Introduction to Cloud Computing Fundamental for Teachers and Students of SMK Negeri 1 Karangdadap Kabupaten Pekalongan

LIPTIA VENICA[1], MUHAMMAD AYYAS[2], MUCHAMAD AMIN MAEZUN TA'SIN BILLAH[3], RISTA DEWI OPSANTINI[3], SYAIFI AL-MAHFUDZI[3]

[1] Department of Mechatronics and Artificial Intelligence, Universitas Pendidikan Indonesia
[2] Department of System and Information Technology Education, Universitas Pendidikan Indonesia
[3] Sekolah Menengah Kejuruan Negeri 1 Karangdadap, Kabupaten Pekalongan
Email: liptiavenica@upi.edu

ABSTRACT

The use of cloud computing technology is currently increasingly widespread. The purpose of this community service is to introduce vocational high school students and teachers to cloud computing and implement it to solve computational problems. Participants are introduced to cloud architecture, the advantages of using cloud, various cloud service providers, and different categories of products that the cloud service providers deliver. During the training, participants are provided with the case studies on the use of three products available on Google Cloud Platform (GCP), i.e., Compute Engine, Cloud Storage, and Cloud Vision API. As a result, participants are able to create virtual machines using Compute Engine, publish static web pages using Cloud Storage, and create an application to detect the name and location of a landmark from an image using Cloud Vision API. After this activity, participants are expected to be able to explore other cloud products available and use them to create their own projects.

***Keywords**: Cloud Computing, Google Cloud Platform, Compute Engine, Cloud Storage, Cloud Vision API, Vocational School*

1. INTRODUCTION

The utilization of cloud computing technology has rapidly developed and permeated various industries **(Erl and Monroy, 2023)**. Cloud computing is a model that enables users to access and utilize computing resources over a network on-demand, without extensive management or interaction with service providers. It involves a shared pool of configurable resources, such as networks, servers, storage, applications, and services, that can be rapidly provisioned and released as needed. Cloud providers offer infrastructure as a service which allows customers to rent virtual machines (VMs) and other computing resources on demand. The internet provides ubiquitous access to cloud services, allowing customers to access their data and applications from any device, anywhere in the world **(Hoff, 2017)**.

In accordance with the current advancements of cloud computing technology, numerous organizations and companies have shifted towards cloud-based solutions to enhance their operational efficiency. For instance, in the entertainment industry, digital streaming services such as Netflix employ cloud technology to store and manage vast content libraries, conduct data analysis for improved content recommendations, and deliver a seamless streaming experience to their customers (**Li et al., 2021**). In the healthcare industry, medical service providers are currently leveraging the cloud to securely store and share patient data, conduct in-depth data analysis for medical research, and enhance the performance of existing healthcare systems **(Zhang et al., 2017)**. Furthermore, in the e-commerce sector, companies like Amazon utilize cloud computing to operate their e-commerce platforms, process transactions, manage inventory and orders, and deliver a seamless shopping experience for consumers. Cloud computing technology has also been adopted in the education sector, allowing educators and students to access learning materials online from anywhere and at any time. The use of cloud computing services in education is exemplified by Google Education Workspace and Microsoft 365 **(González-Martínez et al., 2015)**.

Cloud computing has revolutionized the way businesses and individuals manage data, applications and more. Cloud computing allows organizations to reduce costs by eliminating the need for on-site infrastructure and hardware, as well as the associated maintenance and upgrade costs. Additionally, cloud computing also offers the ability to scale resources up or down based on demand, allowing organizations to easily accommodate fluctuating workloads and avoid over-provisioning **(Khayer et al., 2020)**. Cloud computing also allows users to access their data and applications from anywhere with just an internet connection, this can encourage remote work and collaboration. Furthermore, cloud service providers typically offer high levels of reliability and availability, with built-in redundancy and backup systems to ensure continuous access to data and applications. Cloud providers also invest heavily in security measures, including encryption, access controls, and regular security updates, to protect data and mitigate risks **(Raj, 2021)**.

