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Evaluating Challenges of Using IOT Devices in Competency Based Curriculum

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Abstract

The education sector has benefited greatly with the adoption of information communication technology (ICT). The labor market is in need of competent and skilled labor force that graduates from training institutions. To achieve this objective, adoption of ICT has been encouraged by many proponents of ICT in education.

In the recent years, growth of smart devices and Internet of Things (IoT) technology has revolutionized how various sectors of economy consume and benefit from this technology. According to [21] IoT has a started to gain momentum in matters adoption in developing countries. As early as a kindergarten level a pupil is able to use a smart phone to learn basic level subject, while in institutions of higher learning students are using IoT to conduct research, attend lecture take examinations among other things. By introducing new communication avenues, this approach is giving students the abilities they need to succeed in the twenty-first century. IoT devices may be used in classrooms by both teachers and students to enhance the teaching and learning process.

This paper fills in this vacuum by identifying the IoT issues that are pertinent for students with the bounds of competency based learning.This project aims to solve this by adapting discovery learning methodologies while also identifying the challenges of such an adoption.This study addresses two issues one potential use of IoT in competency based curriculum and two Challenges attached to the use of IoT in competency based learning.

Keywords: IOT; Devices; Competency Based Curriculum.

1. Introduction

Every element of human existence, including education and training, is bound to undergo significant changes driven by the rapid progress in information and communication technologies (ICTs). The Internet of Things (IoT) and the Internet of Everything (IET) currently have a firm foundation in most developed countries thanks to recent advancements and adoption of these technologies [11]. The Internet of Objects (IoT) has the potential to make things better and more interconnected, and as a result, gain ever-increasing relevance in all spheres of existence.

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It is noteworthy to highlight that in some developed nations, kindergartens use their own digital devices that are linked to the Internet. With such use in mind, the probability of full IoT adoption appears likely within the specter of developing better educational capabilities.

Although the Internet of Things is still a fresh concept, it may aid in giving students a stimulating, collaborative, and content-creating environment. It may encourage a collaborative approach to teaching and learning. Students may also create smart learning environments with its assistance [9]. In a similar vein, IoT aids instructors in creating intelligent lesson plans, offering individualized material, and comprehending students' performance and learning elements.

By introducing new communication avenues, this approach is giving students the abilities they need to succeed in the twenty-first century. IoT devices may be used in classrooms by both teachers and students to enhance the teaching and learning process. During this special engagement with professors, students can receive advice and support for the resolution of their academic challenges [18]. When pupils are present remotely, IoT systems are highly helpful for them without regard to gender. This method has made it possible for students to learn at any time and in any location, both on and off campus.

The question of how to build inclusive methods to computer learning remains steeped in development. While recent research has looked into how to make computing education more accessible to students with special, as well as pedagogical approaches used by other student classes [14] there is still little research on whether and how approaches developed for such classes can be transferred to those in regular classroom with competency-based learning pedagogy [13].

IoT is quickly transforming what the future generation will need to know about computers, along with other developing technologies. However, despite new study on the IoT themes that are suitable for specialised, post secondary learning, it is still uncertain what information youngsters who are just beginning their computer education ought to learn about IoT. This paper fills in this vacuum by identifying the IoT issues that are pertinent for students with the bounds of competency based learning.This project aims to solve this by adapting discovery learning methodologies while also identifying the challenges of such an adoption.This study addresses two issues one potential use of IoT in competency based curriculum and two Challenges attached to the use of IoT in competency based learning.

2. Literature Review

Information Technology and its wide adoption has led to creation of a whole new interconnected world. The growth of internet penetration and internet dependent computing ecosystem has been the main contributor of the witnessed growth. Internet of Things commonly know as IoT is gaining tremendous growth owing to its adoption in many areas of economic and society in general [24].

Despite the fact that IoT seems to be a new concept, it was first predicted in the year 1991 by Mark Weiser when according to [24] he said that, “The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it”. Three decades later, the

society has witnessed a growth of Information technology get embedded in things that were unrelated to computers. Therefore, what is Internet of Things?

