ISSN: **2959-6386** (Online)
Journal of Knowledge Learning and Science Technology, Vol. 1, Issue 1, April 2023
Journal Homepage: http://jklst.org/index.php/home
DOI: https://doi.org/10.60087

DATA DRIVEN PEDAGOGY: LEVERAGING ANALYTICS FOR EFFECTIVE E-LEARNING STRATEGIES

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| Abstract

The adoption of a data-driven pedagogy is rapidly occurring among open-distance and e-learning institutions. In certain regions, individuals engaged in the field of education encounter obstacles related to data availability and network coverage, despite the existence of digital tools utilized by educators and online learners to enhance the teaching and learning process. This research study employs a social constructivist theoretical framework as its research paradigm. Additionally, it adopts an interpretivist perspective within the social constructivist paradigm to gather insights from participants who originate from diverse life contexts. The researcher found that employing a mixed-methods research methodology, which combines both quantitative and qualitative methods, was the most appropriate choice for their study. The utilization of both study approaches enabled the researcher to triangulate the collected results, hence enhancing the robustness of the findings. The quantitative portion of the study involved a sample size of forty participants. A questionnaire was employed as a means of gathering information, and subsequent data analysis was conducted utilizing charts and tables. The qualitative component of the study involved conducting interviews with a total of twelve focus groups. The acquired data was subjected to thematic analysis. The findings indicate that a significant proportion of pupils, even those residing in urban and rural areas, derived advantages from the implementation of data-driven teaching.

| Keywords

E-learning, data-driven pedagogy, Open distance and e-learning, triangulation, fourth industrial revolution, internet based learning.

| Article Information:

Accepted: 20/03/23 **Published:** 01/04/23 **DOI:** 10.60087/jklst.vol1.n1.p12

1. Introduction

Open Distance universities have transitioned from conventional print-based pedagogy to data-driven pedagogy by leveraging digital devices such as computers, iPods, mobile phones, and emerging technologies to facilitate the process of teaching and learning.In order to facilitate effective and efficient learning, it is imperative for both facilitators in higher learning institutions and online students to have access to data that enables seamless connectivity. In order to effectively use data-driven pedagogy, it is imperative for online facilitators to acquaint themselves with novel teaching methodologies that enable the dissemination of knowledge to learners. Students have difficulties due to the escalating cost of data. The growth of data-driven teaching is impeded by challenges such as inadequate network coverage.

2. Literature Review

Pedagogy encompasses the methodologies and approaches employed in the instruction and guidance of students, encompassing both the theoretical underpinnings and practical applications of education (Coccia, 2019; Dommet, 2019). The primary objective of teaching is to use students' prior knowledge and foster the growth of their abilities and attitudes (Fomunyan, 2017; Grigoryan, 2020). According to Hamid, Waycott, Kurnia, and Chang (2015), a data-driven strategy involves internet-based cooperation between the facilitator and the students. Both students and facilitators utilize digital tools, and the availability of data and network coverage play a crucial role in this context.

To effectively deploy data-driven pedagogy According to Reynard (2017:17) and Bozkurt (2017), it has been argued that during the next decade, personal, portable, and wirelessly networked technologies will attain widespread presence in the educational experiences of learners. Furthermore, this phenomenon has already been observed in numerous nations. The observation is made that the accessibility of technology has the capacity to facilitate a new stage in the development of technology-enhanced learning. This stage is characterized by the existence of learning spaces that seamlessly integrate various scenarios or contexts, allowing for a continuous learning experience. This development is made possible by the availability of one or more devices per learner.

During the Fourth Industrial Revolution (4IR) period, there existed a plethora of advanced technologies that effectively enabled the process of online learning. Despite the rapid evolution of technology, there exist issues pertaining to the insufficient training of students and lecturers in the utilization of these technologies within the context of open and distance e-learning (ODeL) (Ahn, 2020:788, Brandao & Algarvia, 2020, Bozkurt & Keefer, 2017, Bozkurt & Akgun Ozbek, 2017).

