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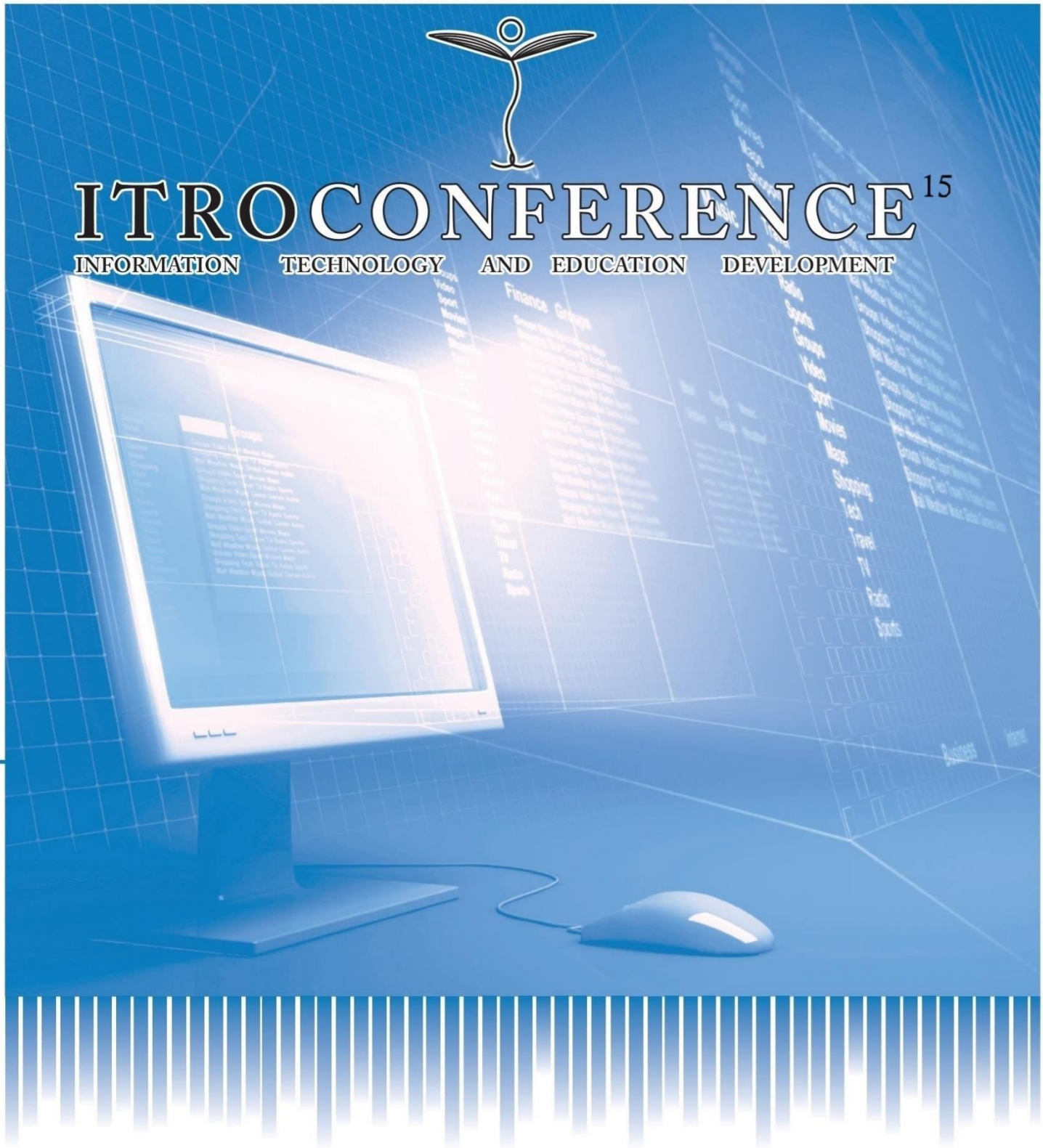
INFORMATION TECHNOLOGY AND EDUCATION DEVELOPMENT



PROCEEDINGS

ZRENJANIN, November 2024

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INTRODUCTION

This Proceedings present the articles delivered at the international conference Information Technology and Education Development (ITRO 2024), held for the jubilee fifteenth time on November 29, 2024. This international event was conducted in a hybrid format, combining in-person and online participation. The conference continues its tradition of bridging science, professional practice, and educational experiences, with this year's focus on the conditions and perspectives of teachers' digital competencies.

