of understanding among the target group of the training?
	A final survey will be conducted to gather participants' perspectives and assess their overall understanding and satisfaction with the training module. To assess the effectiveness of your workshop on cloud-based content creation tools, you can include the following parameters in your post-workshop survey:

	• Overall Satisfaction: Ask participants to rate their overall satisfaction with the workshop. • Learning Outcomes: Inquire about the participants' perception of their understanding and knowledge gain regarding cloud-based content creation tools. • Hands-on Experience: Evaluate participants' level of hands-on experience with the tools covered in the workshop. • Design Skills Development: Assess participants' perception of their skill development in designing visually appealing graphics, videos, and other digital assets. • Workshop Structure and Delivery: Evaluate the workshop's structure and delivery methods. • Suggestions for Improvement: Provide an open-ended question or space for participants to offer suggestions on how the workshop could be further improved.

Module 4: Cloud Security in Education

Learning Objectives	What do you want to achieve by implementing this module?
	• *Appraise cloud computing architectures.* • *Overview of cloud security and its importance in education* • *Understanding cloud security risks and how to mitigate them.* • *Identify the threats, risks, vulnerabilities, side-channel attacks, and privacy issues associated with cloud-based IT services.* • *Implement safeguards and countermeasures for cloud-based IT services.* • *Configure cloud services.* • *Hands-on experience with implementing cloud security measures in an educational* • *Apply security architectures that assure secure isolation of physical and logical infrastructures.* • *Analyze industry security standards, certificates, regulatory mandates, audit policies, and compliance requirements.*

Learning Outcomes	What are the expected results of this module?
	Subject Specific Intellectual and Research Skills Having successfully completed this module one will be able to: • Critically analyse Web and Cloud based systems for security problems • Recognise and discuss examples of cyber security vulnerabilities **Transferable and Generic Skills** Having successfully completed this module one will be able to: • Communicate effectively on a broad range of issues with security professionals **Subject Specific Practical Skills** Having successfully completed this module one will be able to: • Argue and advice on the security of cloud applications • Use examples of security penetration testing tools

	• Perform a security assessment for an organisation as part of a team **Knowledge and Understanding** Having successfully completed this module, one will be able to demonstrate knowledge and understanding of: • The current trends in cyber security; threats, their importance, and why they are hard to face • The core technical elements of cloud-based security systems • Cyber security frameworks, standards and best practices, and how to apply these within an organisation

Theoretical content	What are the main theoretical contents of the module?
	I. Introduction ***A. Explanation of cloud computing*** A cloud computing service provides users with access to data, software applications, and services over the Internet. Cloud computing refers to a service that lets users store and access data and applications remotely rather than on their own computers or servers. Cloud computing offers users versatile and flexible options for accessing computing resources and services that aren't available with traditional on-premise infrastructure. This technology offers increased security, scalability, and reliability while enabling businesses and individuals to utilize computational resources without worrying about the hardware and infrastructure needed to support them. In general, cloud computing may be quite advantageous for anyone wishing to benefit from the most recent technology while lowering the cost and complexity of IT management. ***B. Benefits of cloud computing for education*** Some advantages of cloud computing for education include: 1. Cost-effective: By decreasing the need for physical infrastructure and maintenance expenses, cloud computing can help educational institutions save money. 2. Flexibility: Cloud computing offers flexibility in that data and apps can be accessed from any location with internet access.

3. Collaboration: Cloud computing makes it possible for students and teachers to work together on projects or assignments, as well as access and edit documents in real-time.
4. Scalability: Cloud computing can expand to meet the needs of educational institutions and students when needs change and additional resources are needed.
5. Security: To secure sensitive data, cloud computing companies often have strong security measures in place. This is crucial for educational institutions that must comply with laws and regulations regarding student privacy.

C. Overview of cloud security concerns in education

As most education organisations continue to embrace remote or hybrid learning, it has become clear that investing in a robust and resilient IT infrastructure, such as cloud technology, is a smart and necessary move. The cloud enables schools and districts to adapt quickly in times of crisis and continue to deliver learning to students at scale.

However, the cloud is not without its risks. For example, according to a 2020 Netwrix report, 54 percent of education IT professionals said that employees put data at risk by sharing it in the cloud without their knowledge. Meanwhile, 65 percent of educators don't regularly review permissions.

Remote learning has complicated these risks. "If anything, the pandemic has increased the cybersecurity challenges for K-12," says Sateesh Narahari, chief product officer at ManagedMethods, a cloud security provider. "It's also increased the complexity of cybersecurity."

That's why it's even more important for administrators and educators to be vigilant about security and privacy when using cloud-based platforms. IT teams must also adapt their cybersecurity strategies to keep online classrooms safe and secure.

Here's an overview of common cloud security risks they should be prepared to address:

Loss of visibility: Today, most students and school staff access cloud-based tools from multiple locations, networks and devices. This makes it harder for IT teams to maintain visibility into their users, says Narahari. In addition, because everyone is remote, assumptions about location-based security and privacy are not as valid as they were before the pandemic, he adds.

Data breaches and loss: Leakage or loss of student data is the biggest fear of educational organisations, especially when it comes to minors,

says Stephen Manley, chief technologist at data protection company Druva. The US Government Accountability Office found that thousands of K-12 students had their personal information compromised in data breaches between 2016 and 2020. "When a student's personal information is exposed, it can lead to physical, emotional, and financial harm," the GAO report said.

Insider threats: In addition to external hackers, IT teams need to be aware of threats within their environment, says Narahari. Unintentional sharing and other human errors also pose risks to data stored in the cloud, he explains. Students and teachers can also misuse cloud services and applications, downloading unauthorized applications or posting sensitive information in chat rooms.

Videoconference bombing (zoombombing): Cloud-based video conferencing platforms are also vulnerable to hackers. This has been widely reported in the mainstream media, with bad actors hijacking calls to share inappropriate images, shout profanities, and so on. Disruptive attacks can also involve students deliberately hijacking and disrupting online classes, says Narahari.

Advanced malware and phishing: Manley says malware and phishing attacks are also becoming more sophisticated. Ransomware, for example, has evolved to the point where it's no longer just about encrypting data. "It's now about exfiltration, where [cyberattackers] take your data before they encrypt it and threaten to release it if you don't pay a ransom," he explains. Right now, shared documents are the number one threat vector for ransomware in the education sector, Manley adds.

II. Cloud Security Risks in Education

A. Data breaches

Data breaches can have an immediate impact on hundreds of millions or possibly billions of individuals in the data-driven world of today. Data breaches have grown in scope along with the digital transformation as attackers take advantage of our everyday reliance on data. Although it is impossible to predict how big cyberattacks may get in the future, the biggest data breaches from the twenty-first century show that they have already gotten very huge. There are also situations where data was maliciously or purposefully stolen and reposted, as well as those where a business unintentionally exposed data without adequate protection.

Data Breach: What Is It?

A data breach is defined as the disclosure of private, sensitive, or protected information to an unauthorized individual. Unauthorized people examine and/or distribute the files in a data breach. A data leak might affect anybody, from small businesses and governments to large corporations. What's more, if they are not safeguarded, anyone can endanger others.

Data leaks typically result from flaws in: User behavior with technology

There are more gaps for data to fall through as our computers and mobile gadgets gain more connected functions. There are more new technologies being developed than we can adequately safeguard.

IoT devices are evidence that we are beginning to prioritize convenience over security.

Hackers are taking advantage of the obvious security weaknesses in many "smart home" gadgets, such as the absence of encryption. We'll continue to see this issue get worse since new digital goods, services, and tools are being used without adequate security testing.

Even if the backend technology was flawlessly configured, some consumers would probably still have subpar digital habits.

You are essentially certain to be at risk if you don't have complete security, both at the user and enterprise levels. Understanding how a data breach happens is the first step in protecting yourself and other people.

What causes data breaches?

The assumption is that an outside hacker is to blame for a data leak, but that isn't always the case. Intentional attacks can occasionally be linked to the causes of data leaks. It may, however, also be the result of a person's carelessness or weaknesses in the infrastructure of a business.

An example of a data breach is as follows:

An Insider by Accident. An illustration would be a worker viewing files on a coworker's computer without the necessary authorisation permissions. There is no information disclosed and the access is accidental. However, the data is regarded as compromised because it was read by an uninvited party.

Devices That Have Been Lost or Stolen. Anything that includes private information goes missing, even an unsecured and unencrypted laptop or external hard drive.

Malicious Outside Criminals. These hackers collect information from a network or an individual using a variety of attack routes.

A Malicious Insider.. In order to hurt a person or business, this person willfully accesses and/or shares data. Although the malevolent insider may have legal permission to use the data, their goal is to utilize it for illicit purposes.

B. Cyber-attacks

Any deliberate attempt to gain unauthorized access to a network, computer system, or digital device with the goal of stealing, exposing, altering, disabling, or destroying data, applications, or other assets is referred to as a cyberattack. Threat actors carry out cyberattacks for a variety of motives, including small-time thievery and acts of war.

The 10 Most Common Types of Cyber Attacks are:

- Malware: Malware is intrusive software or computer code that targets computer systems in order to infect, harm, or access them. Malware comes in a variety of forms, each of which affects devices in a unique way and interrupts operations; nonetheless, all malware variations are intended to jeopardize the security and privacy of computer systems.
- Denial-of-Service (DoS) Attacks: A Denial-of-Service (DoS) attack aims to bring down a computer system or network so that its intended users are unable to access it. DoS attacks achieve this by providing the victim an excessive amount of traffic or information that causes a crash. Both times, the DoS attack denies the service or resource that legitimate users (such as employees, members, or account holders) expected.
- Phishing: Phishing is a type of cybercrime when a target or targets are contacted through email, phone call, or text message by someone posing as a reputable organization in order to trick people into disclosing sensitive information including passwords, banking and credit card information, and personally identifiable information.
- Spoofing: Spoofing is a sort of scam when a con artist uses a fictitious email address, display name, phone number, text message, or website URL to trick a victim into thinking they are communicating with a reliable, well-known source. In order to make the communication appear legitimate at first glance, spoofing frequently entails modifying just one letter, number, or symbol. For instance, a phony domain name "netffix.com" could be used to send you an email that appears to be from Netflix.

- Identity-Based Attacks: Identity-based attacks take place when hackers target your computer, network, or account to get your personal data for nefarious or unlawful purposes. Threat actors use them, also referred to as impersonation attacks, to gather private information, take money, and harm the target's reputation.
- Code Injection Attack:Attacks that insert code into an application are referred to as code injection. The application then interprets the injected code, altering how the program runs. Attacks using code injection often take use of an application flaw that permits the processing of false data..
- Supply Chain Attacks: When someone gains access to your system through a third party provider or partner who has access to your systems and data, it is known as a supply chain attack, also known as a value-chain or third-party assault. Since more suppliers and service providers than ever before have access to sensitive data, this has significantly altered the attack surface of the typical organization in recent years.
  A supply chain attack now carries greater dangers than ever before because of new attack types, rising public knowledge of the risks, and heightened regulatory scrutiny. A perfect storm has been created between attackers' increased access to resources and tools.
- Insider Threats: Insider threats pose a complicated and changing risk to both the public and private spheres of all key infrastructure sectors. Understanding and developing an insider threat mitigation program need first clearly defining these threats. The Cybersecurity and Infrastructure Security Agency (CISA) defines insider danger as the risk that an insider will use their allowed access to harm the department's purpose, resources, people, facilities, information, equipment, networks, or systems. Insider threats can take many different forms, including physical harm, spying, sabotage, theft, and cybercrime.

C. Unauthorized access to devices or accounts

Unauthorized access describes those who get access to a network, endpoint, application, or device of a company without authorization. It is closely associated with authentication, a procedure used to confirm a user's identity when they access a system. "Unauthorized access device"

refers to any access device or credit card that has been misappropriated, lost, stolen, run down, or canceled.

Unauthorized access examples are:

- hacking information about money or bank accounts.
- stealing intellectual or organizational information.
- illegally keeping an eye on another user's data.
- unauthorized use or breach of another user's login information.

Additional frequent reasons for improper access

- weak passwords chosen by users, or shared passwords between services
- Attackers often utilize social engineering techniques, such as phishing, to send communications pretending to be reputable organizations in order to acquire user credentials.
- Compromised accounts: Attackers frequently look for a weak system to breach in order to access stronger systems.
- Insider threats: An unscrupulous insider may take use of their position to access corporate networks without authorization.
- The Zeus malware exploits botnets to access financial systems without authorization by stealing login passwords, banking information, and financial data.
- A commercial penetration testing tool called Cobalt Strike is used to carry out spear-phishing and acquire illegal access to computers.

D. Lack of control over data storage and access

Many companies have serious concerns about the confidentiality and privacy of their data. The protection of customer data is required by data protection laws such as the EU's General Data Protection Regulation (GDPR), the Health Insurance Portability and Accessibility Act (HIPAA), the Payment Card Industry Data Security Standard (PCI DSS), and many others, which also impose severe fines for security lapses. The vast amount of internal data that businesses possess is also crucial to preserving their competitive advantage. Although moving this data to the cloud has benefits, it has also raised serious security issues for 66% of firms. Many businesses have embraced cloud computing, but they lack the skills to make sure that both their staff and customers are utilizing it safely.

One of the main reasons for losing the control or access on cloud data is misconfigured cloud security settings. The tactics used by many

	enterprises to maintain their cloud security posture are insufficient for safeguarding their cloud-based infrastructure. This is influenced by a number of things. Because cloud infrastructure is intended to be simple to use and facilitate quick data exchange, organizations find it challenging to guarantee that data is only accessible to authorized parties. As a result, companies utilizing cloud-based infrastructure must rely on security measures offered by their cloud service provider (CSP) to setup and secure their cloud installations. Additionally, organizations using cloud-based infrastructure also lack total visibility and control over their infrastructure. Due to the fact that many firms lack experience with protecting cloud infrastructure and frequently install many clouds, each of which has a unique set of vendor-provided security controls, Other examples of losing the control over data storage and access are: **Unauthorized Access**: In contrast to an organization's on-site infrastructure, its cloud-based deployments are external to the network perimeter and open to the general public. Although this makes the infrastructure more accessible to users and customers, it also makes it simpler for an attacker to access a company's cloud-based services without authorization. An attacker may be able to acquire direct access with the use of improperly configured security or compromised credentials, possibly without the organization's awareness. **Account hijacking:** Password reuse and the usage of weak passwords are two common examples of severely lax password security. Because of this issue, phishing scams and data breaches are made to be even more damaging because a single stolen password can be used on numerous accounts. As enterprises increasingly rely on cloud-based infrastructure and applications for critical business processes, account hijacking is one of the more serious cloud security challenges. While compromised client credentials allow complete control over their online account, an attacker with access to an employee's credentials can access important data or functionality. Additionally, enterprises frequently struggle to recognize and counteract these threats in the cloud in the same way they do for on-premises equipment. **Insecure interfaces/APIs:** Application programming interfaces (APIs) and interfaces are frequently provided by CSPs to their clients. In an effort to make these interfaces simple for a CSP's clients to use, they are typically well-documented. However, if a customer has not adequately protected the interfaces for their cloud-based infrastructure, this could present problems. A cybercriminal may also utilize the customer-facing documents to find and leverage potential access points to the cloud environment of a company in order to access and steal sensitive data.