The evolution of technology is evident in the current era, known as the Fourth Industrial Revolution (4IR), particularly in the realm of digital advancements. The researcher posits that the integration of web-based resources within the context of the Fourth Industrial Revolution (4IR), along with the incorporation of adaptable learning techniques and the utilization of satellite videoconferencing within the realm of fifth-generation technologies, has the potential to provide favorable outcomes. As an illustration, e-tutors might capitalize on this opportunity by identifying pertinent websites for students to examine through the learning management system (LMS). Videoconferencing facilitates comprehensive engagement among students, professors, and their peers, hence promoting interactive learning experiences. Continuous student participation inside the Learning Management System (LMS) has been identified as a crucial element in academic literature (Gillet-Swan, 2017:43; Barba, Askari, & Engelbrecht, 2016; Bolliger & Halupa, 2018; Bogna, Raineri, & Deli, 2020).

Kennedy (2015:60) asserts that institutions providing distance education have undergone a transformation in their methods of content delivery. This evolution encompasses various modes, including the distribution of study materials through cassettes and compact discs, television broadcasting, telephone communication, and the utilization of satellite-based audio and video technologies for video conferencing. In contemporary times, the advent of novel technologies has facilitated a more convenient existence. In order to establish connectivity, students typically require access to a range of technological devices, such as computers, cellphones, tablets, and iPods, as well as reliable Internet coverage, including the more recent addition of Wi-Fi. The prevailing technology frequently encountered in contemporary society is the computer equipped with an Internet browser.

Bond and Daher (2016:302) and Birzina (2015) highlighted the significance of discussions in a synchronous virtual classroom. The synchronous style of communication involves instructors and learners, or learners with each other, engaging in real-time online interactions. On the other hand, the asynchronous type enables all participants to send messages to any other participant through the Internet without the need for immediate responses. The utilization of dialogues played a crucial role in facilitating the transfer of responsibilities, fostering a greater sense of agency among students in their own learning process while

concurrently promoting mutual support among peers. Additionally, learners have exhibited an increased level of attentiveness towards the advantages and gains derived from their educational endeavors.

Artificial intelligence (AI) is poised to assume a prominent role in the future of video conferencing. According to Atanasova (2019) and Bervell, Umar, and Kamilin (2019), machine learning programs are being developed by technical leaders to do tasks such as audio transcription, attendee counting, and analysis of attendee engagement. These systems aim to assist individuals in identifying the most significant aspects of a meeting. According to Lubbe (2017:20) and Lee (2020:23), it is argued that higher education students should possess various digital literacy competencies. These competencies encompass the capacity to effectively search for information on the Internet, efficiently disseminate digital information, develop communication skills within an online environment, comprehend the fundamental principles of digital technologies, effectively plan and manage virtual projects, cultivate a digital civic attitude, and acquire teamwork skills within an online setting. Communication and collaboration are additional crucial competencies within the realm of digital literacy. The facilitation of knowledge exchange and interaction between students and lecturers should be enabled through the utilization of digital technology. It is imperative for students to acquire the skill of collaborative learning through the utilization of digital technologies.

According to Birzina (2015:18), there exists a deficiency of digital training resources inside emerging universities, which poses a challenge in accommodating the substantial student population enrolled in these educational institutions.

According to Bicen and Demir (2020:44), their research findings indicate that the use of social media in online education can facilitate a distinctive learning encounter as it allows students to participate in networks that transcend the conventional boundaries of the physical classroom. Online degrees offer a more cost-effective alternative since students have the opportunity to accrue greater savings when pursuing an online program. Online programs are very convenient. The acquisition of crucial abilities can be fostered among pupils. The acquisition of online learning necessitates the cultivation of essential aptitudes such as self-discipline, self-motivation, and effective communication. The acquisition of skills through online platforms also contributes to the students' professional development in their respective job settings. Online students engage in frequent communication with their e-tutors and fellow classmates. This method of communication can occur through either oral or written means. These various modes of communication enhance the proficiency of students in their communication abilities.

Furthermore, according to Rogers (2020:103) and Biccard (2021), it is evident that the integration of web-based engagement and participatory interaction is crucial in educational courses. The advantages of technology outweigh the problems faced by distance learning institutions in its implementation. The adoption of data-driven pedagogy is accompanied by various problems, one of which is inadequate network coverage. According to a study conducted by Tarus, Gichoya, and Muumbo (2019:16), the adoption of e-learning in Kenyan open distance learning institutions has several hurdles. One significant obstacle identified in the research is the inadequate network coverage, which hampers the successful execution of the e-learning program. Students residing in certain distant regions encounter challenges in accessing the Internet due to inadequate network infrastructure. In addition, it has been observed that students may encounter challenges in engaging with their peers in online environments as well as accessing the instructional materials shared by their online instructors due to inadequate network connectivity (Ahmad & Jantan, 2019:234, Bhandari, 2020).