Several definitions of the IoT have been provided by scholars, technical experts, and researchers in the field of computer science. There is a common thread of non-computer things joining the computer network ecosystem. According to [15] Internet of Things (IoT) is the connection of physical things brought together to collect, process, share and communicate data in manner that is usable to the users. Things in this sense include all physical items which have been left out of computers since inception of computing technology.

Internet of Things has gained immense adoption in various areas of application. According to [20] IoT has applications in smart buildings, transport, health sector, consumer electronics, education among other areas.

2.1 IoT use in competency-based settings

Increased internet access and online technical capabilities provide new approaches to addressing and meeting the requirements of unconventional and multicultural students. CBL provides a structure for the use of online learning as the major instructional modality, as the number of online courses provided and demand for them increases. The CBL framework enables students to study the subject on their own timetable and at their own speed, an approach that works well in an online environment because students do not need to be coordinated with one another [16].

Students may finish work at a faster rate if they are proficient in it, or they can study challenging topics at a lower rate. Modern curriculum delivery platforms provide interactive training that may offer instantaneous feedback, route students to appropriate supplementary information depending on their replies, and allow them to move to more challenging topics only after they have shown competency [4]. These technical advancements make CBL deployment more effective.

In addition to providing enhanced convenience for learners, this trend also improves the efficiency of lesson planning for instructors. As a result of the spread of linked technologies, teachers are no longer required to manually mark exams or conduct other mundane duties [12]. Instead, educators might concentrate on the tailored learning that is most beneficial for their students. [5] indicated that cloud-connected devices enable educators to collect information about their pupils and identify which ones need the most individualized treatment. These data enable instructors to increase student participation and modify future course plans.

Outside of the classroom, colleges may employ linked devices to track their students, personnel, and tools and resources at a lower operational cost, saving money for the institution. Moreover, these monitoring tools could make campuses safer [14]. For instance, learners would be equipped to monitor linked buses and change their itineraries appropriately, preventing them from wasting time in potentially risky spots.

2.3 Challenges associated with adopting IoT in CBC settings

The adoption of IoT in academic settings may appear straightforward, but it is encumbered by several

significant challenges. To ensure and encourage the adoption of IoT it is vital to cover these challenges and provide a ground for the assessment of solutions, a factor that is beyond the address of this paper.

2.3.1 Complications in the implementation of IoT

The infrastructure that saves and analyzes data from these Internet of Things devices must be scalable. The quantity of gadgets that an IoT solution can handle at a certain threshold of acceptable performance is referred to as scalability [1]. The kinds of use cases supported by an IoT ecosystem may determine the allowable device scalability for the framework. The processing of the raw information collected from these sensors requires big data analytics and cloud services. Scalability provides an opportunity for schools to establish solutions that can on-board large groups of students.

In the majority of fields, technical standards are still dispersed. These systems should be consolidated. Converged solutions may employ machine learning technology to improve the user experience and may deliver information in a variety of ways [6]. Implementing technological convergence in a way that is easily accessible to people and immediately connected to a network and many different devices may enhance the appreciation of IoT in academic settings. The consolidation would help build a uniform framework and protocol for Internet of Things devices [1]. Due to the absence of a standardization process, compatibility between IoT and traditional devices should be regarded crucial. This absence of interoperability prevents us from achieving the ideal of compatible daily smart items that are genuinely linked.

2.3.2 Ensuring quality and data security

The majority of IoT security problems are the result of companies not devoting enough attention and money to ensuring the security of their goods. Researchers have also demonstrated that IoT devices are quite vulnerable to virus assaults [5, 22]. IoTs can easily become exposed vector machines if they do not regularly receive security upgrades. It is important to keep in mind that the majority of these gadgets harvest and gather data from various peripheral settings, including medical, corporate, social, and government data [22]. Hacking these IoT devices might result in more damage than anticipated, including botnet assaults, spying, and invasions of private and professional spaces.