The thematic fields of the conference reflect contemporary trends in education, addressing topics such as: the digitalization of education, education in crisis situations, educational challenges, theoretical and methodological issues in contemporary pedagogy, digital didactics and media, modern communication strategies in teaching, curriculum development for contemporary education, advancements in e-learning, education management practices, methodological approaches in teaching natural and technical sciences, and the integration of information and communication technologies in education.

The conference featured three plenary lectures that explored various aspects of the main topic, with the corresponding articles included at the beginning of this volume.

In total, this edition comprises 57 peer-reviewed articles, evaluated through a double-blind review process. These contributions represent the latest research and advancements in the field.

The conference received financial support from the Provincial Secretariat for Higher Education and Scientific Research, Novi Sad. Hosting and technical support were generously provided by the Technical Faculty "Mihajlo Pupin." We extend our sincere gratitude for this invaluable assistance.

The Organizing Committee expresses its heartfelt thanks to the authors, reviewers, and participants for their contributions, which ensure the success and continued tradition of this event.

We look forward to welcoming you to the next ITRO Conference!

On behalf of the ITRO Organizing Committee

Jelena Stojanov

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SCIENTIFIC PAPERS

E-learning Platforms for Studying Cloud Technologies

Velinov A.[*1], Karamazova Gelova E.[*2], Nikolova A.[*3] and Zdravev Z.[*4]

[*] Faculty of Computer Science, Goce Delcev University, Stip, North Macedonia
[1]aleksandar.velinov@ugd.edu.mk
[2]elena.gelova@ugd.edu.mk
[3]aleksandra.nikolova@ugd.edu.mk
[4]zoran.zdravev@ugd.edu.mk

Abstract. This paper presents the usage of e-learning platforms for studying cloud technologies. Several possibilities for implementing e-learning are discussed here. The first possibility is to implement a special learning platform dedicated to cloud technologies using some of the known learning management systems. Another possibility for learning cloud technologies is by using special learning platforms which are provided by the cloud service providers. An overview of some learning platforms is given here.

Keywords and phrases: E-learning, Learning Management Systems, Cloud Computing, Cloud Technologies, Cloud Service Providers.

1 Introduction

Electronic learning or e-learning is the delivery of learning materials in digital form and their access via the Internet. The resources or the learning objects should be digitalized in a suitable format. In context of the resources, special attention should be paid to the content and the way of presenting the material to the end users. It is good to use a resource format that is widely used, so that the resources can be opened and viewed without problems. The main purpose of e-learning is to enable access to resources from anywhere and anytime. This was the biggest obstacle in traditional ways of learning, where we are often limited in terms of the resources or the time to access them.

Many educational institutions use e-learning to provide a continuous learning process for the students. The benefits are mutual because the students can constantly learn while the professors would have prepared students especially for those subjects where prior knowledge is required. The need for e-learning was especially highlighted during the period of the Covid-19 pandemic when most of the universities in the world switched to distance learning (Zdravev, Boev, & Dzidrov, 2020, p. 115). There were universities that were ready for this change in the educational process, but some had to adapt to the new situation and introduce e-learning. In this way, the professors could share the learning resources, while students had constant access to them from anywhere. Those universities that had not implemented e-learning platforms also faced the moment of technology adoption. If the professors have not used an e-learning system before, in that case, time was needed for appropriate training. This also applies to students who had to accept this new way of acquiring knowledge by using digital resources. However, even for those universities that had implemented e-learning platforms, training was again needed to refresh knowledge about the possibilities offered by the platforms and the correct delivery of learning materials. In addition to this, the creation of appropriate learning resources is also extremely important. There are many different types of resources that can be used for learning such as presentations, books, videos, simulations, images, audios and so on. Professors must decide which resources are the most suitable for conveying the material to students. Here, of course, their creativity comes to the fore, but also their commitment to the creation of digital resources that would be helpful for students.

In addition to educational institutions, many companies also use e-learning to improve the skills of their employees. Instead of employees attending face-to-face training, the courses can be organized through e-

learning and video conferencing platforms. The benefits of this are great for both employees and companies. Employees do not have to leave their workplace and attend classical courses. The companies, on the other hand, would have employees who will not be absent too much from their jobs and will still invest in improving their skills and competences (Alsharhan, Salloum, & Shaalan, 2021, p. 928). They must contribute to the development and improvement of their employees to remain competitive in the field in which they operate. Companies should respect the concept of lifelong learning of their employees, thus investing in the human capital they have (Beqiri, & Mazreku, 2020, p. 94). E-learning platforms can encourage the applicability of this concept in a real environment.