One additional issue encountered during online contacts with students is the presence of inadequate technical support, which has proven to be a significant barrier. The students also expressed dissatisfaction with the technological obstacles they encountered, such as difficulties in establishing a connection to the learning platform. The issues encompass a variety of challenges, including the system's inability to

successfully store work during activity postings, the system's failure to establish a functional discussion forum, and the system's unavailability for student interaction. Upon accessing a discussion forum, it is not uncommon to come across notifications indicating that the site is unresponsive (Letseka & Pitsoe, 2018:8, Boldly, Leary, & West, 2019).

According to Holomisa and Dube's (2015:290) study on the preparedness of Open and Distance Learning (ODeL) institutions in select centers within the Eastern Cape region of South Africa, it was discovered that there exists a deficiency in computer resources and associated infrastructure for e-learning purposes. Within the study centers, a significant proportion of the computer systems exhibit signs of age and suboptimal performance. The potential insufficiency of personnel and computer resources could potentially have adverse consequences for the provision of support services for students. Therefore, the effectiveness of e-learning is contingent upon the accessibility of computers and associated infrastructure and resources. One further issue that has been brought to attention in scholarly literature is the matter of computer security within study centers (Ramorola, 2018:5, Beneche & Festing, 2020).

3. Methodology

The researcher employed a mixed-mode method. The mixed-mode approach integrates quantitative and qualitative research methods in order to obtain a more comprehensive understanding of a research problem (Babbie, 2020; Babbie, 2016; Babbie & Mouton, 2011). The researcher anticipated that employing both qualitative and quantitative research approaches would yield fruitful outcomes. The triangulation of study findings from both qualitative and quantitative methods aids in providing a comprehensive understanding of the benefits and obstacles encountered when applying data-driven teaching.

Quantitative research encompasses the systematic gathering and examination of numerical data in order to evaluate hypotheses and formulate predictions (Creswell, 2018; Creswell, 2021). A sample of forty participants engaged in online studies was randomly selected from the city of Port Elizabeth, and each participant was administered a specifically developed questionnaire. The primary objective was to obtain a cognitive perspective from students residing in metropolitan areas regarding their perceptions of data-driven schooling. The questionnaire will inquire about the students' access to data for educational purposes and the availability of network connectivity in their respective locations. The acquired data was analyzed using both a chart and a table.

Qualitative research is a methodological approach that emphasizes the collection of non-numerical data in order to obtain a deeper understanding of human behavior, attitudes, and experiences (Clarke, 2020; Black, 2017). The study employed a purposive sampling technique to choose twelve distinct groups of participants who were engaged in online learning within rural locations. The primary objective was to get their perspectives on the role of dating in facilitating their learning experiences as well as their interactions with instructors. Is the implementation of data-driven pedagogy effective for individuals? Thematic analysis was employed to analyze the data collected from rural students.

4. Results and Discussion

The present analysis aims to engage in a comprehensive discussion of the obtained findings.

4.1. The results obtained by qualitative analysis

The subsequent statements consist of the feedback obtained from different groups through semi-structured interviews regarding the difficulties faced during the implementation of data-driven teaching and its impact on their academic pursuits. This study primarily examines the obstacles, network coverage,

and the impact of data-driven pedagogy on the learning process, with a specific emphasis on online students. The primary obstacle encountered pertained to the costly and limited availability of data. The utilization of technology in implementing data-driven pedagogy has several challenges. The 12 groups provided the following responses regarding the problems associated with implementing data-driven pedagogy in the context of learning:

4.1.1. Challenges of implementing data-driven pedagogy

The first group said: Accessing technology, such as the Internet, necessitates the availability of data, which poses a significant obstacle. In order to establish a connection, individuals require access to data, which can often be prohibitively expensive, particularly given the high rates of unemployment prevalent in many developing nations. Consequently, a scarcity of employment opportunities arises in these regions. Some individuals are fortunate to have access to Wi-Fi in certain work environments.

In summary, the primary challenge encountered by the participant was the Internet. The cost of accessing the Internet is prohibitively high. Many corporations are currently engaging in the practice of selling data at exorbitant prices. As a result, pupils are unable to pay it due to the prevalence of high unemployment rates and poverty.