Lack of visibility: The infrastructure used by a company's cloud-based resources is not part of the corporate network and is placed outside of it. As a result, many conventional methods for attaining network visibility are ineffective in cloud environments, and some businesses lack security technologies that are specifically geared toward cloud environments. This may make it more difficult for a business to keep track of and defend against attacks on its cloud-based resources.

Data sharing with third parties: Data sharing is made simple with the help of the cloud. Many clouds provide users the choice of sending an explicit email invitation to a collaborator or sending a link to a shared resource that anybody with the URL can access.

Although this simple data exchange is a benefit, it can also pose a serious threat to cloud security. Controlling access to shared resources is challenging when link-based sharing is used, a popular choice because it is simpler than individually inviting each intended collaborator. A cybercriminal could guess the shared link, give it to another person, or steal it as part of a cyberattack, giving them access to the shared resource without authorization.

Malicious insiders: For any business, insider threats are a serious security concern. An organization's network and some of the sensitive resources it holds are already accessible to a malicious insider. Most attackers are discovered by their target during attempts to achieve this degree of access, making it challenging for an unprepared organization to identify a dishonest insider. Finding a malevolent insider on the cloud is even more challenging. Because of the absence of control over the underlying infrastructure that comes with cloud deployments, many standard security solutions are ineffective. This makes it considerably more challenging to identify hostile insiders, especially with the fact that cloud-based infrastructure is readily accessible from the public Internet and frequently has security setup issues.

Cyberattacks: Cybercriminals choose their targets based on the likelihood that their attacks will be profitable because cybercrime is a business. Cloud-based infrastructure is easily accessed from the public Internet, frequently has lax security, and holds a lot of confidential and priceless data. A successful attack can probably be performed many times with a high probability of success because the cloud is utilized by a wide variety of businesses. As a result, cloud deployments within corporations are frequently the target of cyberattacks.

E. Legal and regulatory compliance issues

Regulatory compliance describes the goal businesses aim for in achieving compliance. It alludes to the actions a business takes to adhere to legal requirements. To minimize duplicating effort, many businesses are automating compliance processes. additionally to manage the growing quantity of rules. Businesses must set themselves up for regulatory compliance in order to follow the rules and legislation that apply to their sector. The organization's policies, practices, and processes support its attempts to maintain compliance. Meeting all requirements, laws, regulations, guidelines, and rules is the ultimate aim. If you want your compliance efforts to be successful, monitoring them is essential. It's more complicated than just keeping a record of all the compliance rules. The best course of action is to include compliance monitoring in your operational procedures. Your organization may benefit greatly from a compliance program.

Control corporation rules and regulations

Make sure the policies and processes for your organization are properly documented. Make sure everyone is aware of the policies and procedures by including them in the staffhandbook. When requirements change, the compliance staff must adjust policies and procedures.

Employee education on the value of compliance

You can ensure that the documents are accessible both physically and online. Don't forget to train staff members in new areas so they know what to do. Additionally, you can implement a system of rewards for staff members who adhere to the guidelines and sanctions for those who don't.

Keep an eye on new laws and regulations

Changing rules and regulations require your compliance team to be up to date. The practice of monitoring rules and revising organization's policies is ongoing. It is vital to have a system in place so that your organization can easily adapt. In order to comply with regulations, software solutions can also assist in monitoring and updating modifications.

Internally audit compliance on a regular basis.

The best approach to keep track of how your organizationis doing with regulatory compliance is through a compliance audit. It can point up locations where there are bottlenecks and gaps, allowing you to intervene and act right away. Plan to have your organization's activities audited. To get a thorough picture of your compliance issue, conduct a few unannounced interviews as well.

Utilize software to simplify your compliance.

You might think about adopting a software solution for your compliance if you aren't currently. By automating policies and procedures, you can significantly reduce time and expenses. A lot of systems can also update your system automatically as laws and regulations change. It takes a much more proactive compliance.

III. Best Practices for Cloud Security in Education

A. Safeguarding data

1. Data encryption

Corporate executives face privacy and security challenges they do not have the knowledge or experience to address, and small to midsize businesses find cloud encryption inviting yet very confusing.

Cloud encryption transforms plaintext data into data that is completely indecipherable (called ciphertext), meaning if a cybercriminal manages to hack into your email or web traffic, they are left with useless information.

Encryption is hardly a new technology, but traditionally, encrypted data was stored on servers that resided on premises over which the company had direct control. Now, many business applications are hosted in the cloud.

Data exists in three different states: in transit, in use and at rest. In transit, data is traveling from one place to another; in use, data is currently being read, accessed, erased, processed, changed or updated on a computer system.

Not all corporate data requires encryption, and not all users have the same need to access data. Businesses should create rules to identify what information needs encryption and what data can be stored safely in plain text.

Data that requires encryption can be in any of the three states, but protecting data at rest is particularly essential. Encrypt sensitive data when it is created so that it is protected when stored in a data center.

Cloud encryption uses keys to scramble data to prevent bad actors from accessing it. If an organization loses or destroys its access key, its data may be unrecoverable, which is a big problem to consider when using this security method.

Although every reputable cloud service provider offers basic security, cloud users should implement additional measures to ensure data security.

	Multifactor authentication, microsegmentation, and network monitoring are all ways to protect your online accounts. These measures will minimize damage and theft in the event of a breach. Separating the encryption key from the encrypted data is essential in keeping data secure. Organizations should also keep a backup of all keys in an offsite location in case of disaster and audit that backup every couple of months. Manny Landrón argued that cloud service providers or third-party proxy providers should manage a company's encryption keys rather than the business's in-house IT department. This would add another layer of protection and reduce the complexity of key rotation and destruction. Even if you partner with a cloud service provider to encrypt your data and manage your keys, you still need to implement security redundancies and have skilled IT security team members on staff. The Cloud Security Alliance suggests that SMBs use add-ons for Dropbox to protect their data, and avoid letting the cloud services provider access their decryption keys. Cyberattacks on large data centers and commercial sites have increased, so data security should be a top priority for your company. Check out the best cloud storage and online backup services, including IDrive, Egnyte and Backblaze. When accessing the cloud, make sure your team follows clear protocols, investigates which software you already use that contains encryption capabilities, and employs highly rated internet security and antivirus software. **2. Password policies** Password Policy Best Practices **Use a password manager:** Users may complain that they can't remember their passwords, but by using a password manager they won't have to. These tools plug right into their Web browsers and offer up an extremely secure password for future use. **Password creation:** Clearly define password complexity requirements, including uppercase letters, lowercase letters, and minimum password length. Longer passwords are not always better, according to Microsoft's password guidance. **Password protection:** Your password policy needs to outline the ways users should not store passwords, such as on a sticky note tucked under

a keyboard. Make sure that everyone is only using password managers approved by the company, and integrate the product right into your Active Directory.

Password rotation: Users generally loathe periodic password changes, and many information security experts feel that regular password rotation encourages users to be less secure with their practices. If strong and unique passwords are used, you should be able to eliminate the need for periodic user account password rotations.

Consider using tools like a password manager and single sign-on to streamline password use throughout your organization. Multi-factor authentication is a good complement to a strong password.

3. Multi-factor authentication

Multifactor authentication (MFA) requires multiple methods of authentication from independent categories of credentials to verify a user's identity for a login or other transaction.

MFA creates a layered defense so that an attacker must breach at least one barrier before successfully breaking into the target.MFA systems typically require two-factor authentication (2FA), but can use any authentication scheme that requires two or more identity credentials.

Why is multifactor authentication important?

Traditional user ID and password logins can be compromised, potentially costing organizations millions of dollars. Multifactor authentication can help reduce security risks.

MFA authentication methods

Using multiple forms of authentication can make a hacker's job more difficult.

Knowledge-based authentication requires the user to answer a personal security question. Typical user scenarios include swiping a debit card and entering a PIN at the grocery checkout.

Possession factor authentication uses a device in the user's possession to log in, such as a badge, token, key fob or phone subscriber identity module (SIM) card. Mobile multifactor authentication uses a smartphone to provide the possession factor authentication.

Time-based authentication helps prevent online bank fraud by detecting presence at a specific time of day

What are the pros and cons of MFA?

Multi-factor authentication was introduced to strengthen security access to systems and applications through hardware and software. The goal was to authenticate users' identities and ensure the integrity of their digital transactions. The downside of MFA is that users often forget the answers to the personal questions that verify their identity, and some users share personal ID tokens and passwords. MFA has other advantages and disadvantages.

Pros

- Adds layers of security at the hardware, software and personal ID levels;
- Can use OTPs sent to phones that are randomly generated in real time and difficult for hackers to crack;
- Can reduce security breaches by up to 99.9% compared to passwords alone;
- Can be easily set up by users;
- allows organisations to restrict access by time of day or location; and
- Has a scalable cost, as there are expensive and highly sophisticated MFA tools, as well as more affordable ones for small businesses.

Disadvantages

- A phone is required to receive an SMS code;
- Hardware tokens can be lost or stolen;
- Phones can be lost or stolen;
- the biometric data calculated by MFA algorithms for personal IDs, such as thumbprints, is not always accurate and can produce false positives or negatives;
- MFA verification can fail if there is a network or Internet outage; and
- MFA techniques must be constantly updated to protect against criminals who work tirelessly to break them.
- Overcoming the challenges of multifactor authentication

Adding security factors to MFA further complicates the experience for users who have to remember multiple passwords. Therefore, the goal of MFA is to simplify MFA techniques for users. There are three approaches to simplifying MFA:

1. Adaptive MFA. This applies knowledge, business rules or policies to user-based factors such as device or location. For example, a corporate VPN knows it is OK for a user to log on from home because it sees the user's location and can determine the risk of

misuse or compromise. However, an employee accessing the VPN from a coffee shop will trigger the system and be required to enter MFA credentials.

2. Single sign-on (SSO). This one-stop authentication method allows users to maintain one account that automatically logs them into multiple applications or websites with a single ID and password. SSO works by establishing the user's identity and then sharing that information with any application or system that requires it.
3. Push authentication. This is an automated mobile device authentication technique where the security system automatically issues a third, one-time identification code to the user's mobile device. For example, users who want to access a secure system enter their user ID and password, and a security system automatically issues a third, one-time identification code to their mobile device. The user enters this code into the system to gain access. Push authentication simplifies MFA by providing users with a third code that they do not need to remember.

4. Data backup and recovery

With the increasing number of recent data breaches and cyber-attacks, data security has become a key issue for organizations. And while the importance of data backup and recovery can't be overlooked, it's important to understand what a company's data security needs are before implementing a data backup and recovery solution in the world of cloud computing.

1. Cloud costs: In most cases, almost any digital file can be stored in the cloud. However, this isn't always the case, as usage and the amount of storage space rented are important elements to consider before choosing a disaster recovery plan. Some data plans may include the ability to back up and restore important files if necessary. They may also include options on how they are retrieved, where they are stored, how the servers are used and more. These elements may seem trivial at first, but they can prove important later in the disaster recovery process. Different cloud providers offer companies server space based on usage, and organisations need to be clear about what they are storing in the cloud and what pricing plan they want.
2. Backup speed and frequency: Data recovery is not the only issue on the table when considering data backup in the cloud. Some cloud providers transfer up to 5TB of data in 12 hours. However,

some services may be slower as it all depends on the speed of the server, the number of files being transferred and the amount of space available on the server. Determining and negotiating this price is an important point to consider in the long run.

3. Availability for backups: During the disaster recovery process, in order to keep a business firing on all cylinders, it is important to understand the timelines for restoring backed up data. Backups should be available as soon as possible to avoid any roadblocks that could negatively impact the business. The cloud provider will be able to inform you of recovery timelines and how quickly backed up data can be restored in the event of a disaster.
4. Data security: The security of stored data and backups must meet certain security guidelines to prevent cybercriminals from exploiting any vulnerabilities. The cloud provider must ensure that all backed up data is protected with appropriate security measures such as firewalls and encryption tools.
5. Ease of use: Cloud-based storage comes with its own set of servers, which should be available from the business location and other locations as needed. If the cloud server isn't available remotely as well as from the business location, it won't serve the purpose for which it is needed. Ease of use should be an important factor in the backup process. If the data recovery and backup process is not convenient, it may become more of a hassle.

Data recovery is an integral part of the cloud computing world and needs to be taken seriously with a high level of planning from all sides.

B. Addressing Cybersecurity threats

More quickly than ever before, the attack surface is growing and changing. The complexity and reliance on the IT ecosystem are greatly expanding as businesses grow more and more dependent on technology and outside technology suppliers. A breach, which could cause data loss, system disruptions, and reputational harm, will eventually affect an organization. Cybersecurity is quickly taking center stage on the board's agenda as a solution to this problem. For this reason, many businesses and educational institutes incorporate their cybersecurity strategy into their overarching corporate plan.