Cloud computing is one of the four most in-demand skills in the workplace, along with artificial intelligence (AI) **(Torkington, 2023)**. Understanding cloud computing is undoubtedly beneficial for students and teachers. By understanding cloud computing, students will be able to comprehend how to store, share, and access files across various devices, making it easier for them to retrieve information. Cloud computing literacy enables students to harness current knowledge, empower effective knowledge management, access resources anytime and anywhere, and collaborate to produce superior academic outcomes **(Arpaci, 2017)**. On the other hand, understanding cloud computing also offers significant benefits to educators in this digital age. One of the primary advantages is the ability to provide and manage educational resources more efficiently. By leveraging cloud services, instructors can easily access, store, and share learning materials with their students, even from a distance. This enhances teaching flexibility and enables educators to design more dynamic learning experiences and improve learning quality **(Munjal, 2015).**

Indonesia's Ministry of Education, Culture, Research and Technology has a program called "Program Pengembangan SMK Berbasis Revolusi Industri 4.0" that aims to equip vocational school students with the knowledge and skills necessary to thrive in the 4th Industrial Revolution, including cloud computing skills. SMK Negeri 1 Karangdadap, Pekalongan is a vocational school in Indonesia that fulfills the criteria for eligibility to receive government funding for this program. In order to follow up on the program, this community service aims to introduce the fundamental principles of cloud computing and its implementation to teachers

and students at SMK Negeri 1 Karangdadap, Pekalongan. The material that will be presented includes:

1. Basic introduction to cloud computing
2. Getting started to Google Cloud Platform
3. Create a virtual machine and install an operating system using Compute Engine
4. Create and host static website using Cloud Storage
5. Create a landmark detection application using Cloud Vision API

Cloud computing is a rapidly growing field, and it is important for teachers and students of vocational schools to be aware of its potential benefits.

2. METHODS

The method that is applied for the training activity in this community service is divided into four stages, namely the planning stage, the action stage, the observation stage, and the reflection stage **(Ramadona, Amelia, & Gilang, 2022)**. The detailed explanation for each stage is as follows.

2.1 Planning
Prior to the workshop activity, there are some technical aspects discussed by the team, including the level of ability of the target participants related to the use of information technology, the selection of Google Cloud Platform's products that are introduced to the participants, Google account that is used to access the cloud console, room preparation both offline and online, guidance modul, quiz questions, and evaluation schema.

2.2 Action
This community service is organized both online and offline. Participants consisting of teachers and students take part in workshop activities at the Computer Laboratory of SMK Negeri 1 Karangdadap, Pekalongan. The presenter delivers the lecture online through a Zoom Meeting from Universitas Pendidikan Indonesia, Purwakarta campus. The activity is scheduled in one day for four hours, from 9.00 AM to 1.00 PM.

Table 1. Workshop Rundown

No	Time	Activity
1	9.00 – 9.15 AM	Opening ceremony
2	9.15 – 9.30 AM	Participants preparation
3	9.30 – 10.15 AM	Presentation session: Cloud Computing Fundamental
4	10.15 – 10.30 AM	Discussion session
5	10.30 AM – 12.30 PM	Hands on using GCP products based on the case studies provided
6	12.30 – 12.45 PM	Post-test
7	12.45 – 1.00 PM	Closing ceremony

Table 1 indicates the flow of community service activities. During the preparation session, participants are directed to sign up to GCP website using their Google account. The main activity is set to start at 9.30 AM with the presentation by the speaker about cloud computing fundamentals. The training then continues with participants accessing the GCP console from their computer through a web browser to practice using cloud services. The workshop is designed to end with a quiz and filling out an evaluation form by all participants.

2.3 Observation
During the hands-on session, all participants will use the same project folder in Google Cloud Platform (GCP) that has been provided by the workshop team. Through this project, all activities and products produced by participants can be monitored easily. Therefore, the team

can observe quickly when participants experience problems while working on the hands-on module.