Group 2 proposed that students engaged in online studies should consider downloading the application that offers complimentary data from the Play Store. According to the sources, it was stated that:

The issue at hand pertains to the data. The cost of one hundred megabytes is relatively high, amounting to twenty nine rand, and its usage duration is limited to a mere twenty minutes. Simultaneously, the acquisition of data is necessary for establishing connections. It is desirable that the institution provides us with data consistently throughout the year, rather than solely during online tests. Nevertheless, the members of the organization recommended that I acquire an application that offers complimentary access to data sourced from the Internet. Despite its modest pace, it provides significant assistance.

The pupils engaged in online learning are also impacted by technical difficulties.

Group 3 disclosed this information during the interviews, as one of its members stated:

One of the technical issues encountered in virtual platforms is the occurrence of error messages indicating that the platform is unresponsive while attempting to establish a connection. Additionally, the parents of the individual in question are currently unemployed, resulting in a financial challenge to afford both internet access and a laptop. The stability of the virtual platform is lacking. When a substantial cohort of students attempted to establish a connection, they encountered technical difficulties, resulting in affected students receiving a notification indicating that the platform is unresponsive. Group 3 proposed the necessity of enhancing virtual platforms. The bursary department should consider augmenting the financial resources allocated to students with demonstrated financial need.

Group 4 disclosed this information during the course of the interviews. When queried about the alterations observed in students engaged in online learning that impact data-driven teaching, their response was as follows: The economic implications of data expenditure. The acquisition of personal laptops is deemed necessary; nevertheless, the financial resources provided by bursary funds are insufficient to cover the costs, which are notably high. Due to the lack of employment, our parents are unable to financially support the purchase of a laptop or data. Occasionally, individuals encounter technical difficulties when attempting to submit an assignment, resulting in instances where some individuals inadvertently missed the designated submission deadline on a single occasion. If a sufficient amount of funding is granted to students, they would be able to financially afford the purchase of laptops, data plans, and any other necessary technical gear. Access to technology in regional centers is often limited for certain pupils, necessitating long-distance travel in some cases. During the interviews,

Group 5 said that

The cost of data acquisition and management is significant. Regrettably, we are unable to procure a personal laptop due to financial constraints. We are unable to purchase our own mobile devices. The distance between our location and the regional technology hub is considerable. The group additionally asserted that Open Distance learning institutions had to take into account the geographical distance between students' locations and regional centers. This would ensure that students situated in remote rural areas are allocated greater financial resources to adequately support their study requirements.Continuous data provision should be implemented throughout the academic year in order to adequately address the demands of students. During the interviews,

Group 6 made the following statement:

The majority of individuals lack personal laptops, thus necessitating a visit to the regional center for laptop usage. Additionally, the cost of data is exorbitant, prompting the suggestion that the university should provide data access for the entirety of the academic year. The students further said that additional data is required throughout the academic year to facilitate their comprehensive exploration of resources while preparing for assignments. The provision of data alone during online examinations is insufficient on the part of the university. It is evident that the impediments to implementing a data-driven pedagogy extend beyond data-related challenges, as students frequently encounter technical difficulties. In order for data-driven pedagogy to achieve success, universities offering Open and Distance Learning (ODeL) must effectively address the following concerns.

Group 7 made the decision to engage in offline work as a means of mitigating the difficulties encountered by students who are enrolled in an Open and Distance Learning (ODeL) environment. When queried about the difficulties encountered by students in online learning environments, they responded: The financial implications associated with the acquisition and utilization of data. The accessibility of data is prohibitively expensive across many major telecommunication companies. One of the factors that influenced my decision to only utilize the university-provided resources was the desire to work offline.

The participants of Group 8 were accustomed to conducting their studies at the library located within their local municipality. The individuals expressed dissatisfaction with the absence of complimentary data provision in the municipal libraries within their locality. When queried regarding the difficulties encountered during their academic pursuit, they responded: The primary obstacle lies in the acquisition of data, as it incurs significant costs. Even the public libraries fail to provide us with complimentary information. To illustrate, the acquisition of an Internet service necessitates a monetary transaction.

The students were required to remunerate for the Internet services provided by the municipal library. Typically, our customary practice involved accessing the municipal or government library as a means of engaging in virtual debates within a virtual platform. Participants 9 and 10 were required to solicit financial support from their parents in order to establish connectivity. The information in question was disclosed during the course of the interviews.