	1. Educating staff and students: It is crucial to regularly train staff and students on how to recognize and stay away from typical cyberthreats like phishing attempts, malware, and ransomware because cybercriminals' tactics are constantly evolving. Training sessions should be participatory and interesting, including examples and scenarios from the real world to make them more relatable. Age-appropriate training materials should be used. For younger kids, instruction can be carried out using educational and entertaining cartoons, movies, and learning games. More thorough training on cybersecurity themes, including password security, two-factor authentication, safe browsing habits, dangers from social media, and how to swiftly identify and report potential threats, can be given to older students and staff. By encouraging a positive and proactive attitude to cybersecurity, schools may foster an environment where students are aware of the issue. A sense of shared responsibility for cybersecurity can be created by encouraging effective cybersecurity activities, such as reporting occurrences or avoiding common cyberthreats. Create this culture by running regular cybersecurity awareness campaigns utilizing classroom banners and posters, bulletins, and emails to highlight current cyberthreats and best practices. To boost staff and student participation, these programs should be imaginative, interesting, and interactive. It should be encouraged that faculty, staff, and students quickly report any suspicious activities or security incidents. This lessens damage and makes it possible for the school's IT team to react swiftly and efficiently. Informing employees and students on the procedure for reporting security incidents and assuring them that their reports will be treated carefully and in an anonymous manner. By developing an incident reporting system that is user-friendly and open to anyone, you can encourage reporting. An anonymous reporting system for incidents could be a website, a phone line, or an email address where staff and students can report incidents. Regular monitoring of the reporting system is necessary, and any reported issues must be looked at right away. **2. Developing an incident response plan:** Cyberattack-related losses, disruptions, and damages have grown to be a significant concern for both governments and corporations. During times of conflict or instability, these dangers are significantly increased, as demonstrated by Russia's invasion of Ukraine. Cyber incident response plans can aid in resource mobilization, containment of the assault, damage mitigation, and speedy recovery should the worst happen. A written strategy, however, is never sufficient; it cannot replace actual practice. Cyber drills must be carried out frequently, properly tested, and adjusted for the real

world. Everyone should know where they are when the bell rings, much like during school fire drills.

Exercises are always an excellent approach for companies to assess their capacity to respond to cyber incidents and determine the level of staff preparedness for cybersecurity. Exercises should be hard while also being doable; the goal is not to discourage or demoralize staff but to engage and excite them about creating a strong security culture and making sure they are well-equipped to manage cyber catastrophes. To make exercises appear more urgent and genuine, think about giving participants scenarios connected to current affairs such as ransomware. Give participants instructions before the workout so they feel well-prepared. Make every effort to be as transparent as you can; state clearly who will participate, how input will be gathered, and what metrics will be reported. Focusing on a specific system, procedure, or part of the cyber passing away chain will make the exercise more challenging. Even the most severe assault scenarios, such as "black swan" Cyberattack, which might happen unexpectedly and have far-reaching effects, can be tested. For incident response exercises to be successfully delivered using a variety of use-cases and expertise, it's crucial to choose the appropriate mix of resources from both business and technical backgrounds. Organizations should involve all stakeholders, and other parties including forensic and legal specialists. The goal is to choose a group of people who will help you achieve your intended goals. It's also a good idea to get senior management teams' support, as this will have a big impact on how participants view and engage with the activity.

3. Vulnerability management: Vulnerability management is the ongoing, regular process of identifying, assessing, reporting on, managing and remediating cyber vulnerabilities across endpoints, workloads, and systems. In order to prioritize risks and address vulnerabilities as soon as feasible, a strong vulnerability management program makes use of threat intelligence and understanding of IT and business operations.

The International Organization for Standardization (ISO 27002) describes a vulnerability as "a weakness of an asset or group of assets that can be exploited by one or more threats." An exploitable weakness is what constitutes a threat. When a threat takes advantage of a vulnerability, there is a risk. It is the potential harm that would result from a threat using an exposed vulnerability.

CrowdStrike and many other cybersecurity groups use the Common Vulnerability Scoring System (CVSS), a free and open industry standard,

to evaluate and convey the seriousness and characteristics of software vulnerabilities. The National Vulnerability Database (NVD) includes a severity rating for CVSS scores in addition to the CVSS Base Score, which spans from 0.0 to 10.0. Vulnerability management is different from vulnerability assessment. Vulnerability management is an ongoing process, while a vulnerability assessment is a one-time evaluation of a host or network. Vulnerability assessment is part of the vulnerability management process, but not vice versa

C. Compliance considerations

Cloud and cyber security compliance is all about ensuring that the companies adhere to all the important regulatory requirements and follow the national and state-level cyber laws to protect sensitive information. In simple terms, cybersecurity compliance is the risk management method that is aligned with some pre-defined security measures and controls data confidentiality. Organizations have to implement the systematic risk governance approach that combines with the respective authorities, industry-relevant units, and laws to meet the data management requirements. An information security management system that adheres to the regulatory requirements to guide companies about the precautionary measures that should be followed to minimize the possibility of a breach. Additionally, IT security compliance help in monitoring and accessing the process of devices, systems, and networks that adheres to the regulatory compliance requirements.

1. Data protection regulations: The European General Data Protection Regulation (GDPR) went into effect just over a year ago, on May 25, 2018. During its development, the groundbreaking policy showed great promise. Its goals were to harmonize privacy and data protection laws across Europe, improve EU citizens' understanding of how their personal information was being used, and encourage them to file complaints if their rights were violated. The GDPR, a new legislative framework, was a recognition that the digital economy, which is supported by (personal) information, should function with the informed consent of users and clear guidelines for businesses, looking to conduct business in the European Union. However, putting the policy into practice is showing how much more work needs to be done before the GDPR is fully operational. There are still a number of problems that the GDPR was designed to address, as well as a few new challenges that European individuals, businesses, school or educational institutes and data governance systems must deal with. In order for the GDPR to be more effective in the months and years to come, tougher penalties,

	increased cooperation, and an admission of some of the policy's blind spots are all urgently required. The GDPR defines: ● individuals' fundamental rights in the digital age ● the obligations of those processing data ● methods for ensuring compliance ● sanctions for those in breach of the rules The GDPR lists the rights of the data subject, meaning the rights of the individuals whose personal data is being processed. These strengthened rights give individuals more control over their personal data, including through: ● the need for an individual's clear consent to the processing of his or her personal data ● easier access for the data subject to his or her personal data ● the right to rectification, to erasure and 'to be forgotten' ● the right to object, including to the use of personal data for the purposes of 'profiling' ● the right to data portability from one service provider to another The regulation also lays down the obligation for controllers (those who are responsible for the processing of data) to provide transparent and easily accessible information to individuals on the processing of their data. The regulation confirms the existing obligation for member states to establish an independent supervisory authority at national level and establishes a mechanism to create consistency in the application of data protection law across the EU. The GDPR establishes that a single supervisory decision is taken in cross-border cases where several national supervisory authorities are involved. This principle, known as the 'one-stop-shop' principle, means that a company with subsidiaries in several member states will only have to deal with the data protection authority in the member state of its main establishment. The European Data Protection Board makes sure that the GDPR is fully applied. This board consists of representatives of all 27 independent supervisory authorities. **Individuals can lodge a complaint** with a supervisory authority and have the right to judicial remedy and compensation. They have the right to have a decision by their data protection authority reviewed by their national court, irrespective of the member state in which the data controller concerned is established.

Severe sanctions are provided against controllers or processors who violate data protection rules. Data controllers can face fines of up to €20 million or 4% of their global annual turnover.

2. Industry-specific compliance requirements: The term "regulatory compliance" describes how well an organization complies with the rules, laws, policies, and requirements that apply to particular business operations. The Health Insurance Portability and Accountability Act (HIPAA), Sarbanes-Oxley Act (SOX), Critical Infrastructure Protection (NERC-CIP), Payment Card Industry (PCI) Security Standard, and numerous other laws and regulations are examples of regulatory compliance. Regulatory compliance rules violations frequently have legal repercussions and incur federal fines.

Over the past 20 years, there have been a significant increase in legislation, which has made regulatory compliance management more important in a variety of organizations. In many firms, corporate, chief, and regulatory compliance officers and compliance managers jobs have been created as a result of this growth. These positions' main goal is to make sure the business complies with all relevant laws and strict, complicated legal requirements.

While audit reports serve to demonstrate compliance and assist businesses in better marketing themselves to customers, regulatory compliance processes and strategies offer organizations direction as they work to achieve their business goals. Being open and honest with clients regarding compliance procedures may increase profitability.

Different industries are subject to different levels of regulation. For instance, regulatory compliance requirements are imposed on the financial services sector in order to safeguard investors and the general public from dishonest business practices. Because they retain a lot of sensitive and private patient data, healthcare organizations are subject to severe compliance laws. Regulations for safety and environmental protection apply to energy providers. The sections that follow offer more information on how businesses in each of these industries can achieve their compliance goals, even if these are just a few instances of why compliance matters in certain industries.

3. Keeping current on laws and regulations: Cloud computing is not subject to a special "cloud law," and its services are not directly regulated. Instead, the legal and regulatory environment is built up of a matrix of many laws that spans numerous industries and regions and is as expansive as the technology itself.

	To guarantee data security and privacy, enterprises must adhere to a number of cloud policies and standards. To safeguard the security, privacy, and integrity of their data, enterprises using cloud services must adhere to certain laws and standards. Some of the most popular rules and guidelines for the cloud are listed below: 1. GDPR stands for General Data Protection Regulation. A European Union (EU) rule known as GDPR establishes stringent data protection requirements for businesses that handle the personal data of EU residents. The law governing data protection in the EU is based on seven essential principles that are intended to protect the rights of EU people and hold companies responsible for data processing. Among these are the values of justice, fairness, and transparency, awfulness, equity, and openness, purpose restriction, Data reduction, Precision Storage Restrictions, Integrity and discretion, Accountability 2. HIPAA stands for the Health Insurance Portability and Accountability Act. HIPAA is a US law that establishes requirements for the security of private patient health data. The Privacy Rule, the Security Rule, and the Breach Notification Rule make up the three rules that make up HIPAA. Companies who comply with HIPAA regulations are not given certifications after they do so. Instead, they can be subject to routine assessments of their compliance status by either an internal or external organization. 3. PCI DSS: Payment Card Industry Data Security Standard A global standard known as PCI DSS establishes security standards for businesses that handle credit card payments. Twelve criteria are outlined in this framework and must be met by businesses to be PCI-DSS compliant. Depending on the level at which a company is operating, a PCI DSS audit is conducted on an annual basis under specific guidelines. The certificate is good for 12 months. 4. FedRAMP, short for Federal Risk and Authorization Management Program, A US federal initiative called FedRAMP establishes requirements for cloud service providers' security. Despite the fact that private sector businesses are not required to adhere to FedRAMP/NIST, doing so can help them adopt a more uniform approach to privacy, particularly in light of the US's disjointed legislative framework. 5. ISO 27001:2022 The International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) together created the ISO 27001 standard, which describes the best practices for operating Information

Security Management Systems (ISMSs) to protect sensitive data. The ISO 27001 certification is still valid for three years whether your business has been certified against the new or old edition.

IV. Case studies:

A. Universities that suffered data breaches and how they responded

Cyber-attacks are particularly prevalent in the education sector. In these often financially motivated attacks, valuable data such as intellectual property and personally identifiable information (PII) is sought by cybercriminals.

The increased use of digital platforms, shared online resources between stakeholders (students, staff, professors, visiting lecturers, etc.) and working from home has enabled cybercriminals to target higher education institutions, especially during the pandemic.

In 2020 alone, around 50% of colleges and universities were affected by a social engineering incident. More than a quarter of these attacks resulted in confirmed data breaches.

Data breaches that have hit the headlines in recent years include a textbook rental company, a Catholic university in Australia and a number of schools in the U.S. These incidents illustrate the threats facing higher education and how institutions can protect their data.

The college that shut down permanently after a ransomware attack

The one that got hacked: Lincoln College in Illinois, which opened its doors in 1865 and is classified as a predominantly black institution by the Department of Education.

The attack: In May 2022, Lincoln College was hit by a ransomware attack. It was unable to recover from the attack. The school was the first to close due in part to a ransomware attack, although a pandemic contributed to the closure as students chose to defer enrolment or take leaves of absence.

The cyberattack rendered critical systems inoperable, such as those used to fundraise, recruit, retain and enrol, and blocked institutional data.

The take away: This particular ransomware attack left the school without access to its computer systems and data, which it couldn't afford to replace. If possible, to stay up to date on cybersecurity threats and risk management, higher education institutions should join the Research Education Networking Information Sharing and Analysis Center (REN-ISAC).

	Compromised passwords are often hackers' way in to launch a ransomware attack. You can stop these attacks before they start by strengthening passwords across your organisation. **Data breach at textbook rental giant** T**he one that got hacked:** Chegg **The attack:** In 2018, the online textbook rental service experienced a data breach. 40 million customers were affected. Cybercriminals were able to steal usernames and email addresses. They then decrypted the logins and posted them online. **The takeaway:** Chegg did not notify individual users of the breach. Instead, colleges like Saint Mary's College in Indiana were alerted by REN-ISAC (Research and Education Networks Information Sharing and Analysis Center) when Saint Mary's email addresses appeared in the credential dump. By the time the college notified students and staff of the breach, their credentials had already been compromised. With a tool like Dark Web Monitoring, available with all Dashlane Premium accounts, users are notified immediately if their credentials have been compromised. They can then quickly change their passwords. In addition, Dashlane is built on a zero-knowledge architecture. This means that not even Dashlane has access to customer passwords, which helps defend against decryption strategies. **The phishing attack on an Australian university** **The one that got hacked:** Australian Catholic University (ACU) **The attack:** In 2019, threat actors impersonated the university. They sent an email with a link to a fake ACU page. Cybercriminals were able to harvest staff logins and use them to access sensitive information, including bank accounts, when staff entered their credentials on the malicious page. **The takeaway:** Although only a fraction of employees were at risk in the ACU breach, phishing attacks can be sophisticated and highly destructive. Dashlane monitors the web for scammers. (And we never ask for your login credentials over email. Having a password manager automatically protects you from phishing attacks. Because Dashlane only autofills passwords on sites you trust, it won't do so for fake sites that try to harvest your credentials.

Make sure your sensitive accounts are protected with multi-factor authentication, like 2FA codes, if a hacker does manage to steal your passwords.

The ransomware attack that cost $1.14 million

The one that got hacked: Columbia University, Michigan State and the University of California, San Francisco (UCSF)

The attack: NetWalker, a group of ransomware operators, went on a ransomware spree in 2020. They targeted universities. Using "brute force attacks" - trial-and-error password attempts by bots - NetWalker gained access to sensitive data. It threatened to release the data if the universities did not pay the ransom. One of the hardest hit by this double extortion scheme was UCSF. It paid a ransom of $1.14 million to recover critical data related to the medical school's academic work.