2.4 Reflection

At the reflection stage, the effectiveness of the workshop on the fulfillment of participants' cloud computing skills is identified by conducting a post-test and distributing questionnaires to the workshop participants. The post-test is carried out by giving participants questions related to cloud computing in the form of multiple-choice questions as shown in Table 2. The questions are related to the cloud service models and product functionality.

Table 2. The List of Post-test Questions

No	Questions	Answer Choices
1	Which statement best describes cloud computing?	A. An on-premise server that can be configured for personal use B. A magic computer in the sky that the user can rent C. A computer that can be used without the internet D. The user can use the resources provided by servers on the internet.
2	Which one is the main advantage of cloud computing?	A. Can be accessed without the internet B. Easy to access and provide cost-efficiency with pay-as-you-go system C. Expensive and hard to manage D. None of the above
3	The following is not a cloud computing service model:	A. Infrastructure as a Service B. Software as a Technology C. Software as a Service D. Platform as a Service
4	The physical infrastructure of cloud computing services is grouped into Regions and Nations.	A. True B. False
5	What kind of cloud computing service is Google Drive?	A. IaaS B. PaaS C. SaaS D. All of the above
6	The type of cloud computing service that is more inclined towards renting hardware such as hard disk space allocation, CPU, memory, etc. is...	A. IaaS B. PaaS C. SaaS D. None of the above
7	Here are some cloud computing services provided by Google Cloud Platform, except	A. Gmail B. Alibaba Elastic Compute Service C. Cloud Storage D. Cloud Vision API
8	Examples of cloud computing service utilization practiced in the workshop today, except	A. Renting infrastructure in the cloud and installing Ubuntu OS B. Creating a movie ticket reservation application C. Creating a landmark detection system based on images D. Creating and uploading a static website to the cloud so that it can be accessed publicly
9	During the hands-on session, we created a static website on Google Cloud Platform using Cloud Storage.	A. True B. False

Table 3 points the list of questions to measure the satisfaction of workshop participants with the delivery and materials from the speakers. The survey is created by using Google Form and contains questions with 5-point Likert scale, where 1 represents "Poor" and 5 represents "Excellent" to communicate how satisfy the participants with a particular statement. At the end of the survey form, the participants are provided with a section to provide their feedback and suggestions regarding the workshop.

Table 3. The List of Satisfaction Survey Questions

No	Questions
1	How well does the instructor understand the material being presented?
2	How is the material being organized?
3	How useful is this training for you?
4	How well does the instructor identify and address the difficulties of the participants?
5	How interested are you in learning more about cloud computing?
6	How well does the instructor understand the diversity of competencies of the participants?
7	How was the overall implementation of this workshop?

3. RESULTS AND DISCUSSION

This community service was held on Tuesday, 27 September 2022. The event was attended by 10 participants consisting of 2 teachers and 8 students of SMK Negeri 1 Karangdadap. This four-hour event was organized in a blended manner, the speaker was at UPI Purwakarta Campus and connected via Google Meet with participants at the Computer Laboratory of SMK Negeri 1 Karangdadap. The event was opened by singing the Indonesia Raya song and delivering remarks from Muchamad Amin Maezun Ta'sin Billah. Afterwards, the event continued with the preparation of the participants to create Google Cloud Platform accounts using their respective Google accounts. Participants are divided into four small groups to ease the discussion process.
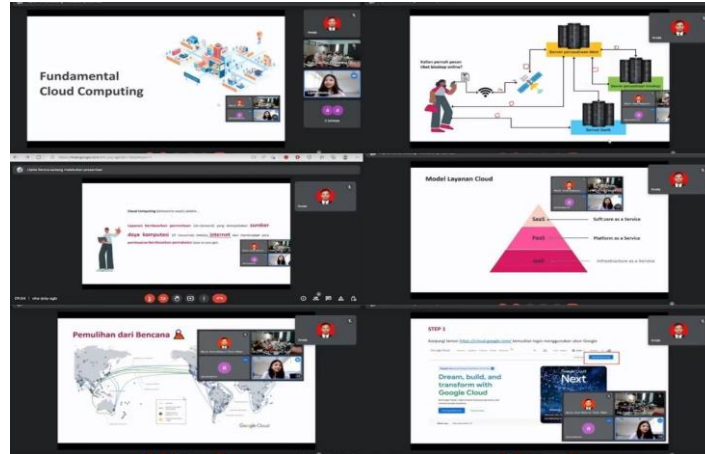
3.1 Presentation and Discussion Session
The activity continued with a presentation entitled "Fundamental Cloud Computing" by Liptia Venica as shown in Figure 1. Participants were first introduced to the basic concept of cloud computing through a simple scenario, the online cinema ticket purchase service. Through this simple scenario, participants get to know the computing process that occurs in the cloud which involves various entities such as computing that occurs on the side of the ticket selling companies, cinema companies, and banks that handle non-cash payment processes. They also received exposure to how complex the massive process of online ticket booking services can be handled by computers on cloud services in a short time.