Cybersecurity may be a major issue in public settings like those fostered by educational institutions. Many schools find it challenging to develop sound cybersecurity procedures while also attempting to educate and enlighten everybody who might require it [2].

Given that they most students utilize personal devices, the massive number of students that transit through the institution each year undoubtedly hinders the achievement of that goal. Threats to equipment as well as data that is administered by educational institutions may be more serious than one may imagine [5]. For instance, a data breach could put the security of confidential scholar and parental information at risk. Such data could comprise of the identities and the birth dates of the pupils, the guardians' contact information, and the instructors' personal information.

2.3.3 Ensuring ethics and trust

The instructor is more aware of who and where he needs to assist in order to convey an awareness of the difficulties pupils have when they encounter problems or the positive things they are doing despite education being mass-produced. The agency (having control over activities) is the key concept, with a focus on options and judgments [19]. Human freedom should not be bound to recurring systems since it might sometimes allow control to depart from core duties; otherwise, freedom, choice, and decision are constrained, if not outright decided. What changes is how students and teachers interact when using analytical models to support the instructor during curriculum planning, evaluation, or re-evaluation. Data monitoring can drastically alter how people interact with one another and make education more deterministic with the advent of AI and its powerful usage [17]. In light of a personalized education model in which the student's profile serves as the center of the learning system, profiling helps determine the immersive method of instruction and learning, obstructing the issue of the nature of education and the relationship between automation and interaction, which raises the possibility that the education system is predetermined.

2.3.4 Depths and variance in resource requirements

One of the biggest challenges in education has always been and remain access to resources. Even in some developed nations such as the US and the UK, the adoption of IoT may be marred by differences in resource distribution [23]. This challenge was evident at the height of the COVID-19 pandemic when students from marginalized communities struggled to learn using remote learning because of lack of the requisite devices. This challenge places a heavy burden on governments which are best placed to establish and implement solutions through relevant educational departments and agencies.

Government and regulatory authorities should establish a standard committee to develop standards for the safety and security of people, technologies, and infrastructure. The emergence of IoT devices and technologies does not mean that instructors will no longer be needed [19]. In reality, it increases the need for instructors who are more qualified and competent. Additionally, governments will need to concentrate on addressing problems like teacher strain and exposure to professional development opportunities. The following administration should make it clear how it will motivate educators to remain in the field and guarantee that recruiting goals are raised.

2.3.5 Insufficient ICT and IOT facilities

Another challenge facing the use of IoT is lack or insufficient facilities in schools. This can be confirmed by the study done by [10, 3] which noted that most schools lacked resources such as internet connectivity, computing equipment to roll-out computer based training.

2.3.6 Lack of Computer Literacy Skills

The use of IoT devices requires basic computer literacy skills just like with any other ICT general skills. In the empirical research findings it was reported that most teachers in primary schools in Kenya lacked requisite computer skills to deliver CBC curriculum [10]. It was reported that 77% of teacher respondents had computer

skills training which was acquired during the training but they lacked a follow up training, which rendered the skills weak with time. This finding is supported by a study by [3] which stated that lack of technical skills in e-learning was an impediment towards adoption of e-learning in institutions of higher learning in Kenya. This form a compounded problem with the general challenge of adopting ICT in education system in Kenya.

2.3.7 Lack of Teachers Commitment

Another challenge facing IoT usage in implementation of CBC is lack of commitment form individual teachers. This challenge was noted by [3] where they found that teachers were not willing to adopt e-learning methods into their traditional pedagogical methods. This is similar to what was reported by [10] that 44.7% of primary school teachers did not use computers to prepare instructional materials while 58.4% of teachers could not plan and integrate computers in their teaching.

3. Methods

Convenience sampling was the sample technique employed, where IoT users in various academic subjects who were familiar with IoT use were located in a convenient manner. Utilizing the Qualtrics UX survey platform was used.