In (Cloke, 2024), we can see some e-learning statistics. It is predicted that by 2030 the e-learning market will grow exponentially reaching over 545 billion. Trends show growth in each new year. In the education sector e-learning is the quickest growing market since 2000 with a 900% growth rate. It is worth mentioning that mobile learning with 23% annual grow is the fastest growing trend in the e-learning field, which only confirms the importance of using mobile devices in the learning process. 90% of students prefer e-learning over traditional classroom learning. This is primarily due to the flexibility and affordability that this form of learning provides. E-learning is used by 90% of companies that conduct some form of training nowadays. For comparison, in 1994 only 4% of companies used some kind of e-learning. More than 40% of Fortune 400 companies use e-learning regularly for their activities. As many as 94% of employees stated that they would like to work in a company that invests in training and development. All these statistics only confirm the importance of e-learning in education and corporate environment.

Cloud technologies are significantly used nowadays. Many organizations and institutions use cloud services offered by cloud service providers. Most of them have also migrated their applications to the cloud (Zdravev, Velinov, & Spasov, 2021, p. 100) (Filatov, 2019). Some of the benefits of cloud technologies for organizations are scalability, flexibility, cost savings, automatic updates, disaster recovery and continuous security. That is the reason why cloud technologies are quite current and used nowadays. Subjects related to cloud technologies are part of university curricula. Some of the companies that use cloud technologies also provide training for their employees. For easier mastering of the material, greater flexibility and acquisition of skills, educational institutions and companies can use some of the e-learning platforms offered by cloud service providers or their own platforms.

The existing research papers are mostly concerned with the application of cloud technologies in the process of creation of e-learning platforms, but not with the creation of specific e-learning platforms for studying cloud technologies. In this regard, in this paper we present several e-learning platforms for this purpose. The rest of the paper is structured as follows. Section 2 presents the concept of Learning Management Systems (LMS) and some well-known LMS. Section 3 is for the application of e-learning in studying cloud technologies. Section 4 presents some learning platforms specially designed for acquisition cloud skills and knowledge. The last Section 5 is a conclusion of our work.

2 Learning Management Systems

Learning Management System (LMS) is a software primarily used for creation, management, and distribution of educational content. These systems are the basis for the development of electronic learning. There are multiple Learning Management Systems (LMS) in use nowadays (Ouadoud, Nouha, & Tarik, 2021, p.60). Some of them are open source and can be used for own purposes, while others are not open for use by the general public and are paid. Open-source platforms usually have a community that is quite active in terms of discovering and fixing bugs, informing about new versions, sharing experiences, etc. This is significant for developers and users of these platforms in case of facing problems or timely information regarding the technology. It is worth mentioning here that many plugins have been developed for the open-source platforms. This is due to the openness of the code and the activity of the community. By using the platforms and according to the needs, innovative ideas for additional features often appear among the users that were not included in the basic version. The plugins significantly help in enriching the functionalities of the e-learning platforms. Some of the paid platforms have a trial period in which they can be used freely, for example 1 year, but after the trial period for their use, the users must pay. In the basic versions, some of the e-learning platforms do not offer all the functionalities. These are usually more advanced functionalities, and we must pay for their usage.

Some of the most used LMS today are Moodle, Canvas, Sakai, Blackboard, ATutor, MyGuru2, Claroline,

Connect Edu, SumTotal and so on. According to (Bouchrika, 2021) the three most used LMS in the USA are: Canvas with 30.77% market share, Blackboard with the same percent of market share and Moodle with 25.27%. In (Benta, Bologa, & Dzitac, 2014, p. 1170) we can see one case study for the application of e-learning platform in higher education. It is presented an example of usage of the Moodle e-learning system, as a basic tool for student motivation and in solving independent or collaborative tasks. Ouadoud at al. (2016) present a comparative analysis of the following free LMS tools: ATutor, Claroline, Moodle and Sakai. Elbasuony et al. (2018) explore the knowledge, attitude and usage of Blackboard learning system. According to this study the students have excellent knowledge and attitude for e-learning and the Blackboard platform. Garcia et a. (2021) describe the adoption of Canvas tool for e-learning and the acceptance of LMS as a web-based platform. The students perceived this tool as an important platform for improving their learning, especially because of the functionalities that are easy to understand, easy access to courses and assistance with given tasks.