Furthermore, the participants are introduced to various terms related to cloud computing such as data centers, regions, zones, and so on. Not to forget, participants were introduced to three types of cloud service models, namely Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) along with examples of services provided by various cloud service providers such as Google Cloud Platform (GCP), Amazon Web Service (AWS), Alibaba Cloud, and IBM Cloud. Participants were also encouraged to analyze the benefits of using cloud services in terms of accessibility, efficiency, cost, and disaster recovery. The presentation session ended by inviting participants to see various project examples of the implementation of cloud computing services in various sectors.

In the discussion session, participants asked several questions regarding the development of cloud services provided by Google and regarding various tools for exploring or learning more deeply about cloud computing. Teachers were also asked some questions related to the application of cloud computing in educational institutions.

Figure 1. The Presentation and Discussion Session

3.2 Hands-on Session

In the hands-on session, all participants were required to login to their Google Cloud account and access the cloud console to see the diverse type of services that GCP provided. They were introduced to how to access GCP's free tier services. During the hands-on session, teachers and students gained experience using several GCP services including Compute Engine, Cloud Storage, and Cloud Vision API. In this workshop there were 3 types of projects created by participants using cloud services on GCP. The first project was working with Google Cloud Compute Engine for creating a virtual machine. Participants were directed to create a virtual machine in the free-tier zone provided by GCP and install an Ubuntu operating system as shown in Figure 2. With the virtual machine instance, participants gained experience installing and working with operating systems where the computing resources are not physically visible because they are located in the cloud service provider's data center. They were directed to install some computer games through the console as shown in Figure 3. Through this console game experience via VM instance on GCP, participants practiced the use of the operating system as they usually use on their laptop or personal computer.
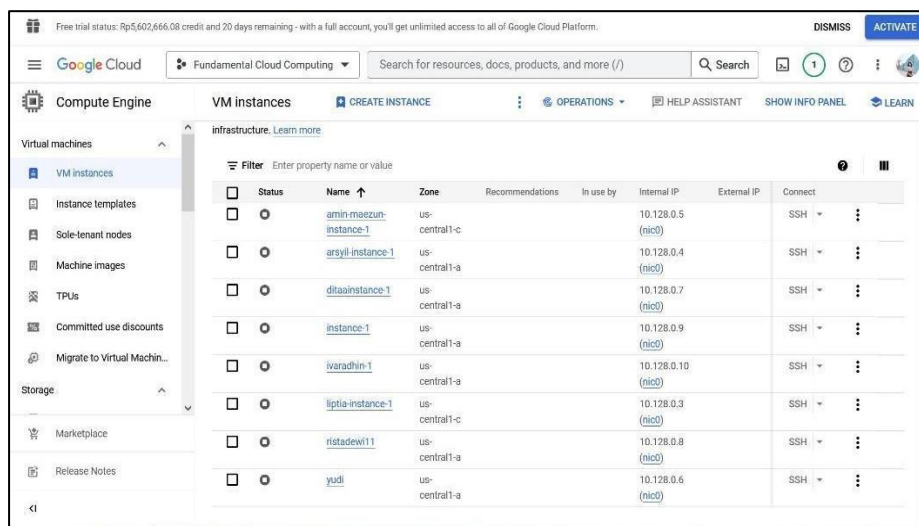
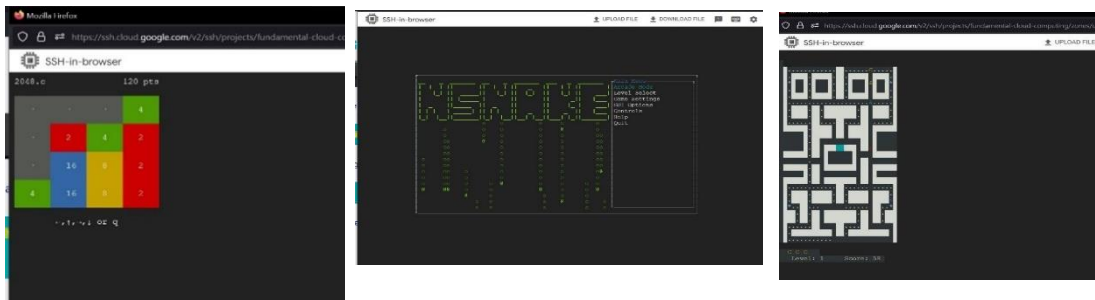**Figure 2. Virtual Machine Instances on GCP Created by Participants**