4. Results and Discussion

Nine items make up the constructions utilized to look at the difficulties encountered in the education industry while adopting IoT services. The findings show that IoT implementation in institutions (mean=3.52) was regarded as the top challenge encountered when implementing IoT services in the education industry. The usage of IoT can be hard to implement is one of the factors that most respondents agreed with. This finding was in agreement with most of the assessed literature [9, 12]. The second major issue with employing IoT services in schools has been dubbed privacy and data security concerns (mean=3.48). This is consistent with the result that IoT deployment in education has an effect on the exposure of data and student privacy.

On the other side, ethics and trust were the two least ranked barriers to implementing IoT services in academic settings. As individuals become more accustomed to technological use in schools, technological advancements in the educational field are also advancing [19]. These results contradict the hundreds of papers that have been discovered discussing the technological and technical difficulties with IoT services. Users in the education industry thus experience less freedom and complexity while utilizing IoT.

This paper performed a study to investigate the impact and challenges of IOT in education. IOT has been found to be popular with both learners and instructors as it provides a high degree of convenience and vast array of learning techniques and opportunities [7]. IOT is effective because it ensures that there are no geographical barriers, students in far flung areas can comfortably attend online classes, it saves time in that there is no time lost traveling to and from class and those feeling unwell can attend classes comfortably from their locations.This learning system also provides efficient record keeping and feedback mechanism. There are also some challenges with adoption of IOT such as high cost of acquiring and maintaining equipment, training of users and security

issues. Some of these challenges can be addressed by training initiatives targeting both students and teachers, also by improving security of IOT devices to prevent data breaches and safeguard the privacy of IOT users.

IoT as a subset of ICT is gaining momentum in the education sector in Kenya. Its adoption in CBC is a work in progress and it faces the same challenges facing the implementation of general ICT in education system in the country. This review noted that some of the challenges facing the adoption of IoT in the implementation of CBC were high cost of implementing, lack of adequate ICT and IoT infrastructure, limited ICT skills among teachers and lack of commitment form teachers to adopt ICT and IoT in their teaching. The use of ICT and IoT is a game changer in the education system. Most countries in the world have developed and adopted ICT policies aimed at integrating ICT in education to build a digital enabled economy. Therefore, adoption of IoT in delivery of CBC needs serious input form both private and government institutions.

5. Conclusion

IoT is quickly developing. It links users and technology and will result in significant changes for many industries. For instance, one of the primary sectors that has improved but still has many issues is the education sector, where use is still evolving. This research paper addressed some of the noted issues in IoT security and privacy that has been done identified in prior. I have discussed the various difficulties, the ethical and legal concerns raised by the Internet of Things, as well as the vision for the critical problems that require immediate attention. Future work will focus on creating specialized standards for the education industry.

References

[1]. A. Adel, (2020). Utilizing technologies of fog computing in educational IoT systems: privacy, security, and agility perspective. *Journal of Big Data*, *7*(1), 1-29.

[2]. A. Badshah, A. Ghani, M. Qureshi, & S. hamshirband, (2019). Smart security framework for educational institutions using internet of things (IoT). *Comput. Mater. Contin*, *61*(1), 81-101.

[3]. C. Odoyo, & S., Olala, (2020). Covid-19 Pandemic as a Catalyst to E-Learning Acceptance in 2020. International Journal for E-Learning Security (IJeLS), 9(1), 610-615.

[4]. D. Echols, P. Neely, D. Dusick, (2018). Understanding faculty training in competency-based curriculum development. *The Journal of Competency-Based Education*, *3*(2), e01162.

[5]. D. Ramlowat, B. & Pattanayak, (2019). Exploring the internet of things (IoT) in education: a review. *Information systems design and intelligent applications*, 245-255.

[6]. G. Tripathi, & M. Ahad, (2019). IoT in education: an integration of educator community to promote holistic teaching and learning. In *Soft computing in data analytics* (pp. 675-683). Springer, Singapore.