Typically, in an e-learning system there are multiple roles that can be assigned to users. Each role has its own defined permissions regarding access to resources or the platform. Common roles are administrator, professor, and student. The administrator is responsible for maintaining the e-learning platform, assigning permissions to the users and for technical support. The professor creates digital content or learning resources for the courses he teaches. He is also in charge of their logical ordering in terms of the content of the course in the e-learning platform. The students enroll in the courses and have access to all learning materials.

The general architecture of an e-learning system can be seen in Figure 1. The users, through devices such as laptops, tablets or mobile devices have access to the presentation layer. The core functionalities of the system are in the e-learning platform layer. This layer communicates with the database layer to store user records and manage settings.

Some of the features of e-learning platforms are:

- Ability to create courses for appropriate subjects
- Creation of tests and electronic testing
- Management of digital learning resources
- Modules for collaboration between the professor and the students such as messaging components, forums, videoconferencing tools, etc.
- Monitoring and evaluation of students' progress according to their activity on the platform
- Modules for assigning tasks and evaluation of solutions submitted by the students
- Provision of special tools for performing simulations, editors, online compilers, etc.

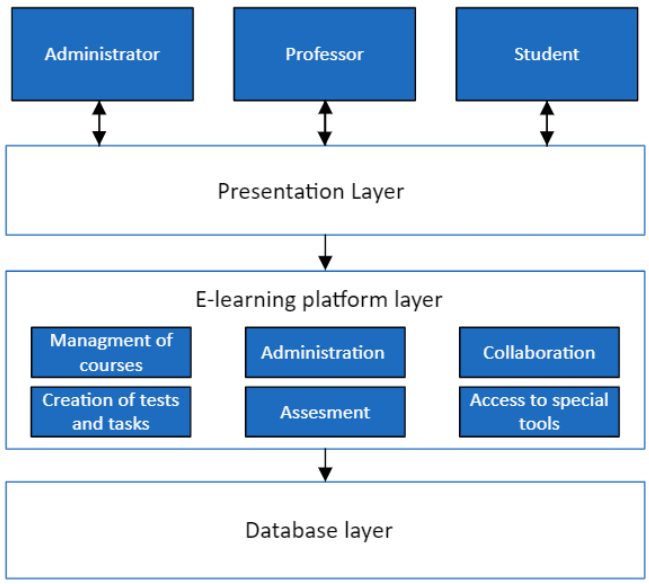

Figure 1. E-learning system architecture

All functionalities provided by e-learning platforms contribute to creating an integrated environment for students in which they can learn, share, ask and create. In addition to the students, there are also benefits for the professors who, through the platform, provide a special place where they can upload the materials, communicate with the students, review assignments, and keep up with the progress of the students.

3 Application of E-learning for Cloud Technologies

Cloud technologies have been applied in many fields of society nowadays. Considering the novelties they offer, their application in education is significant from the point of view of studying but also in the context of their usage in the implementation process of educational software (Velinov et al., 2023, p.67). Additionally, they can be used to provide IT infrastructure such as access to processing, storage, or networking resources. Ferri et al. (2020) describe the usage and adoption of cloud computing in high tech startups. They also provide

a case study in which they explore some of the features of cloud such as reduced costs, greater opportunities, scalability and so on. Sultan (2014) presents some of the challenges and opportunities of the usage of cloud computing for healthcare provision. An exploratory case study for adoption of cloud computing in public sector is given in (Zhao et al., 2013, p.42). This study also presents some guidelines for evaluation of cloud services in decision making process of the governments.

Considering the wide application, the study of cloud technologies is important. In education, cloud technologies are mostly studied and used in higher education. They are studied less in primary and secondary education (Velinov et al., 2023, p.68). Considering the applicability, more attention should be paid to these technologies in both primary and secondary education. In this way, the students would be prepared with knowledge about these technologies, and this would benefit them in higher education but also in their application in different use cases. Curricula in higher education should also include more subjects related to cloud technologies or their application in some of the related subjects. In context of this, the students will be able to acquire cloud computing skills.

E-learning can have a significant impact in acquiring knowledge about cloud technologies. As it provides access to learning resources at any time and from any place, this can help the interested individuals. This is especially true for people who are employed and who cannot attend regular training to acquire knowledge and skills in cloud technologies. In this regard, standard learning management systems can be used to create courses dedicated to the cloud. The digital learning content will be published in the courses and the users will be able to login and learn with a progress that they can dictate to themselves. This provides great assistance and flexibility in mastering the course content.