The participants from Group 9 expressed their views as follows:

The issue at hand is to the cost of data, which presents a challenge due to financial constraints faced by a significant portion of the population who are currently unemployed. We are need to request financial assistance from our parents in order to obtain the necessary funds for acquiring the data.

According to the statements made by Group 10, it can be inferred that the cost of data is rather high. Typically, we request funds for the acquisition of data from parental sources. Students using a Learning Management System (LMS) may encounter occasional challenges such as network coverage issues and other technological difficulties. The aforementioned information was disclosed by participants 11 and 12 of the group over the course of an interview. One of the participants from Group 11 expressed the following viewpoint: The primary issue pertains to data and technical challenges encountered within an

online platform. Specifically, while logging in, users may encounter difficulties in saving their work, resulting in the unfortunate loss of their diligent efforts.

The participants from Group 12 expressed the following:

Occasionally, the virtual platform may present technical obstacles on submission days, resulting in system failures when engaging with teachers and other group members.

In summary, a cohort of 12 individuals encountered difficulties when utilizing technological tools. According to the participants, the primary obstacle encountered when utilizing technology is the Internet, primarily due to the high cost associated with data usage.

Computers are a costly investment, rendering them financially unattainable for pupils hailing from socioeconomically poor backgrounds. Students often encounter technological difficulties when attempting to log into a Learning Management System (LMS), particularly during assignment submission periods. In summary, the research findings indicate that students engaged in online education encounter several technological hurdles. Specifically, a significant number of participants reported that the cost of data is a key obstacle, which consequently impedes the use of data
driven pedagogical approaches.

4.1.2 Network coverage

The utilization of data bundles placed into a digital device is closely linked to the availability of network coverage. The implementation of data-driven teaching becomes unfeasible in instances of inadequate network coverage. When queried about the impact of network coverage on their academic pursuits, the members of Group 1 expressed the following sentiments: Occasionally, there is a suboptimal network coverage in the vicinity of my current position. We really desire for our university to take action in order to effectively mitigate this issue. On occasion, it becomes necessary to journey to the urban center in order to establish connectivity during weekends when we are not engaged in professional duties. The urban area exhibits superior Internet coverage. A significant amount of financial resources and time are expended throughout the process of commuting to urban areas.

The aforementioned group encountered a significant deficiency in network coverage within their locality. The issue at hand has had an adverse impact on the pupils, as it necessitated their travel to regions with superior network connection, hence incurring certain expenses. The researcher holds the perspective that in order to address the issue faced by this particular group, participants may consider purchasing various sim cards to enable them to switch between different service providers when encountering network problems or experiencing a weak signal. This will ensure that individuals have a stronger signal for improved internet connectivity, enabling them to engage in uninterrupted study activities.

The participants in Group 2 encountered suboptimal network connectivity during instances of load shedding. Occasionally, network coverage may be significantly impaired, particularly during instances of load shedding. However, the occurrence of such issues was not encountered during online examinations due to the absence of load shedding.

Despite the potential negative impact of load shedding on students, such as signal drop and reduced connectivity, it is important to consider its implications. This challenge is of a transient nature, resulting in a limited duration of load shedding, with a maximum duration of three hours. Once the power supply is reinstated, students have the ability to resume their academic tasks since the network coverage typically experiences enhancement. In light of the issue of inadequate examination coverage, it is recommended that the institution provide impacted students, who have experienced load shedding and network signal disruptions, with an opportunity for a supplementary examination.

Adverse weather conditions have a detrimental impact on the network signal, leading to less network coverage, thereby affecting students in an unfavorable manner. The concept was proposed by a cohort

consisting of three individuals. Upon being questioned, they expressed that they encountered certain difficulties, particularly during unfavorable weather conditions. It is worth noting that both inclement weather and load shedding are temporary occurrences. Once the weather conditions are favorable, the signals will commence functioning, thereby allowing the pupils to resume their academic activities. In the event that the coverage coincides with online assessments, it is imperative for the institution to provide the impacted students with an opportunity to retake their examinations. As previously elucidated by the researcher, the geographic location has the potential to impact network coverage, thus influencing the academic advancement of students engaged in Open and Distance e-Learning (ODeL) environments.

As to the account provided by Group 4, their geographical setting was situated within a remote rural region characterized by the presence of elevated landforms, including mountains. When questioned about their whereabouts, they acknowledged this particular place. The area in which we reside experiences inadequate network coverage. The facility is situated in a remote rural area, geographically distant from urban centers, hence presenting a lack of network coverage as a notable obstacle. In order to locate the network, it is necessary to proceed towards the closest elevated terrain.