[7]. H. Algozani, & A. Aleryani, (2018). The Impact of IoT on the Higher Education (Review Study). Saba Journal Of information Technology And Networking (SJITN)-ISSN: 2312-4989, 6(2).

[8]. I. Moraiti, A. Fotoglou, K. Dona, A. Katsimperi, K. Tsionakas, & A. Drigas, (2022). IoT in Special Education. *Technium Soc. Sci. J.*, *30*, 55.

[9]. J. Marquez, J. Villanueva, J. Solarte, & A. Garcia, (2016). IoT in education: Integration of objects with virtual academic communities. In *New advances in information systems and technologies* (pp. 201-

212). Springer, Cham.

[10]. J. Murithi, & J. Yoo, (2021). Teachers' use of ICT in implementing the competency-based curriculum in Kenyan public primary schools. Innovation and Education, 3(1), 1-11.

[11]. K. Ahlin, E. Wästlund, A. Ahmad, S. Nöjd, P. Mozelius, & A. Sodhro, (2022). IoT in Elementary School for Everyone-A Research Plan. *Studies in Health Technology and Informatics*, *294*, 955-956.

[12]. K. Ling, N. Yelland, M. Hatzigianni, & C. Dickson-Deane, (2022). The use of Internet of Things devices in early childhood education: A systematic review. *Education and Information Technologies*, 1-20.

[13]. K. Maksimović, (2018). IOT concept application in educational sector using collaboration. *Facta Universitatis. Series: Teaching, Learning and Teacher Education*, *1*(2), 137-150.

[14]. K. Moriati, Player-Koro, C., & Bergviken Rensfeldt, A. (2022). Production of knowledge of teachers' professional work in the digital platforms infrastructures of schools–the problem of locating and defining the ethnographic field. In Oxford Ethnography and Education Conference.

[15]. K. Patel, S. Patel, P., & Scholar, (2016). Internet of things-IOT: definition, characteristics, architecture, enabling technologies, application & future challenges. International journal of engineering science and computing, 6(5).

[16]. M. Abdel-Basset, G. Manogaran, M. Mohamed, & E. Rushdy, (2019). Internet of things in smart education environment: Supportive framework in the decision-making process. *Concurrency and Computation: Practice and Experience*, *31*(10), e4515.

[17]. M. Al-Emran, S. Malik, & M. Al-Kabi, (2020). A survey of Internet of Things (IoT) in education: Opportunities and challenges. *Toward social internet of things (SIoT): enabling technologies, architectures and applications*, 197-209.

[18]. M. Igbinovia, & O. Okuonghae, (2021). Internet of Things in contemporary academic libraries: application and challenges. *Library Hi Tech News*.

[19]. M. Kassab, J. DeFranco, & J. Voas, (2018). Smarter education. *IT Professional*, *20*(5), 20-24.

[20]. M. Umair, M., Cheema, O. Cheema, H. Li, & H. Lu, (2021). Impact of COVID-19 on IoT adoption in healthcare, smart homes, smart buildings, smart cities, transportation and industrial IoT. Sensors, 21(11), 3838.

[21]. S. Moin, A., Karim, Z., Safdar, K. Safdar, E., Ahmed, & M. Imran, (2019). Securing IoTs in distributed blockchain: Analysis, requirements and open issues. Future Generation Computer Systems, 100, 325-343.

[22]. S. Tiwari, (2020, February). Impact of CBL on Student's Learning and Performance: An Experience Report. In *Proceedings of the 13th Innovations in Software Engineering Conference on Formerly known as India Software Engineering Conference* (pp. 1-5).

[23]. U. Matthew, J. Kazaure, & N. Okafor (2021). Contemporary development in E-Learning education, cloud computing technology & internet of things. *EAI Endorsed Transactions on Cloud Systems*, *7*(20), e3-e3.

[24]. Z. Maamar, (2020, November). Internet of things: The way ahead. In Proceedings of the 12th International Conference on Management of Digital EcoSystems (pp. 1-1).