The takeaway: There are ways to protect yourself from a brute force attack, including using passwords with the maximum number of characters for sensitive accounts. When you generate a password , you can choose the number of characters - and you don't have to remember the long string of numbers and letters . The longer the password, the longer it would take for software to "guess" it, and the less likely cybercriminals are to succeed.

B. Schools with robust cloud security protocols

The education sector ranked as the least secure in 2018, with the highest vulnerabilities present in application security, endpoint security, and keeping software up-to-date. The 2020 calendar year saw a record-breaking number of publicly disclosed school cybersecurity incidents.

Though these attacks affected only a small fraction of schools and districts in the U.S., the frequency may increase as more lucrative targets mount a better defense.

Cybercriminals target school districts' networks because they house a large amount of personal data and exist in a milieu not necessarily attuned to the threat of attack.

How Cyberattacks Happen:

Phishing and Distributed Denial-of-Service Attacks: More than 90 percent of cyberattacks in schools start with phishing campaigns, which include "spear phishing" and business-email compromise attacks. In the

2019–2020 school year, the San Felipe Del Rio Consolidated Independent School District was hit by a business email compromise attack.

Schools and districts can also fall victim to distributed denial-of-service attacks, which can be traced to the IP address of a 16-year-old student at South Miami Senior High School.

Ransomware: During a DDoS attack, hackers use malicious software to encrypt school districts' data. The districts are then forced to pay hackers a ransom to regain access to their data.

Monroe-Woodbury Central School District: Monroe-Woodbury Central School District had an incident response team working within an hour of learning of the attack. The team contained the attack, assessed the damage, and developed a mitigation plan. After stopping the ransomware, the district focused on restoring weeks' and months' worth of data from offline and cloud-based backup systems and brought Wi-Fi back online for 3,000 student and staff devices and computers. The district had gotten an assessment of their network from the National Institute of Science and Technology prior to the attack. The IT team changed its policies after the attack and established scenario-based cybersecurity training. They also educated the school community about the latest trends in cybersecurity.

Haverhill Public Schools: The attack on Haverhill Public Schools started shortly after midnight on Wednesday, April 7. After an hour of evaluation, the Haverhill Public Schools IT team determined that 140 of the 13,000 district endpoint devices had been infected with the ransomware. Most of the virtual servers had detected the infection and shut down, exactly as they had been designed to do. The transition to laptops for staff during the pandemic, a change to the district's virtual environment, and moving many systems to cloud hosting made the attack less severe. The district has yet to confirm if any personal data was compromised, but they did learn that they needed to upgrade their systems and backup options. They also realized that they needed to increase redundancy and upgrade their anti-malware and anti-ransomware software.

V. Closing Remarks

A. Recap of main points

Cloud computing offers users access to data, software applications, and services over the Internet, providing flexibility and reliability that traditional on-premise infrastructure does not provide. It offers increased security, scalability, and reliability while enabling businesses and individuals to utilize computational resources without worrying

about hardware and infrastructure. Cloud computing benefits education by being cost-effective, flexible, and scalable, enabling collaboration, real-time access, and security. However, cloud security concerns in education include loss of visibility, data breaches and loss, insider threats, videoconference bombing, advanced malware, and phishing. Data breaches can have a significant impact on millions of individuals in the data-driven world of today. They can result from flaws in user behavior with technology, as well as from new technologies being developed without adequate safeguards. IoT devices are evidence of convenience over security, and hackers are exploiting security weaknesses in smart home gadgets. Understanding how a data breach happens is the first step in protecting oneself and others. Data breaches can occur due to flaws in user behavior with technology, as well as the lack of encryption in smart home gadgets. Insider by accident, for example, can result in a worker viewing files without the necessary authorization permissions without the necessary authorization. However, the data is considered compromised if the user does not have the necessary authorization. In conclusion, cloud computing offers numerous benefits for education, including cost-effectiveness, flexibility, collaboration, scalability, and security. However, it is crucial for administrators and educators to be vigilant about security and privacy when using cloud-based platforms and adapt their cybersecurity strategies to keep online classrooms safe and secure.

B. Final thoughts and recommendations

Given the sensitive and private data stored in educational institutions' systems, cloud security is of the utmost importance in the field of education. Following are some ideas and suggestions regarding cloud security for education:

Strong Authentication Techniques: To make sure that only authorized users can access the cloud resources, use strong authentication techniques like multi-factor authentication (MFA). Because of this, even if the credentials are stolen, unauthorized access is prevented.

Data Encryption: Use encryption methods to protect data while it is in transit and at rest. This includes using protocols like HTTPS to encrypt communication channels between users and cloud services and encrypting data before it is stored in the cloud.

Regular Data Backups: To avoid data loss due to hardware failures, unintentional deletions, or security breaches, regularly backup important data that is stored in the cloud. To guarantee the integrity of the backups, periodically test the restoration procedure.

Access Control and Authorization: Implement role-based access control (RBAC) mechanisms and granular access controls to ensure that users only have access to the resources they require for their roles. Review and update user privileges on a regular basis as roles within the educational institution change.

Continuous Monitoring and Auditing: Use effective mechanisms for tracking and examining cloud activity. This involves keeping an eye on system logs, network traffic, and user access logs to look for any suspicious activity or security flaws. Review and analyze these logs on a regular basis to spot and fix any potential security flaws.

Security Education and Awareness: Inform faculty, staff, and students about the best practices for cloud security, such as password security, phishing awareness, and secure browsing practices. To make sure users are aware of potential risks and comprehend how to protect sensitive data, hold regular training sessions.

Vulnerability management: To keep the system secure, regularly check cloud environments for vulnerabilities and immediately apply patches and updates. To address any known vulnerabilities, keep up with security bulletins and patches offered by cloud service providers.

Incident Response Plan: Create a thorough incident response plan that outlines the actions to be taken in the event of a security incident. Procedures for containment, investigation, communication, and recovery should be included. To make sure the plan is effective, test and update it frequently.

Vendor Due Diligence: Research thoroughly the security procedures and certifications of any third-party cloud service providers you plan to use. Examine their security policies, data handling practices, and adherence to any applicable laws like FERPA or the GDPR.

Regular Security Assessments: Conduct routine penetration tests and security assessments to find holes and flaws in the cloud infrastructure. To ensure a fair assessment, hire reputable security experts or companies to carry out the assessments.

Keep in mind that maintaining security in the cloud requires ongoing monitoring, adaptation, and development. These suggestions can help educational institutions improve their cloud security posture and safeguard their sensitive data from threats and unauthorized access.

Concrete methods to transmit knowledge: Activities	What kind of practical activities (NFE) are you going to implement in order to transmit the knowledge?	
		Please, specify here the methods used and the kind of activities you think might be functional in order to practically transmit the theoretical knowledge (Roleplay, Brainstorming Session, project-based learning, experiential learning, collaborative learning, problem-based learning. etc). *…* *Down below you should develop an activity related to the module's contents*
	Main Aim	We will use a serious game to raise awareness of roles and responsibilities related to cloud security
	Used tools	Like every classic game, it needs a Game Master (GM) to organize and host the game, and to handle questions raised by the participants during the game. Each team uses a game board to place different sets of cards to model attack and defense plans. In total, there are up to 40 cards, 24 for the defender team and 16 for the attacker team. Each card states one countermeasure to secure cloud assets.
	Material and preparation	When the game starts, the GM randomly assigns players to the two teams: defender and attacker. The defender team builds a defense plan by assigning defense cards to one of the roles: cloud asset owner and cloud asset manager. If a card is assigned to the wrong role, it will be sorted out from the defense plan. The attacker should build a three-step attack plan and discuss and decide with their teammates to assign 2, 3, and 1 card(s) to each step.
	Session Description	During the game, the defender team should develop a defense plan and the attacker team an attack plan. Each team uses a game board to place different sets of cards to model attack and defense plans. Attackers and defenders can only place a limited number of cards. This constraint reflects the reality that neither attacker nor the defender has unlimited resources, and both of them need to prioritize accordingly. This drafting of

		attack and defense plans is done with teamwork. Teams use breakout rooms virtually to discuss and develop plans in an online game. If the game is played face-to-face, different teams should sit apart and work on their defense or attack plan separately.
	Debriefing	An evaluator analyzes the defense plan against the attack plan and calculates the probability of the input attack plan tearing down the defense plan. Along with the attack steps, it shows the reasoning also step-by-step. The ultimate output of the evaluator is the calculated probability in percentage numbers.

Module References	What is the source from which you gathered the information about the form?
	Please, briefly describe and mention the source where you took the information from. University of Southampton. COMP3226 Web and Cloud Based Security. Available at: https://www.southampton.ac.uk/courses/modules/comp3226#assessment Thomas Edison State University. Syllabus for CYB-451. CLOUD SECURITY AND PRIVACY https://www2.tesu.edu/syllabus/current/CYB-451/syllabus_CYB-451.html Carnegie Mellon Heinz College. 95-746 Cloud Security. Available online: https://api.heinz.cmu.edu/courses_api/course/syllabus/144483/ Harvard University. *CSCI E-49. CLOUD SECURITY. Course Syllabus available at:* https://www.google.com/url?sa=i&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=0CAIQw7AJahcKEwjgm93_gMv_AhUAAAAAHQAAAAAQAg&url=https%3A%2F%2Fcanvas.harvard.edu%2Fcourses%2F20028%2Ffiles%2F3102489%2Fdownload%3Fverifier%3DmdnEsTQK2v324vqwpLGGH13S5jCiLSdgbDCaUOjP%26wrap%3D1&psig=AOvVaw3NRdhz0abCu1RRgiZDdISt&ust=1687115425845026&opi=89978449 Coursera. https://www.coursera.org/search?query=Cloud&=null&index=prod_all_launched_products_term_optimization Zhao, T.; Gasiba, T.; Lechner, U.; Pinto-Albuquerque, M. Raising Awareness about Cloud Security in Industry through a Board Game. *Information* 2021, *12*, 482. https://doi.org/10.3390/info12110482

Evaluation methods	How are you going to evaluate the level of understanding among the target group of the training?

	Please, briefly describe the evaluation methods you intend to adopt in order to evaluate the success and effectiveness of the training. Course Grading Criteria:

Percent	**Component**
50%	Mid Term Quiz (Online)
50%	Final Quiz (Online)

Module 5: Cloud Storage Solutions

Learning Objectives	What do you want to achieve by implementing this module?
	Topic: Introduction to Cloud Storage: Understand the concept of cloud storage and its advantages over traditional on-premises storage solutions. The main aim of this module is to help the target group and the project audience gain further insight into the world of Cloud Computing. This module also helps the target audience understand the importance of cloud-based storage servers and how these make it easy for the user to access a wide range of knowledge and information stored in these servers. Moreover, this module draws a comparison between traditional on-premises storage solutions and lists the advantages of cloud computing technologies over traditional storage methods. It guides us as to why adopting cloud computing skills is a must for the future.

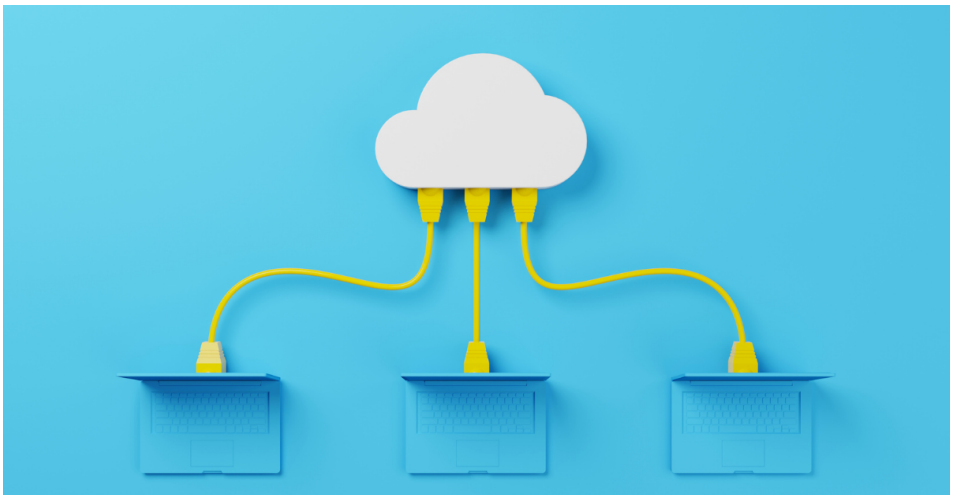
Learning Outcomes	What are the expected results of this module?
	After the completion of this module the target group would have learned about cloud computing technologies. In addition to this, they will learn about various advantages of implementing cloud-based storage solutions. They will realise the importance of cloud computing storage methodologies over traditional paper based on-premises storage methodology.

Theoretical content	What are going to be the main theoretical contents of the module?
	Cloud Computing can be defined as any internet-based service that could be made available to customers as and when required by them. A few examples of internet-based services are storage, infrastructure, servers, analytics, software, and intelligence. The availability of these services over the internet (cloud) makes them easily accessible and efficient. In addition to that cloud services enable faster innovation, flexible resources, and richer economies of scale. This in turn

eliminates the need for setting up physical data storage centres. This initiative encourages cost saving as it eliminates the need to purchase, install, configure, and manage their on-premises internet infrastructure.

Therefore, the organisation dependency on the IT department for the deployment of the cloud-based services is eliminated. This enables immediate implementation of cloud-based internet services.

Cloud computing is based on different models. These models are based on the sharing of the on-demand resources, software, and information available over the internet.



This model is a pay-per-use model. This means that companies/individuals pay to access a virtual pool of shared computing resources including storage and networking services.

Cloud computing works in various ways. A cloud computing network assists the users while connecting to a cloud-based platform. The cloud-based platform incorporates a wide range of services (i.e. networking, analytics, storage etc). Once the user connects to the cloud platform, they are presented with a list of various internet-based services. The users have the opportunity to select a service as per their computing needs. The user gets the opportunity to rent the service. The user can subscribe to the cloud-based service and pay in accordance with their monthly usage. The pay-per-use model increases the availability and affordability of the cloud-based services.

However, before opting for a model, it is important to understand how the client interacts with the service.

The communication between the client server and the host server happens over the internet. This communication is hosted by a central server that guarantees to keep the client's personal data secure and private.