4 LEARNING PLATFORMS FOR CLOUD TECHNOLOGIES

Due to bringing cloud technologies closer to users, cloud service providers often present special platforms for learning cloud technologies. In context of this, Amazon Web Services (AWS) has made AWS Academy LMS available to educational institutions (Figure 2).

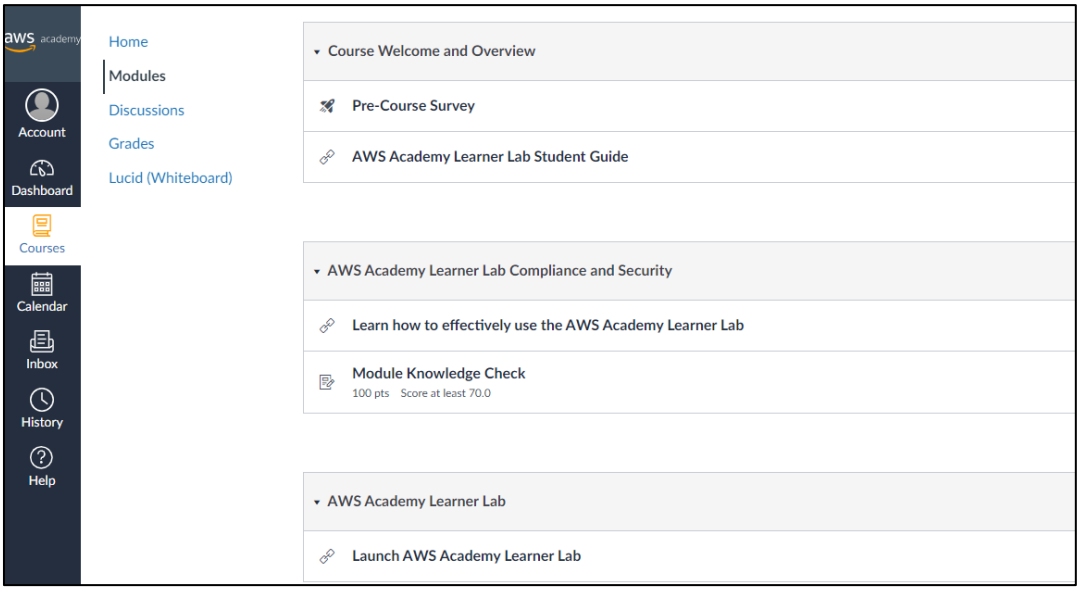

Figure 2. AWS Academy LMS

This learning platform allows creation of courses from multiple categories that are related to basics of cloud computing, data engineering, cloud security, microservices, machine learning, natural language processing and so on. What is particularly interesting and provided by this platform is the creation of courses from the AWS Academy Learner Lab category through which access to AWS services is provided. The students have a certain free budget for using the services for 1 year. All this significantly contributes to practical work with cloud technologies and is helpful for professors and educational institutions.