Figure 3. The 2048, NSNAKE, and Pacman Console Game Installed on A VM Instance

The second project was working with Google Cloud Storage for deploying a static web page. Participants were directed to create a bucket on Cloud Storage to store the HTML file as shown in Figure 4. Inside the bucket, participants stored an HTML file for a web page and an image that would be displayed on it. The permission for these files were set to "Public to internet" to establish the web page available for the public. Internet users could access the web page through the public URL of the HTML file stored inside the bucket.
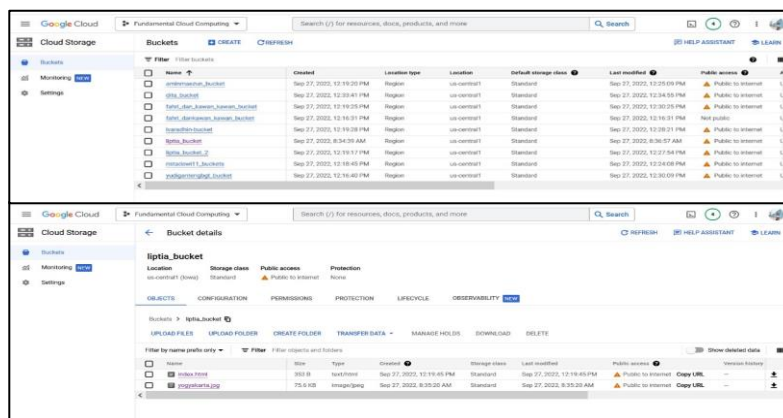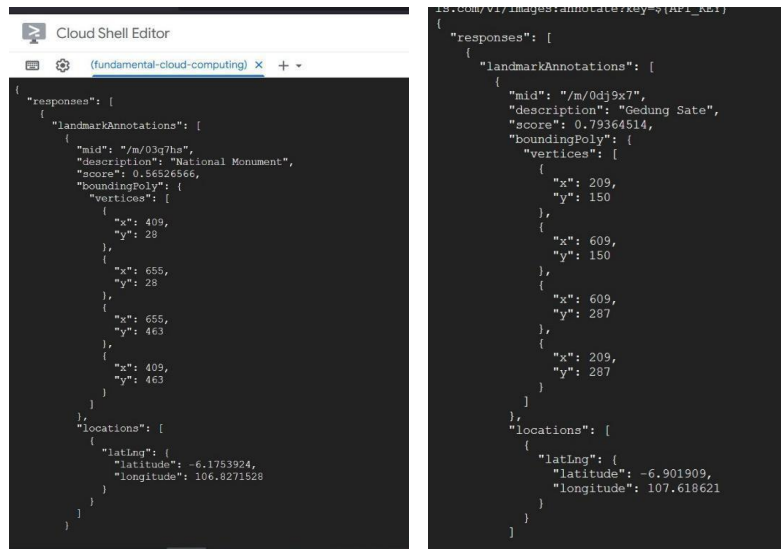
Figure 4. Buckets on Cloud Storage