Cloud computing services are widely recognised by the versatility and flexibility it offers the customers. It provides the user complete freedom to choose a specific model as per their need and specification. Not only individuals but even organizations have the opportunity to implement a cloud-based service. The service can be made available on the organization's server. The flexibility, affordability and availability of these services assists the organization heavily while they are adapting to the changing market trends and technological advancement. It also eliminates the hefty cost associated with establishing and managing cloud computing centres.

Regardless of the vastness of the Cloud Computing Services, they can be recognised as 3 different models:

1. Public Cloud: They are run by third-party cloud service providers. They offer computation, storage, and networking services over the internet. These services can be accessed by anyone who can connect to the internet via their mobile, laptop or desktop, etc. Some popular examples of public cloud-based services are Google Workspace, Amazon Web Services, Dropbox etc.
2. Private Cloud: They are built, managed and owned by a single organisation and are being privately hosted by their data centres. This type of cloud is known as an on-premises cloud server. It is suitable for Multinational corporations with operation teams spread across the globe and working around the clock. The reason behind investing in establishing and managing own data centres is the data security and privacy offered by them. The private cloud is considered more reliable and secure as it keeps the data within the company's boundary and reach. Ex: Amazon VPC, VMware and IBM.
3. Hybrid Cloud: This server brings together the best of both worlds by providing the organisations with the accessibility of public cloud servers while incorporating the security features offered by the private cloud servers. EX: Google Anthos, AWS Outposts etc

Cloud Storage is considered as a cloud computing model. It enables the user to store data and files on the cloud (internet) based storage system. This storage system can be considered as a warehouse, where an organisation can stock their resources. These resources can be accessed, shared, implemented as per the need and requirement of the organisation or individual. The storage space is made available and accessible via a cloud computing service provider. The client can connect to the cloud storage service via a public or private cloud network.

The cloud storage service provider is responsible for securely managing, storing and maintaining the data storage servers and centres. They make sure to build a strong service infrastructure which would enable regular and on-demand access to the storage network. The virtuality of the storage service provides the organisation with the ability to grow without restrictions and with an elastic capacity.

The cloud storage service is provided by organisations or individuals who either own or operate data storage servers while maintaining multiple data centres across the world or a region. The biggest advantage of the cloud storage systems is that the users can access the data stored on the server from anywhere in the world and at any time. However, they have to follow some steps in order to connect to the cloud storage server. In order to access the data stored on a cloud server, the user connects to the cloud server via the public or private internet connection. A web portal, website or a mobile app can be used to connect to the internet.

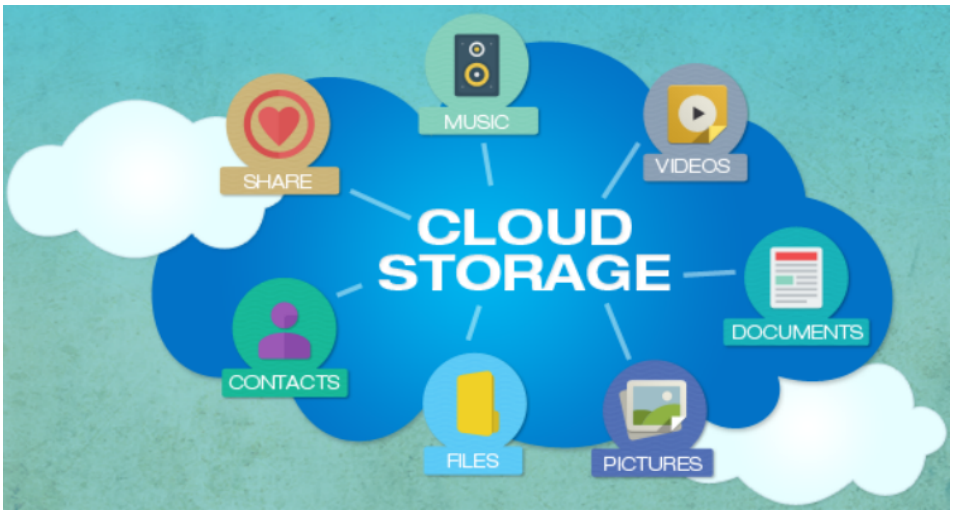
If the user opts for a pay per use model (subscription) for a cloud-based storage service then the user is transferring the majority of aspects of data storage to the service provider to handle. These aspects include:

1. Network data delivery,
2. Storage servers and computing resources,
3. Data availability,
4. Capacity and
5. Storage.

The user can also access the cloud storage services from mobile applications through application programming interface (API). In addition to the storage services, the cloud storage service provider might offer other services that are designed to collect, manage, secure and analyse the customer's data.

Cloud storage is deemed as the most efficient storage service because it is elastic in nature. This means you can either scale up (increase storage capacity) or scale down (storage capacity) as per the client's storage requirement. Moreover, the client subscribes to the storage service and pays for the amount of storage capacity they require.

For example: If the customer requires 100 GB of storage then they pay 50 Euros. However, if in the following month, the user requires less storage space and decides to downscale the storage to 50 GB then they would pay 25 Euros for the cloud-based storage service.



Cloud-based storage services can be implemented by an individual, small enterprises (private owners), and MNCS (Multinational Corporations). Moreover, implementing cloud storage services can offer various advantages to all users:

1. Cost Effectiveness: Cloud storage eliminates the requirement of hardware to store and manage data. The storage capacity can be increased or reduced on demand. This also affects the cost of the storage model because it is directly proportional to the storage capacity. Hence, reducing storage capacity will in turn decrease the cost of the storage model and vice versa.
2. Increased Agility: The resources stored on the server are just a click away. Therefore, the time taken to access and implement the resources is decreased. The employees can focus on more critical tasks rather than procurement, installation, administration, and maintenance of data storage centres.

3. Efficient Data Management: Cloud storage enables performing powerful information management tasks i.e. locking down data or automated tiering. It enables the organization in creating multi-region or global storage servers. Hence the teams distributed across a region can be up to date. This can be done by implementing the replication tool. Data can be managed and organised in regard to cost-effectiveness, enforce security and meet compliance requirements.
4. Virtually Unlimited Scalability: It offers the ability to scale up operations at an increasing rate. By eliminating the need for on-premises storage capacity. The organisation is able to either scale up or down as per their requirements based on analytics, data lakes, or backups. The data is accessible anytime, from any location across the world, without having to wait for the latest hardware or complex allocation processes.
5. Business Continuity: The data is stored in data security centres that promise stable data security. This protects the customers data and ensures business continuity. The storage servers are designed to reduce redundancy by continuously detecting and repairing glitches in the server.

The cloud storage service can be divided into 3 different categories. These categories are as follows:

- Object Storage: A big organisation would have massive amounts of data to deal with. This data is majorly unstructured and scattered and could include photos, videos, machine learning, sensor data, audio files, etc. Object storage provides the user with the opportunity to scale the rows of data efficiently and in affordable ways. The data is stored in a bucket rather than files and folders which makes it inexpensive to store large amounts of data.
- File Storage: The data is stored in a hierarchical order in the form of files. This type of storage is also known as Network Attached Storage (NAS) with Server Message Block (SMB) protocol for Windows and Network File System (NFS) for Linux operating system.
- Block Storage: It includes databases or Enterprise Resource Planning (ERP) systems. This is an analogous method to access Direct Attached

Storage (DAS) or a Storage Area Network (SAN). Data is stored in the form of blocks and each block has a unique identifier.

It is a crucial and important decision for an organisation while they are planning a shift from on premises storage facilities to a cloud-based storage system. The following crucial considerations can help the organisation in making the right as per their requirements. The following considerations also draw a comparison between on premises and cloud-based storage facilities:

Category	On-premises	Cloud Storage
Cost and Maintenance:	To deploy a network infrastructure, the organisation needs to invest in hardware installation and hire an IT staff to maintain the infrastructure. Moreover, the company needs to invest in hardware upgrades and replacement equipment after regular intervals.	The organisation does not have to invest hefty amounts into establishing an infrastructure. In addition to that, the maintenance of the cloud server is included in the monthly subscription fee. Moreover, the company does not need to hire IT staff to maintain the network infrastructure.

	Security/ Threat Protection:	The organisation has to create a security monitoring and management plan for their data assets. This guarantees more control over data but on the other hand, initiates additional costs for hiring a data security expert and setting up data protection measures.	Cloud service providers have added additional security measures to safeguard the client's data. The service provider also appoints dedicated data security experts to enhance the data security measures. Moreover, the organisation has time to focus on core operations. As per Gartner estimates, traditional on-premise data storage facilities are 60% more prone to security incidents.
	Scalability:	The organisation needs to invest in physical/ tangible resources such as new hardware, software updates, increased computing power etc. However, this is not an easy task. Scaling up requires hefty amounts of investment in terms of money, labor, hardware, software, SMEs, and monitoring systems. However, for a small scale up, the expenditure is inefficient.	On the other hand, in the case of a cloud-based storage server, the client can take advantage of the built-in features incorporated in the cloud platform. Therefore, the client has the opportunity to scale up on a temporary basis in order to respond to a spike in operations. This would lead to massive cost saving as no infrastructure is required to be built and the user has the opportunity to come back to the original subscription fee.
	Anywhere access:	In case an office space requires physical presence that hardly turns into a Work from Home situation. In that	In case the team is working from an offshore location or they are traveling for work. They won't be

		case, an on-premise server cloud is the best choice.	able to access the on-premise cloud server. However, if a cloud-based storage server is adopted, the team can work from anywhere in the world and anytime. Moreover, cloud-based servers enable effortless file sharing and real-time collaboration.
	Data backup:	The organisation prefers to store their data on location as it provides them with the assurance that the data is safe and no third party can access or misuse the data. However, in case of a mishap, the organisation might end up losing tons of crucial data which can halt the company operations for days to come.	Cloud-based servers eliminate this worrisome situation. The cloud storage server provider guarantees many features to avoid data loss. Some of these features could be built-in redundancy, failover, automatic backup, and regular data monitoring. This would also lead to shorter data recovery time in case of data loss.

Concrete methods to transmit knowledge: **Activities**	What kind of practical activities (NFE) are you going to implement in order to transmit the knowledge?	
		Please, specify here the methods used and the kind of activities you think might be functional in order to practically transmit the theoretical knowledge (Roleplay, Brainstorming Session, project-based learning, experiential

		learning, collaborative learning, problem-based learning. etc). *…* *Down below you should develop an activity related to the module's contents*
	Main Aim	The name of the Activity: Knowledge Whispers. The activity is aimed at testing the knowledge of the participants regarding different aspects of Cloud Storage Systems.
	Used tools	- A presentation regarding different aspects of Cloud Storage - Laptop to present - Cards containing topics related to cloud storage. - A bowl for cards
	Material and preparation	A presentation to describe information regarding different aspects of cloud storage. A laptop with the presentation and a screen for the presentation. Preparing cards with different topics related to cloud storage. Securing a bowl to put the cards in
	Session Description	1. The participants will be divided into a group of 4. 2. The group will be asked to stand in a chain with a first and a 4 person. 3. The 1 person from all the chains will be asked to pick 1 card from the bowl. 4. They will choose the cards 1 by one. 5. Then the activity begins. Activity: Knowledge Whispers

		1. The topic from the card is only known to the 1st person. 2. The first person thinks about some information related to the topic (1-2 sentences) and whispers it in the ear of the 2nd person. 3. Based on the information passed by the 1st person. The second person thinks of some information that is related to the information passed to them. 4. The second person then combines the received and their own information and passes it to the third person. 5. The third person repeats step 3. 6. The third person passes all the information to the fourth person. 7. Then the fourth person presents all the information passed to them. 8. This is repeated for every chain. Topics: ● Cloud Computing ● Cloud Computing Models ● Cloud Storage ● Types of Cloud Storage ● Advantages of Cloud Storage ● Aspects of Comparison between Cloud Storage and Traditional On-Premises Storage Solutions ○ (Anywhere Access, Data Backup, Scalability, Cost/Maintenance, and Security/ Data Protection)
	Debriefing	The trainer's form a chain by themselves and demonstrate the activity to the participants.

Module **References**	What is the source from which you gathered the information about the form?

	Please, briefly describe and mention the source where you took the information from. 1. *https://aws.amazon.com/what-is/cloud-storage/* 2. *https://azure.microsoft.com/en-us/resources/cloud-computing-dictionary/what-is-cloud-computing#cloud-computing-models* 3. *https://cloud.google.com/learn/advantages-of-cloud-computing* 4. *https://www.ibm.com/topics/cloud-computing* 5. *https://www.microsoft.com/en-ww/microsoft-365/business-insights-ideas/resources/cloud-storage-vs-on-premises-servers*

Evaluation methods	How are you going to evaluate the level of understanding among the target group of the training?
	Please, briefly describe the evaluation methods you intend to adopt in order to evaluate the success and effectiveness of the training. 1: The presentation of the information by the last member of the chain would help in understanding the participant's knowledge regarding the project. 2: A form will be shared with the participants by the end of the activity. The form will contain questions related to the information shared with the participants during the activity. The number of correctly answered questions will help us evaluate the efficiency of the content and the activity. 3: A questionnaire will be shared with the participants. This form will question the participants which will engage them regarding their confidence in dealing with cloud storage services before and after the activity.

Learning Objectives	What do you want to achieve by implementing this module?
	Topic: Types of Cloud Storage Solutions: Explore different types of cloud storage solutions, including object storage, block storage, and file storage. - The primary objective of implementing this module is to provide an understanding of cloud storage solutions and their various types. - The module aims to explore different types of cloud storage solutions, including object storage, block storage, and file storage

Learning Outcomes	What are the expected results of this module?
	- Participants will clearly understand cloud storage solutions and their applications. - Participants will be able to differentiate between different types of cloud storage solutions and their advantages. - Participants will gain knowledge about the use cases and limitations of each type of cloud storage solution.

Theoretical content	What are going to be the main theoretical contents of the module?
	1.0 Introduction to Cloud Storage Cloud storage solutions refer to remote data storage services that allow users to store, manage, and access their data over the Internet. Cloud storage provides a flexible and scalable alternative instead of relying on local storage devices like hard drives or physical servers. Users can store various types of data, such as documents, images, videos, and application data, in the cloud.