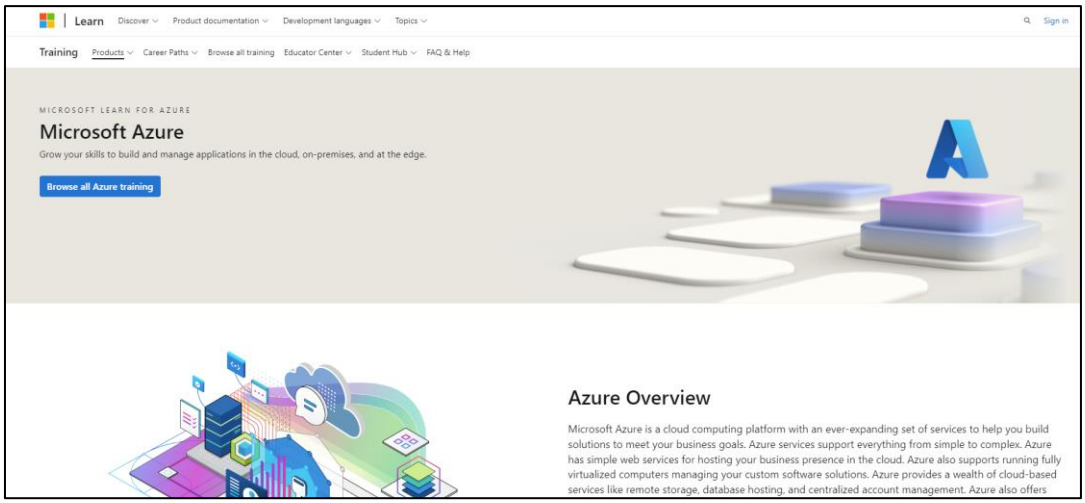

Figure 3. Microsoft Learn Platform

Microsoft has the Microsoft Learn Platform for learning cloud technologies offered through Microsoft Azure cloud service provider (Figure 3). This platform has guiding training paths at its own pace. In terms of the learning process this platform also provides great flexibility. Microsoft Learn has several learning paths related to fundamentals of Microsoft Azure, Azure architecture and services, Azure management and governance, Cloud Adoption Framework, Microsoft Azure Well-Architected Framework and so on. The platform also offers the possibility of certification and instructor-led training. There is also an option for Microsoft Virtual Training Days which provides free training in multiple languages on different topics. Another functionality that is offered by Microsoft is Azure for Students. With it, the students can register and get a free budget to use Azure cloud services by logging in with their university or school email. There is also an option to create Azure free account which gives students free credits to use Azure services for 1 year.

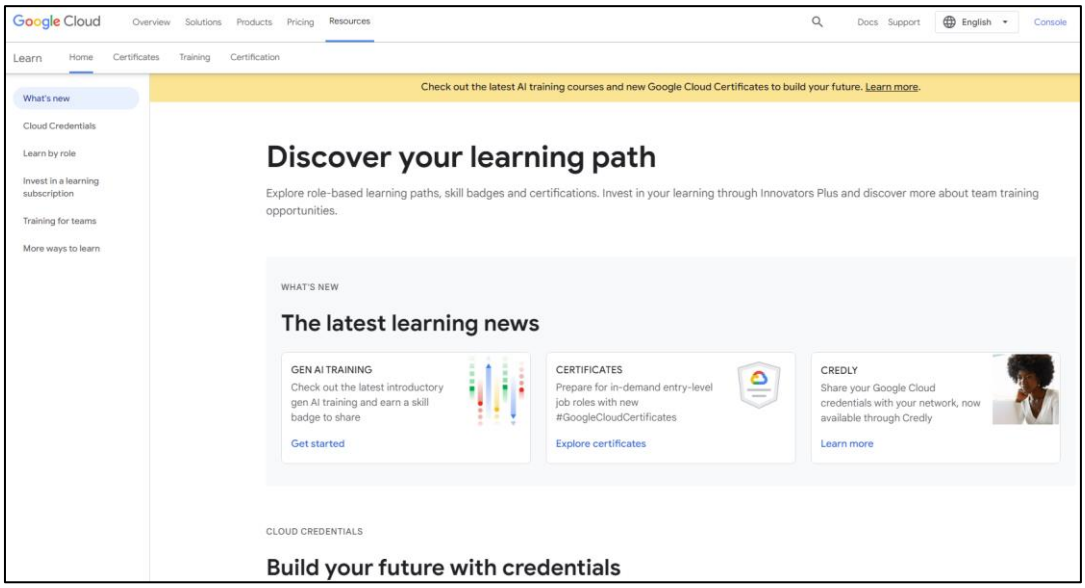

Figure 4. Google Cloud Learn Platform

For learning of Google Cloud Platform services, we can use the Google Cloud Learn Platform (Figure 4). It provides a lot of features for the users such as learning paths, training, certification, learning by role, training for teams, online events, blogs and so on. This platform can be used by both beginners and advanced users who want to acquire new skills. Another option for students is Google Cloud for Students program, which offers free credits for usage of Google Cloud services, resources, and digital learning content.

5 CONCLUSION

Cloud technologies are being used significantly nowadays. They are used in different areas which confirm their application. In this regard, there is a need to create e-learning platforms that are dedicated exclusively to learning cloud technologies. This is the reason why in this paper we present some e-learning platforms for cloud. Some of the most used LMS can be used for creation of cloud-dedicated e-learning platforms. Cloud providers also offer learning platforms that can assist users in acquiring knowledge and practical skills related to cloud technologies. The e-learning platforms can be beneficial for students who can access the learning materials at any time and from anywhere. The access to cloud services through e-learning platforms can significantly help students enrich their practical skills and expand their knowledge of cloud technologies.

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