Figure 5 exhibits one of the participant's web pages hosted on Cloud Storage. Through this second project, participants gained experiences on how to configure a Cloud Storage bucket to host a static website and were also equipped with knowledge regarding the main function of Cloud Storage to store files in the cloud without having to provide physical storage.

Figure 5. The Static Web Pages Hosted on Google Cloud Storage

The third project was working with Google Cloud Vision API for landmark detection. The landmark detection project detected the name and location of a landmark within an image. Participants uploaded image files to their Cloud Storage bucket. Furthermore, the participants were directed to activate the Cloud Vision API so that the service could be used. In order to configure the Cloud Vision API to create the landmark detection application, participants were asked to activate the Cloud Shell on the GCP console. By running Cloud Vision API commands on Cloud Shell to request the "LANDMARK_DETECTION" feature, participants were able to see the result of landmark detection processes as shown by Figure 6. The results were information on the name, the latitude and longitude coordinates of the landmark.

Figure 6. Result of Landmark Detection Feature on Cloud Vision API

3.3 Post-test

After the hands-on session was completed, the post-test session began. This test was intended to measure how well the participants received and understood the cloud computing materials that were presented during the workshop. The test was held on the Mentimeter website and consisted of 9 multiple choice questions as described in Table 2. To increase the enthusiasm of workshop participants in taking the post-test, the team gave prizes to the participant with the highest scores. Figure 7 shows the leaderboard of the post-test that was conducted. By analyzing the test result, most of the participants could answer the questions correctly.
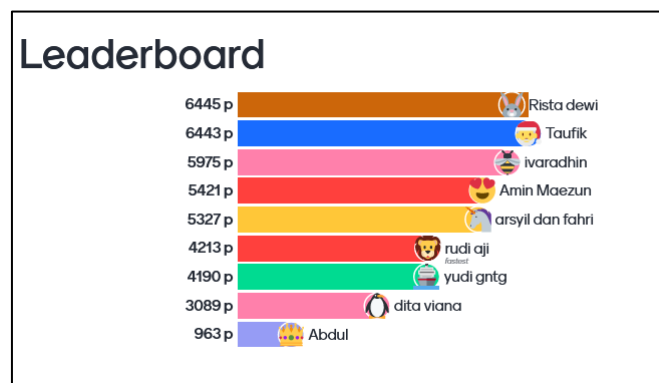
Figure 7. The Leaderboard of The Fundamental Cloud Computing Quiz

Liptia Venica, Muhammad Ayyas, Muchamad Amin Maezun Ta'sin Billah, Rista Dewi Opsantini, Syaifi Al-Mahfudzi

3.4 Reflection

For the reflection aspect, there was an online form distributed to all participants, including teachers and students. The form aims to assess participant satisfaction with the conducted activities. Figure 8 shows the results of the workshop satisfaction survey. Participants' responses to the seven key metrics listed in Table 3 (instructor expertise, overall event execution, etc.) were generally positive, indicating a high level of satisfaction with the workshop overall. However, the data suggests that there is still room for improvement in order to meet the varying needs of teachers and students.

The Workshop Satisfaction Survey Result

	Poor	Fair	Average	Good	Excellent
How was the overall implementation of this workshop?				70%	30%
How well does the instructor understand the diversity of competencies of the participants?			10%	70%	20%
How interested are you in learning more about cloud computing?				60%	40%
How well does the instructor identify and address the difficulties of the participants?			30%	50%	20%
How useful is this training for you?			20%	70%	10%
How is the material being organized?				80%	20%
How well does the instructor understand the material being presented?			20%	50%	30%

Figure 8. the results of the workshop satisfaction survey

Through the evaluation form, the participants of the workshop evaluated the presentation of the material and hands-on activities as good and very interactive. However, they wished that the material presented could be easier to learn. They also suggested that the workshop be held offline with more advanced material, as they found it more engaging.