Cloud storage solutions have become increasingly significant in modern computing due to several key factors such as:

- ***Scalability:*** Cloud storage providers offer flexible storage options, allowing users to increase or decrease their storage capacity based on their needs. This scalability eliminates the need for users to worry about hardware upgrades or running out of storage space.
- ***Accessibility:*** Users can access their files from anywhere with an internet connection, using various devices such as computers, smartphones, or tablets. This makes it convenient for collaboration and remote work scenarios.
- ***Data Redundancy and Disaster Recovery***: Cloud storage solutions typically employ robust data redundancy and backup mechanisms. Data is often replicated across multiple servers and data centers, reducing the risk of data loss due to hardware failure or natural disasters. Cloud storage providers also offer backup and restore functionalities, allowing users to recover their data in the event of accidental deletion or system failures.
- ***Cost Efficiency:*** Cloud storage eliminates the need for upfront hardware investments, reducing capital expenditures. Users pay only for the storage resources they need, avoiding overprovisioning or underutilization. Cloud storage also eliminates maintenance costs associated with physical storage devices, such as power, cooling, and hardware upgrades.
- ***Integration and Flexibility:*** Cloud storage solutions integrate seamlessly with other cloud-based services, such as cloud computing platforms, content management systems, and collaboration tools. This integration enables the development of innovative applications and facilitates the adoption of hybrid cloud and multi-cloud architectures.

2.0 Types of Cloud Storage

Cloud storage solutions have revolutionized the way we store, manage, and access our data. With the advent of cloud technology, businesses, and individuals can now securely store their files, documents, and media assets in remote servers, providing flexibility, scalability, and ease of access.

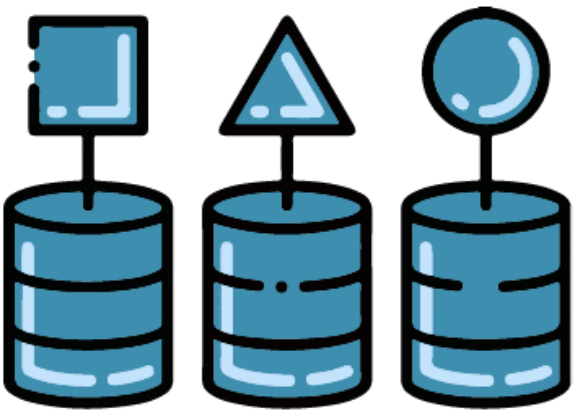
This module will explore the various types of cloud storage solutions, namely object storage, block storage, and file storage, highlighting their key features, use cases, and examples.

1. Object Storage

Object storage came into the IT industry in the 1990s when high-performance computing researchers needed scalable options for their massive data sets. Moreover, the growing, scalable cloud services lead to the popularity of object storage in the market.

As a flexible storage solution, object storage allows any data for the desired duration, facilitates easy retrieval of data, and is ideal for unstructured data, binary, or blobs. It adapts to frequent component failures of systems via continual monitoring, fault tolerance error detection, and automatic recovery. Object storage can accommodate massive data sets and files.

Since object storage is highly scalable, distributed, and more efficient. Furthermore, modern object storage is adapting to new technology.



Features*:* Scalability, durability, and high availability. Object storage systems are designed to handle large amounts of unstructured data efficiently.

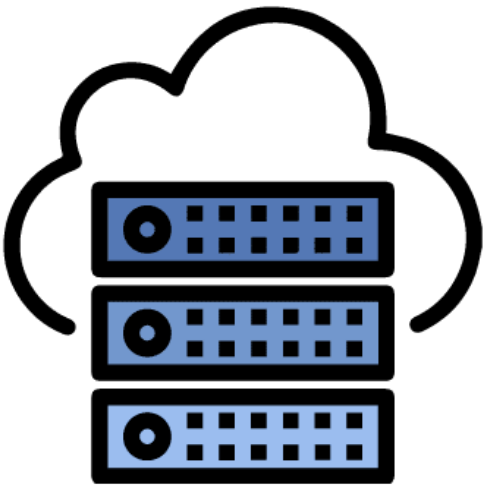
Use Cases:

- Backup and Disaster Recovery: Object storage enables businesses to securely back up their critical data and recover it in the event of data loss or system failures.
- Content Distribution: With object storage, companies can distribute large media files to end-users efficiently, ensuring high availability and reduced latency.
- Data Archiving: Object storage is ideal for long-term data retention, enabling organizations to store large volumes of data for compliance or historical purposes.

Examples: Prominent examples include Amazon S3, Google Cloud Storage, and Microsoft Azure Blob Storage.

2. Block Storage

Many cloud enterprise workloads are currently run using block storage. In this type of cloud storage, data is divided into sections called blocks and stored in a system that can be physically distributed. Each block has a unique identifier, allowing the system to track and assemble them as needed.



	As an integrated storage solution, block storage facilitates integration with Compute Engine and Google Kubernetes Engine (GKE). It also has low latency and high performance and is Ideal for Virtual Machines (VMs) and stateless workloads. A block storage system is used in cases where quick retrieval and manipulation of data are needed. **Features:** High performance, low-latency access, and the ability to mount block devices directly to virtual machines. **Use Cases:** • Database Storage: Block storage is often used to store databases, providing fast and reliable access to critical data for applications. • Virtual Machine Storage: Virtual machines require block storage for storing operating systems, applications, and other data necessary for their functioning. • High-Performance Computing: Block storage supports parallel access and high I/O throughput, making it suitable for demanding workloads like scientific simulations and data analytics. **Examples:** Notable examples are Amazon EBS, Google Cloud Persistent Disk, and Microsoft Azure Managed Disks. ***3. File Storage*** As the name indicates, in file storage, the data is stored in files. These files are then sorted and set up in folders arranged into directories, subdirectories, and more. Files in file storage are generally easy to name, delete, or customize without additional interfaces. As a fully managed network-attached storage solution, it is ideal for unstructured data/shared file storage.

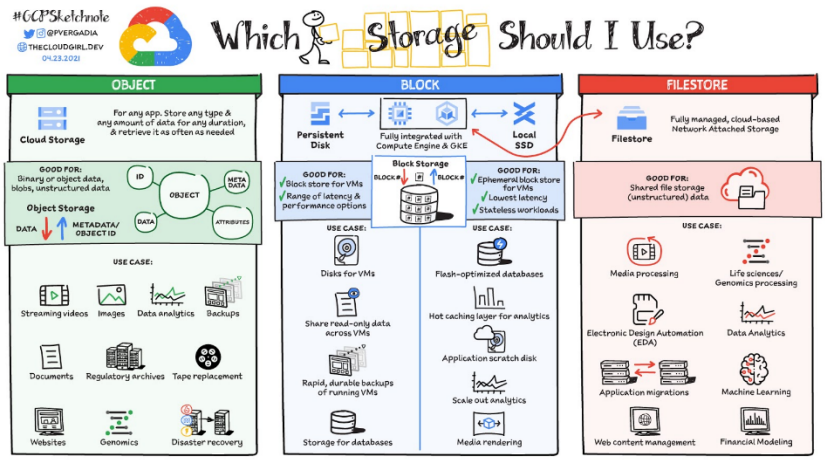
One of the significant advantages of file storage is its approachability. There are also other vital elements worth noting - for instance, file storage facilitates sharing and collaboration. Common uses for file storage are storage for office directories in content repositories, application migration, media processing, machine learning, and data storage that need data protection and easy deployment capabilities.

Features: File-level access, support for network file-sharing protocols (such as NFS and SMB), and permission controls.

Use Cases:

- Collaboration and File Sharing: File storage solutions facilitate seamless collaboration among team members by providing shared access to files and enabling real-time editing and version control.
- Media and Content Management: File storage is commonly used to store and manage media assets, such as images, videos, and documents, making them easily searchable and accessible.
- File-Based Workloads: Applications that rely on file-based input/output operations, such as media processing, data analysis, and web serving, benefit from file storage's ease of use and file-level access.

Examples: Leading examples include Dropbox, Box, Google Drive, and Microsoft OneDrive.

	In conclusion, cloud storage solutions come in various types, each designed to address specific storage requirements. Object storage excels at storing unstructured data, block storage provides low-latency access and is suitable for VMs and databases, while file storage offers hierarchical file system access for collaborative work. By understanding the different types of cloud storage solutions, businesses and individuals can choose the most appropriate option based on their needs and effectively leverage the benefits of cloud storage. 

Concrete methods to transmit knowledge: **Activities**	What kind of practical activities (NFE) are you going to implement in order to transmit the knowledge?	
		Please, specify here the methods used and the kind of activities you think might be functional in order to practically transmit the theoretical knowledge (Roleplay, Brainstorming Session, project-based learning, experiential learning, collaborative learning, problem-based learning. etc). *…* *Down below you should develop an activity related to the module's contents*

	Main Aim	The main aim of this activity is to encourage participants to analyze real-life scenarios and choose the most suitable type of cloud storage solution based on specific requirements.
	Used tools	Whiteboard or flipchart, markers, sticky notes.
	Material and preparation	Prepare a list of different scenarios that require cloud storage solutions. Each scenario should have specific requirements, such as performance, scalability, or cost constraints. Prepare sticky notes with the names of different cloud storage types (object storage, block storage, file storage).
	Session Description	1. Divide participants into small groups (3-5 members per group). 2. Explain the different types of cloud storage solutions: object storage, block storage, and file storage. Provide examples and explain their characteristics. 3. Present a scenario to each group, describing the requirements and constraints. 4. Ask each group to discuss and decide which type of cloud storage solution would be most suitable for the given scenario. 5. Each group should write their choice on a sticky note and place it on the whiteboard or flipchart. 6. After all groups have made their choices, facilitate a discussion where each group presents their decision and explains their reasoning. 7. Encourage group discussions and allow participants to ask questions and challenge each other's choices. 8. Summarize the advantages and disadvantages of each type of cloud storage solution based on the discussion.
	Debriefing	Facilitate a debriefing session where you summarize the key points discussed during the activity. Emphasize the importance of considering specific requirements and constraints when choosing a cloud storage solution. Address any remaining questions or concerns from the participants.

Module **References**	What is the source from which you gathered the information about the form? *Please, briefly describe and mention the source where you took the information from.* 1. Amazon Web Services. (n.d.). Cloud Storage. Retrieved from https://aws.amazon.com/what-is-cloud-storage/ 2. Microsoft Azure. (n.d.). What is cloud storage? Retrieved from https://azure.microsoft.com/en-us/overview/what-is-cloud-storage/ 3. https://vexxhost.com/blog/3-types-of-cloud-storage/ 4. https://domaonline.com/2021/10/05/3-types-of-cloud-storage/ 5. https://www.yourtechmasters.com/what-are-the-three-types-of-cloud-storage/ 6. https://domaonline.com/2021/10/05/3-types-of-cloud-storage/

Evaluation methods	How are you going to evaluate the level of understanding among the target group of the training? *Please, briefly describe the evaluation methods you intend to adopt in order to evaluate the success and effectiveness of the training.* • *Q&A sessions:* Organize Q&A sessions where participants can ask questions related to cloud storage solutions, their types, and their use cases. Assess the participants' engagement and the quality of their questions. • *Feedback forms:* Distribute feedback forms to participants to gather their opinions and suggestions regarding the module's content, delivery, and effectiveness. Analyze the feedback to make improvements for future training sessions.

Session Description Exercise

Scenario Description: You are working as an intern at a technology consulting company. Your supervisor has asked you to assess the storage requirements of three different clients. Each client has unique needs, and it's crucial to choose the appropriate cloud storage solution that best fits their requirements.

Client 1: Tech Startup (Object Storage)

The first client is a tech startup specializing in developing mobile applications. They require a storage solution that can efficiently handle vast amounts of unstructured data, such as images, videos, and

user-generated content. The company needs to access and retrieve this data quickly for its application's functionality and user experience.

Client 2: Financial Institution (Block Storage)

The second client is a renowned financial institution. They need a storage solution that offers high-performance and low-latency access to critical financial data. The institution performs numerous read-and-write operations on its data, such as database queries, financial calculations, and transaction processing. Data integrity and security are of utmost importance to them.

Client 3: Publishing Company (File Storage)

The third client is a well-established publishing company. They primarily deal with large-sized files, including manuscripts, images, and layouts. Collaborative file sharing and maintaining version control are essential for their distributed teams. The company requires a storage solution that allows multiple users to access and modify files simultaneously while maintaining data consistency.

Task: Your task is to analyze the unique requirements of each client and recommend the most suitable cloud storage solution for their needs. In your recommendation, explain the key characteristics and benefits of the storage solution you chose and highlight how they align with the client's requirements.

Take into consideration factors such as data structure, accessibility, scalability, performance, and cost when formulating your recommendation. Prepare a brief presentation summarizing your analysis and provide your recommendations along with your rationale.

Remember, this exercise aims to assess your understanding of Object, Block, and File storage solutions, and how well you can apply this knowledge to real-world scenarios. Good luck, and have fun exploring the diverse world of cloud storage solutions!

Learning Objectives	What do you want to achieve by implementing this module?
	Topic: Cloud Storage Providers: Discover popular cloud storage providers, such as Amazon S3, Microsoft Azure Blob Storage, and Google Cloud Storage. - Discover popular cloud storage providers like Google Drive, One Drive, and Dropbox. - Discuss the difference between Cloud storage and Object Storage - Obtain practical knowledge of how to use the basics of Cloud Storage using any of the providers discussed. - Evaluate the trainees' knowledge of what is learned so far.

Learning Outcomes	What are the expected results of this module?
	- Become familiar with various cloud storage providers, their pros as well as their cons. - Have experiential knowledge on how to use at least one of the providers discussed. - Be able to identify whatever provider is needed for their cloud solution

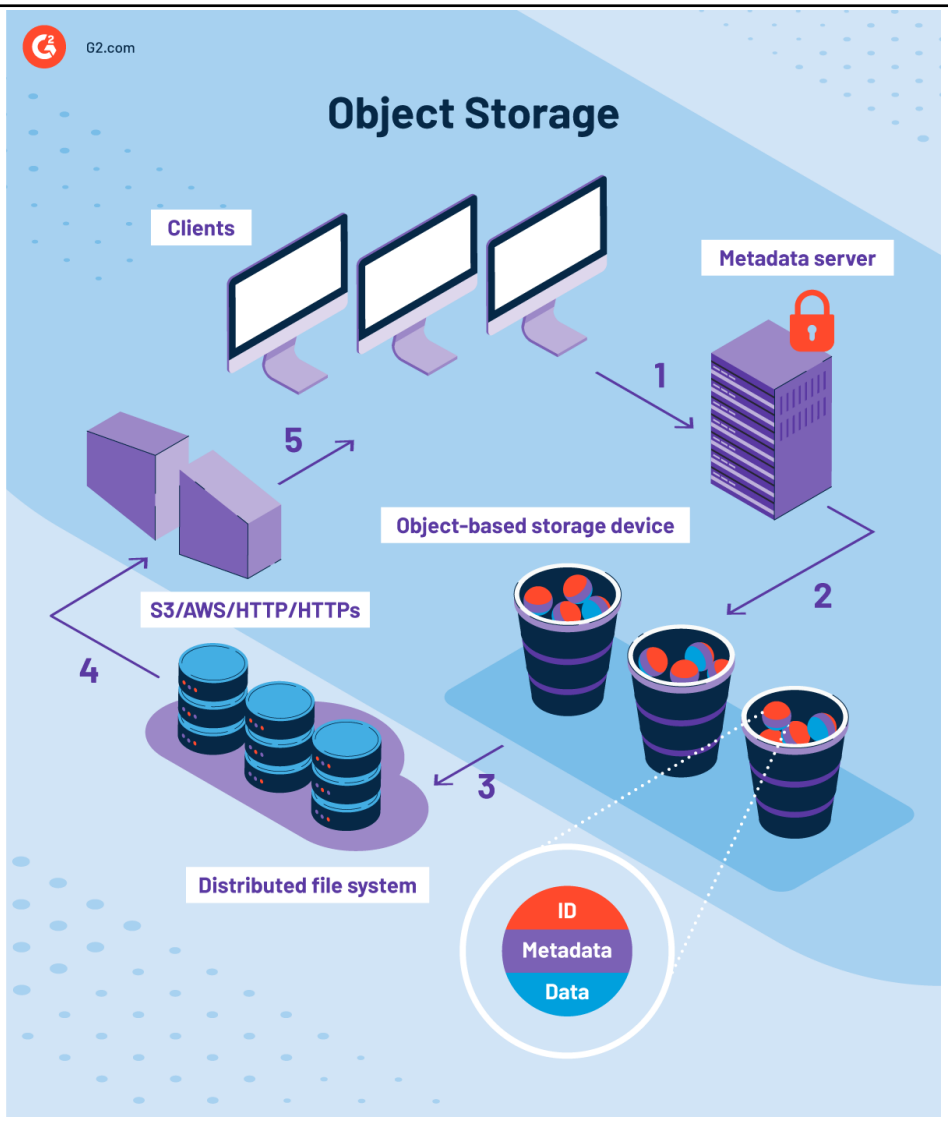
Theoretical content	What are going to be the main theoretical contents of the module?
	1. What is Cloud Storage Cloud storage is a service that allows individuals and organizations to store and manage data on remote servers that are accessed over the Internet. Instead of storing data locally on physical devices like hard drives or servers, cloud storage enables users to store their data on the infrastructure of a cloud service provider.

With cloud storage, users can upload, store, and retrieve their data from anywhere with an internet connection (Accessibility). The data is securely stored (Security) and replicated across multiple servers and data centers, ensuring durability and availability (Durability). Cloud storage providers typically offer scalable storage options, allowing users to adjust their storage capacity based on their needs (Scalability and Cost Efficiency).

Examples of popular cloud storage services include Amazon S3, Microsoft Azure Blob Storage, Google Cloud Storage, Dropbox, Google Drive, iCloud, etc.

2. What is Object Storage?

Object storage is a data storage architecture that stores data as discrete, independent objects rather than in a hierarchical file system or block structure. Each object in object storage consists of data, metadata (descriptive information about the object), and a unique identifier.



Characteristics/Features

***1. Scalability*:** Object storage is designed to scale horizontally, allowing for the storage of vast amounts of data. It can handle petabytes or even exabytes of data without performance degradation.

2. Metadata-driven: Each object in object storage has associated metadata, which provides information about the object's attributes, such as creation date, size, and content type. This metadata enables efficient searching, indexing, and retrieval of objects.

***3. Flat Namespace*:** Object storage systems use a flat namespace, where each object is uniquely identified by a globally unique identifier (GUID). This allows for easy and efficient access to objects without the need for complex directory structures.

4. Durability and Resiliency: Object storage systems typically employ data replication or erasure coding techniques to ensure data durability and resilience against hardware failures. Data is distributed across multiple storage nodes or data centers, reducing the risk of data loss.

5. High Availability: Object storage systems provide high availability by replicating data across multiple locations or data centers. This enables seamless access to data even in the event of hardware failures or network disruptions.

6. Access via APIs: Object storage is accessed using RESTful APIs, which allow for easy integration with applications and services. These APIs provide functionalities such as object creation, retrieval, deletion, and metadata management.

Object storage is commonly used for a wide range of applications, including cloud storage, backup, and archiving, content delivery networks (CDNs), media and entertainment, IoT data storage, and big data analytics.

Examples of object storage include Amazon S3 (Simple Storage Service), Microsoft Azure Blob Storage, and Google Cloud Storage.

3. Comparison between Cloud and Object Storage

Confused?

Cloud storage and object storage are quite similar, they both leverage cloud infrastructures to perform. We'll explore some comparisons between them.

Comparison Factors	**Cloud Storage**	**Object Storage**

Data Structure	Hierarchical file system or block storage	Object-based structure with unique identifiers
Scalability	Scalable vertically or horizontally	Highly scalable horizontally
Access Method	Traditional file system APIs or block storage protocols	RESTful APIs over HTTP/HTTPS
Metadata	Limited metadata support	Extensive metadata support with custom key-value pairs
Data Management	Primarily focused on storing and retrieving files or blocks	Built-in features for data replication, erasure coding, and lifecycle management
Use Cases	General-purpose file storage, virtual machine storage, traditional applications	Massive data storage, content distribution, backup and archiving, big data analytics, cloud-native applications

Key considerations when choosing a Cloud Storage provider:

- **Pricing:** Understand the provider's pricing structure, including storage costs, data transfer fees, and any additional charges for services like API requests or data retrieval. Compare pricing plans and consider long-term costs to determine the most cost-effective solution for your storage needs.

- **Security features:** Data security should be a top priority. Look for providers that offer strong encryption for data both at rest and in transit, as well as robust access controls, authentication mechanisms, and compliance with relevant security standards and regulations.

- **Performance:** Assess the provider's network infrastructure and global presence to ensure their data centers are located strategically to offer low-latency access. Consider factors like data transfer speeds, network bandwidth, and the ability to handle peak workloads effectively. This is particularly important if you

have specific performance requirements or if your applications heavily rely on data access.

- **Storage Capacity & Scalability:** Consider your current storage needs and evaluate whether the provider offers enough storage capacity. Additionally, assess their scalability options to accommodate future growth or sudden spikes in demand. Flexible storage plans and easy scalability can save you from unnecessary costs or limitations.

- **Integration with other cloud services:** Evaluate the compatibility of the cloud storage provider with your existing infrastructure, applications, and workflows. Look for support for common protocols and APIs (such as RESTful APIs) that enable seamless integration with your systems. Compatibility with various operating systems and devices is also important for easy access and collaboration.

4. Amazon S3, Microsoft Azure Blob Storage, and Google Cloud Storage.

Cloud storage providers have revolutionized the way individuals and businesses store, manage, and access their data. Among the most popular and widely used cloud storage providers are Amazon S3, Microsoft Azure Blob Storage, and Google Cloud Storage. These platforms offer scalable, secure, and reliable storage solutions, catering to a wide range of use cases and requirements. Let's delve into each of these providers and explore their features, benefits, and use cases.

1. ***Amazon S3***

Amazon Simple Storage Service (S3) is a highly scalable object storage service provided by Amazon Web Services (AWS). It is designed to store and retrieve any amount of data from anywhere on the web. Amazon S3 offers several features that make it popular among individuals and enterprises:

a) Scalability: Amazon S3 provides virtually unlimited storage capacity, allowing users to store and retrieve any amount of data. It can seamlessly handle small files as well as large datasets, making it suitable for a wide range of applications.

b) Durability and Availability: S3 is designed for durability, with data being automatically distributed across multiple geographically diverse data centers. It offers 99.999999999% (11 nines) durability, ensuring that data is protected against hardware failures and other disruptions. Additionally, S3 guarantees high availability, enabling users to access their data with low latency.

c) Security: S3 offers robust security features to protect data at rest and in transit. It supports encryption at rest using server-side encryption (SSE) and client-side encryption for added security. Access to data can be controlled using Access Control Lists (ACLs), bucket policies, and AWS Identity and Access Management (IAM) roles.

d) Integration and Ecosystem: Amazon S3 integrates seamlessly with other AWS services, such as Amazon EC2, Amazon Lambda, and Amazon Redshift, enabling users to build powerful and scalable applications. It also supports a wide range of SDKs and APIs, making it easy to integrate with third-party tools and applications.

Use Cases

Amazon S3 is widely used for various purposes, including backup and restore, content storage and delivery, data archiving, data lakes, and application hosting. It serves as the backbone for many popular services, such as Netflix, Airbnb, and Pinterest.

2. Microsoft Azure Blob Storage

Azure Blob Storage is a scalable and cost-effective object storage service provided by Microsoft Azure. It is designed to store and manage large amounts of unstructured data, including text, images, videos, and binary data. Azure Blob Storage offers several key features:

a). Scalability and Performance: Azure Blob Storage can automatically scale to accommodate growing storage needs and high-demand workloads. It offers multiple storage tiers, including hot, cool, and archive, allowing users to optimize costs based on data access patterns. It also provides high throughput and low-latency access, ensuring efficient data transfer.

b). Security and Compliance: Azure Blob Storage offers robust security features, including encryption at rest and in transit. It supports server-side encryption using Azure Storage Service Encryption (SSE) and client-side encryption for added control. Compliance certifications, such as HIPAA, ISO,

and GDPR, ensure that data stored in Azure Blob Storage meets industry standards.

c). Data Management and Lifecycle Policies: Azure Blob Storage provides various data management capabilities, including lifecycle policies, versioning, and data tiering. Users can define rules to automatically move or delete data based on specific criteria, optimizing storage costs and data lifecycle management.

d). Integration and Ecosystem: Azure Blob Storage seamlessly integrates with other Azure services, such as Azure Functions, Azure Logic Apps, and Azure Machine Learning, enabling users to build comprehensive solutions. It also supports a wide range of development tools and frameworks, including .NET, Java, Python, and Node.js.

Use Cases

Azure Blob Storage is well-suited for scenarios like backup and restore, media storage and streaming, data archiving, and content distribution. It is used by organizations of all sizes, including enterprises, startups, and individual developers.

3. ***Google Cloud Storage:***

Google Cloud Storage is a scalable and highly available object storage service offered by Google Cloud Platform (GCP). It provides secure and durable storage for a wide range of data types, including structured and unstructured data. Here are some key features of Google Cloud Storage:

a). Scalability and Performance: Google Cloud Storage is designed to handle massive workloads and can automatically scale to accommodate growing data requirements. It provides low-latency access to data and offers different storage classes, including Standard, Nearline, Coldline, and Archive, enabling users to optimize costs based on data access patterns.

b). Data Redundancy and Durability: Google Cloud Storage replicates data across multiple geographically distributed data centers, ensuring high durability and availability. It offers 99.999999999% (11 nines) durability for stored objects, providing robust data protection against failures.

c). Security and Access Control: Google Cloud Storage offers advanced security features, including encryption at rest and in transit. It supports server-side

	encryption using Google-managed keys or customer-supplied keys. Access to data can be controlled using Identity and Access Management (IAM) roles and policies, providing granular control over permissions. **d). Integration and Interoperability:** Google Cloud Storage integrates seamlessly with other Google Cloud services, such as BigQuery, Compute Engine, and Cloud Functions. It also supports a wide range of APIs and SDKs, enabling easy integration with third-party tools and applications. ***Use Cases*** Google Cloud Storage is well-suited for various use cases, including data backup and restore, data archiving, multimedia content storage and delivery, and analysis of large datasets. It is utilized by organizations across industries, including media and entertainment, healthcare, and e-commerce. In conclusion, popular cloud storage providers like Amazon S3, Microsoft Azure Blob Storage, and Google Cloud Storage offer robust and scalable solutions for storing, managing, and accessing data in the cloud. Each provider has its own unique features, integrations, and pricing models, allowing users to choose the one that best aligns with their specific needs and requirements. Whether you are a small business, a startup, or a large enterprise, these cloud storage providers provide reliable and secure storage options to meet your data storage and management needs.

Concrete methods to transmit knowledge: **Activities**	What kind of practical activities (NFE) are you going to implement in order to transmit the knowledge?	
		Please, specify here the methods used and the kind of activities you think might be functional in order to practically transmit the theoretical knowledge (Roleplay, Brainstorming Session, project-based learning, experiential learning, collaborative learning, problem-based learning. etc). *…*

		Down below you should develop an activity related to the module's contents
	Main Aim	Experiential learning : To make participants get familiar and hands-on experience on using cloud storage services
	Used tools	Laptop Mobile Phone Internet Connectivity
	Material and preparation	A powerpoint presentation of this module A projector to present this presentation to the audience, and or an online classroom or meeting platform capable of screen sharing.
	Session Description	**Step-by-Step Implementation Guide: Teaching Cloud Storage with Google Cloud Storage** 1. **Account Setup and Service Provisioning:** - Instruct students to create a Google Cloud Platform (GCP) account by signing up at https://cloud.google.com/. - Guide them through the process of enabling the Google Cloud Storage service in the GCP Console. 2. **Creating Storage Bucket:** - Explain the concept of a storage bucket in Google Cloud Storage, which acts as a container for storing data. - Walk students through the steps to create a new storage bucket using the GCP Console or the Cloud Storage API. 3. **Uploading and Retrieving Data:**

		- Demonstrate how to upload files to the created storage bucket using the GCP Console, command-line tools (like gsutil), or client libraries (e.g., Python). - Show students how to retrieve and download the uploaded data using various methods, such as the GCP Console or programmatic access via API. 4. **Data Management and Organization:** - Illustrate how to organize files within the storage bucket using folders or prefixes to group related data. - Introduce metadata attributes and explain how to associate metadata with objects for better organization and searchability. 5. **Data Security and Access Control:** - Walk students through the process of configuring access controls for the storage bucket using IAM (Identity and Access Management) roles and permissions. - Explain how to generate signed URLs to grant time-limited access to specific objects in the storage bucket. 6. **Cross-Platform Integration:** - Integrate Google Cloud Storage with other Google Cloud services like Google App Engine or Google Cloud Functions to showcase its interoperability. - Show how to store and retrieve data from Google Cloud Storage within these platforms. 7. **Backup and Restore:** - Explain the importance of data backups and demonstrate how to create backups of objects in Google Cloud Storage using features like Object Versioning or Object Lifecycle Management.