4. CONCLUSIONS

This community service activity which included the introduction of a cloud computing fundamental workshop for students and teachers of SMK Negeri 1 Karangdadap was successfully carried out on 27 September 2022. The workshop successfully introduced cloud computing to participants and increased participants' understanding of cloud computing basic concepts. Based on the results of the evaluation, the workshop participants were satisfied with the implementation of the workshop. However, there are several things that can be improved to increase the quality of workshops in the future, including:

1. The duration of the workshop is extended in order that the participants could better understand the material presented;
2. The level of difficulty and type of cloud services introduced must be adjusted to the needs of the participants;
3. Participant discipline and engagement need to be improved so that all participants can take part in workshop activities properly, especially when carried out online;
4. There needs to be follow-up for the workshop activities, for instance providing additional materials or further training.

Based on feedback and suggestions from participants, the team can create several improvements to enhance the quality of the community service activities in the future. To ensure the sustainability of the implemented program, workshops or advanced training

sessions will be conducted to provide a deeper understanding of cloud computing, specifically focusing on how cloud computing technology can be maximally utilized in the field of education and learning. Additionally, partnership relationships will also be established as a form of collaboration and monitoring, should there be any further discussions or areas of discussion concerning cloud computing itself.

LIST OF REFERENCES

Arpaci, I. (2017). Antecedents and consequences of cloud computing adoption in education to achieve knowledge management. *Computers in Human Behavior, 70*, 382-390.

Erl, T., & Monroy, E. B. (2023). *Cloud Computing: Concepts, Technology, and Architecture.* Pearson.

González-Martínez, J. A., Bote-Lorenzo, M. L., Gómez-Sánchez, E., & Cano-Parra, R. (2015). Cloud computing and education: A state-of-the-art survey. *Computers & Education, 80*, 132-151.

Hoff, T. (2017). *Explain the Cloud Like I'm 10: Learn the inner-secrets behind Kindle, Netflix, AWS, Apple, Facebook, and Google.* Possibility Outpost Inc.

Khayer, A., Talukder, S., Bao, Y., & Hossain, M. N. (2020). Cloud computing adoption and its impact on SMEs' performance for cloud supported operations: A dual-stage analytical approach. *Technology in Society, 60*, 101225.

Li, X., Darwich, M., Salehi, M. A., & Bayoumi, M. (2021). Chapter Four - A survey on cloud-based video streaming services. (A. L. Hurson, Ed.) *Advances in Computers, 123*, 193-244.

Munjal, M. N. (2015). Cloud Computing in Higher Education: Opportunities, Challenges and Counter Measures. *International Journal of Advance Research In Science And Engineering, 4*(1), 659-668.

Raj, J. S. (2021, January). A Novel Encryption and Decryption of Data using Mobile Cloud Computing Platform. *IRO Journal on Sustainable Wireless Systems, 2*(3), 118-122.

Ramadona, S., Amelia, R., & Gilang, W. (2022). Workshop on Creating Game Using Scratch as an Activity to Support the Vision of Indonesia Gold 2045 at SMK Negeri 5 Pekanbaru. *REKA ELKOMIKA: Jurnal Pengabdian kepada Masyarakat, 3*, 186-195.

Torkington, S. (2023). *These are the 4 skills you'll need in the workplace of the future.* Retrieved September 2023, from World Economic Forum: https://www.weforum.org/agenda/2023/01/skills-jobs-future-workplace/

Zang, Y., Qiu, M., Tsai, C.-W., Hassan, M. M., & Alamri, A. (2017). Health-CPS: Healthcare Cyber-Physical System Assisted by Cloud and Big Data. *IEEE Systems Journal, 11*(1), 88-95.