		- Teach students how to restore data from backups in case of accidental deletion or data corruption. 8. **Performance Optimization:** - Introduce caching techniques and demonstrate how to enable caching for objects stored in Google Cloud Storage using Cache-Control headers. - Explain the benefits of using a Content Delivery Network (CDN) with Google Cloud Storage for faster content delivery and reduced latency. 9. **Monitoring and Billing:** - Show students how to monitor the usage and performance of their Google Cloud Storage resources using Cloud Monitoring and Cloud Logging. - Educate them on how to analyze billing reports, set budget alerts, and optimize costs by understanding pricing tiers and storage classes. Ensure that students have access to the Google Cloud Platform documentation and resources, as they can serve as references for the implementation steps and provide additional details when needed. Note: Ensure that students adhere to any usage limits, pricing considerations, and compliance requirements of the cloud storage services being used.
	Debriefing	

Module **References**	What is the source from which you gathered the information about the form? 1. AWS S3 Developer Guide: https://docs.aws.amazon.com/AmazonS3/latest/dev/Welcome.html 2. Azure Blob Storage Documentation: https://docs.microsoft.com/en-us/azure/storage/blobs/ 3. Google Cloud Storage Documentation: https://cloud.google.com/storage/docs 4. https://www.architecting.it/blog/nine-critical-features-for-object-stores/ 5. https://www.ibm.com/topics/object-storage 6. https://aws.amazon.com/what-is/object-storage/ 7. Google Cloud Storage Documentation: https://cloud.google.com/storage/docs 8. Google Cloud Platform Tutorials: https://cloud.google.com/docs/tutorials

Evaluation methods	How are you going to evaluate the level of understanding among the target group of the training? *Please, briefly describe the evaluation methods you intend to adopt in order to evaluate the success and effectiveness of the training.* ❖ Participants will be asked to reproduce the experiential knowledge without guidance

Module 6: Cloud-Based Assessment and Evaluation

Learning Objectives	What do you want to achieve by implementing this module?
	The main aim of this module is to help the target group understanding the main Cloud-based tools for assessment and evaluation: • Understanding the main Cloud-based assessment and evaluation tools for VET schools: Google Forms ,Kahoot, Thatquiz, Socrative,Quizlet, Wooclap, This Base, Survey Monkey, Rubistar, Rubric maker • Creating and managing online questionnaire and quizzes using cloud-based tools according to the topic and need of the teacher • Hands-on experience with using cloud-based assessment and evaluation tools for lessons and learning assessment

Learning Outcomes	What are the expected results of this module?
	At the end of this module, both VET learners and VET providers will be able to understand two of the main possibilities offered by cloud computing for assessing and evaluating learning. More specifically, the objectives are as follows: • VET learners and VET providers: Understanding the main Cloud-based assessment and evaluation tools for VET schools: Google Forms and Kahoot: how to access them and how to use them as tools for education • VET learners: Understand how to create questionnaires to self-assess their acquired knowledge • VET providers: how to create and manage assessment and evaluation cloud based tools matching students perception; how to get feedbacks after the lessons

Theoretical content	What are going to be the main theoretical contents of the module?
	GOOGLE FORMS Integrated tool in the Google Suite for Education, it allows the production of questionnaires and surveys that can be customised in terms of graphics and various settings. You can administer multiple choice questions (also with multiple answers), open-ended questions, with file upload, with multiple choice grids and multiple answers and others. Different scores can be assigned to each question and feedback can be customised for individual answers. The administration via Google Classroom provides for the setting as a test, which in

any case can also be set outside of Classroom.
Tests can be shared via links, sent by email or embedded in a web space.
The graphics of the results are excellent, combined with the answers in Google Sheets format, even if the mistakes made are not highlighted in the latter.

Google Forms is the ideal tool, within Google Workspace for Education, for evaluation processes. In fact, it is essential to know this tool both to send evaluations in the most traditional sense of the term, and to give feedback, create reports, stimuli and ideas for reflection.

Google Forms is a very useful tool for teachers, a free online platform that integrates perfectly with Google Classroom.
Google Forms is a quick and easy way to create quizzes to share with students or other teachers, who can modify them according to the subject. This tool is also all cloud-based, so distributing anything you create is as easy as sharing a link.
Forms also offers numerous templates and a selection of pre-filled options for generating quizzes, assessments, worksheets and more.

Here the official free guide to use Google Form:
https://edu.google.com/intl/ALL_us/for-educators/product-guides/forms/?modal_active=none

KAHOOT! - is a game-based learning platform, used for educational purposes in schools and other educational institutions.
Its learning games, “Kahoots,” are multiple-choice quizzes that can be written by users and can be accessed via a Web Browser or through the Kahoot App. This platform can be used to measure student knowledge, for formative assessment, or as a break from traditional classroom activities.
It was designed for social learning, with students gathered around a common screen such as an interactive whiteboard, projector or computer monitor (https://www.google.com/url?q=https://kahoot.com/&sa=D&source=docs&ust=1690380608656396&usg=AOvVaw3jN5-oUvOcII2vpbUabvUO)
For the formative assessment, the teacher creates the kahoot by entering the questions, the answers (also indicating the one considered correct), the projection time and the score of each question and any images or links to videos on Youtube.

THATQUIZ – Before an application for creating tests is a database of questionnaires in English on various subjects of mathematics, science, geography and foreign languages.
It allows the creation of classes, the customisation of measurement scales, the administration of questions and answers in random order and the differentiated management of the scores of each question. If the interface in English and the unattractive graphics are not a problem, it is a reliable tool, which also allows the sharing of the generated tests among colleagues.

SOCRATIVE – Pleasant graphics and ease of use are the most evident characteristics of this versatile application, which provides different methods of

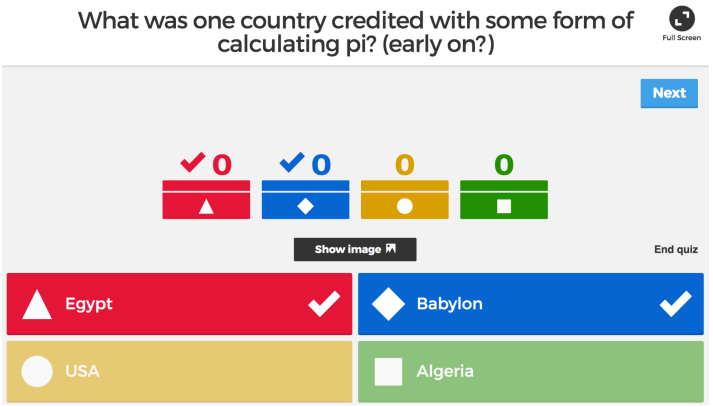
	administration and feedback and the return of results with graphs and tables, as well as with individualised files showing the evaluation obtained and the correction of each single answer. In addition to the Quiz mode, there is the Space Race mode, for stimulating group challenges. Uploading quizzes using an ID code makes it easy to share them with colleagues. **QUIZLET** – Among the functions of this pleasant application, mainly dedicated to learning vocabulary, we find the management of flashcards, listening to pronunciation, learning spelling, the timed challenge at increasing speed, even in groups. **WOOCLAP** – The application offers a wide variety of questions: multiple choice, true/false, ranking, matching, completing, comparing, open-ended answers, file submission and many more. Feedback is provided via PDF, Excel/ CSV and grids. Integration into PowerPoint, Google Slides, PDF and Keynote presentations is planned. More than a tool for verification, in fact, it can be considered a generator of questions to be used in presentation mode, to involve participants, probe their opinions and verify some specific knowledge. **THISBASE** – Multi-platform web application that allows the generation of tests and checks of all kinds. It can also be used to create opinion and satisfaction surveys. It allows the importation of questions of various types, the automatic and manual evaluation and the online publication of the tests. Flexible and articulated, after the trial period it is accessible for free only through Fidenia. **SURVEY MONKEY** – Effective and feature-rich tool for collecting opinions and administering satisfaction questionnaires and quizzes of all kinds. Allows collection of feedback via web links, emails, social media and more. Analyse the results and export or integrate them into various applications. Easy to use, it offers interesting tools even in the free version. **RUBISTAR** – Creating evaluation rubrics in a short time is not easy. Unless you try the RubiStar application, where registered users can edit and save address books online, through the Create Rubric function. The site is accessible in English or Spanish, but the procedure is easily understandable. **RUBRIC MAKER** – Simple and intuitive, this English-language application provides templates for developing customisable and downloadable evaluation rubrics.

Concrete methods to transmit knowledge:	What kind of practical activities (NFE) are you going to implement in order to transmit the knowledge?	
		Experiential learning

Activities N. 1	Main Aim	Create a customised, reusable feedback form for every VET learner
	Used tools	ICT class, Laptop, Google Form
	Material and preparation	Printed guideline on how to use Google Form as evaluation tool. Questions are prepared together with the students. Each student has to have its own gmail account.
	Session Description	Teacher will create a Google Form with all of the questions and prompts he/she'd like learners to use as a guide while giving feedback. It is possible to create any type of question or prompt on Google Forms for peer feedback, but remember to keep it simple. Allow students to edit their feedback before submitting it to the speaker. We want it to be their best work, and sometimes they can't do that in only a few minutes. Limit responses to just one. For learners to turn a teacher template into their own form and see the feedback they receive, they'll need to make a copy of the template so they own the form. After learners have accessed their forms, the teacher walks them through the steps they'll need to personalise them. They should change the document's name, insert their name into the form title and add you as a collaborator (if you'd like to see the feedback they receive). In order to distribute peer feedback links create a document (word or excel sheet) where learners will share links to their forms. The document where the links for accessing all the forms are saved must be accessible online and all users must be able to modify them. In this way, when it's time for learners to speak publicly, student feedback forms are only a click away. The feedback is available instantly to the speakers, and they can even view graphs or charts from questions. Gathering and evaluating data is a great skill to embed into any lesson. To let learners collect peer feedback again, there is no need to reinvent the wheel—or just make a copy of the Google Form you've already created. First, they should make sure they've created a spreadsheet

		with their first speech or presentation results. They can save the document with their class files and use it as a baseline for their progress as they continue to present to the class. Next, they'll open their form and select "Responses," and then turn off the Form. Afterward, they'll click on the three dots and select "Unlink form." Now they'll start with a fresh spreadsheet the next time they use the Form. Finally, they'll go back to the three dots and select "Delete all responses." This gets all of the responses cleared from the Form itself. Now the Form has been reset, so to speak, and it's ready to use again.
	Debriefing	Participants will work in pairs and share the results and their impression to the whole class.

Concrete methods to transmit knowledge: Activities N. 2	What kind of practical activities (NFE) are you going to implement in order to transmit the knowledge?	
		Please, specify here the methods used and the kind of activities you think might be functional in order to practically transmit the theoretical knowledge (Roleplay, Brainstorming Session, project-based learning, experiential learning, collaborative learning, problem-based learning. etc). *…* **Maths as a Welcoming activity in the class**
	Main Aim	A nice socialisation activity with and among the class, which can be programmed in the first few days of school for a first class, is a "team maths competition". The activity will allow the teacher to understand, beyond the general level of "mathematisation" of the class, the first dynamics of interaction and competition.
	Used tools	A surface on which to project the questions – IWB or simple projector. Devices of all kinds that can connect to the Internet – smartphones, computers, tablets

	Material and preparation	For teachers it is necessary to subscribe to the service and choose from the library, based on their discipline, one of the ready-made tests or create new ones (which I recommend in order to calibrate specific language and objectives for your class). To access the quiz (Kahoots), students will simply have to enter the pin code provided by the teacher without having to register. Preparation of Kahoot lessons are prepared together with the students
	Session Description	The teacher's task is to have a deck of cards on each of which is written a mathematical question and the relative score based on the difficulty. The class is divided into two groups and the teacher takes turns reading the various questions, and the relative score, to a boy/girl in the group, who, if he answers correctly, earns the point, otherwise the turn passes to a boy/girl from the other group until the correct answer is reached. The game is a cloud-based version of the game "Guess who". You can either use the scheme already provided or insert new graphics in an empty scheme also present on the site.  The teacher chooses a graph each time and the students take turns asking questions (passage through a point, intersections with the axes, etc.) which have the only answer "YES" or "NO". The students use the answers to exclude some boxes from time to time. The student who first guesses the box initially chosen by the teacher wins. The game will allow you to create automatisms, without them becoming boring, also useful for carrying out more traditional exercises, moreover, it will favour the direct involvement of the students who will be stimulated to

		participate actively by putting themselves "in the game". The teacher can also decide to launch the game in classic mode (individual game) or in teams, and to have the students play all together at the same time, to consolidate or repeat a topic in class, or to have the quiz carried out independently as an exercise for home, sharing the link created on your own classroom.
	Debriefing	The quizzes will be very useful in understanding where the class is in relation to a certain learning objective. Through the answers, perhaps asking for the complete resolution or the exact explanation between one exercise and another, the teacher can understand which topics are internalized and which are, instead, the ones to return to because they need reinforcement. At the end of each test it is possible, in fact, to view the scores and questions of the individual pupils in order to understand the right answers and the wrong answers.

Module	What is the source from which you gathered the information about the form?
References	*Please, briefly describe and mention the source where you took the information from.* https://zonamatematica.deascuola.it/ https://edu.google.com/intl/ALL_us/for-educators/product-guides/forms/?modal_active=none https://it.wikipedia.org/wiki/Kahoot

Evaluation methods	How are you going to evaluate the level of understanding among the target group of the training?
	Please, briefly describe the evaluation methods you intend to adopt in order to evaluate the success and effectiveness of the training. A self-assessment of module understanding will be done through a mandate to create: - an evaluation questionnaire with Google Form for the VET learners target - a mini activity on Kahoot! for VET providers

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