It was discovered during the investigation that the group was required to ascend the hill in order to access the network and obtain optimal coverage.

In contrast to the preceding cohort, members in group 5 did not encounter network coverage in their respective locality. When asked about the presence of network coverage in their area, the participants responded by stating that they did not encounter any issues due to their proximity to a network pole in the town. This observation highlights the prevalence of network signals in most towns, resulting in the surrounding areas reaping the benefits, as elucidated by the fifth participant.

The presence of strong winds has an impact on the optimal operation of network signals. Group 6 experienced a similar set of circumstances as Group 3. The villagers provided additional clarification that their settlement is situated in close proximity to a hill, resulting in intermittent gusty conditions that therefore give rise to connectivity issues. During the interview, the participants expressed that the network coverage is generally satisfactory, albeit occasionally encountering connectivity issues during periods of high wind.

Group 7 expressed their indifference towards the availability of the network, as they do not rely much on technology. Conversely, groups 5, 9, 10, 11, and 12 reported a lack of network coverage in their respective localities. Participants from groups 8, 9, 10, 11, and 12 did not encounter any network-related issues.

In my perspective, network signals possess the capacity to influence the accessibility and retrieval of information. The utilization of mobile devices by a significant proportion of students can occasionally present limitations in terms of network connectivity and bandwidth capacity. This can be a potential difficulty for several students who are enrolled in Open and Distance Learning (ODL) institutions. While wireless networks utilized by certain students can address the issue of network coverage, it should be noted that not all mobile devices employed by these students are compatible with newer networks like 4G. Insufficient network connectivity results in a decrease in the ability to access data, which has a detrimental impact on students. Consequently, it is probable that they will discontinue their academic pursuits. During the conducted interview with the participants, the researcher observed that certain individuals, particularly those residing in remote rural locations, encountered challenges related to network connectivity.

The participants expressed dissatisfaction with the inadequate network coverage, resulting in instances where they had to go to urban areas in order to establish a connection. The participants' experience of network coverage was observed exclusively during instances of load shedding. Certain participants encountered network connectivity issues during inclement weather conditions, such as periods of high

wind. Individuals live in a remote rural location encountered limited network coverage due to the scarcity of network signals in their vicinity.

4.1.3 The utilization of virtual platforms in the context of data-driven pedagogy has been found to enhance the process of learning.

When queried about the impact of technology on learning, Group 1 responded:
In our perspective, it is imperative for students to engage in daily logins to ensure they remain up-to-date and actively participate in discussions, both with their online instructors and fellow classmates, in order to avoid falling behind. Ensuring consistency throughout online discussions can enhance the learning experience and contribute to students' academic performance. The initial cohort of participants held the belief that enhancing learning outcomes was contingent upon students engaging in daily logins and active participation inside the discussion forum. It was hypothesized that the maintenance of uniformity in online dialogues could lead to improved academic performance for all students.

Based on the findings of Group 2, it is suggested that the implementation of discipline and active participation of all students in the Learning Management System (LMS) may lead to significant enhancements in the learning process. Upon being subjected to questioning, their response was as follows: It is believed that the use of disciplinary measures is necessary for students. It is advisable for individuals to consistently log in to their accounts in order to stay updated on the latest information and announcements disseminated by university faculty members. The researcher posits that the use of effective discipline practices will provide significant advancements in the realm of online education.

When asked about the impact of the Learning Management System (LMS) on learning, group 3 expressed their belief that regular login activity can potentially enhance students' academic performance and elevate their success rate. This viewpoint aligns with the perspectives shared by groups 1 and 2, emphasizing the potential of sustained LMS utilization to foster increased rates of achievement. E-learning serves as a catalyst for fostering student engagement, facilitating meaningful interactions among peers, and promoting the exchange and appreciation of diverse perspectives.

The participants from Group 4 and Group 9 expressed the belief that it is necessary for officials at the regional centers to provide training on the utilization of technological gadgets. The authors contend that the provision of such training could potentially lead to enhanced learning outcomes. When asked about the impact of the Learning Management System (LMS) on learning outcomes, participants belonging to Group 4 expressed the need for comprehensive training sessions conducted by authorized personnel from the regional centers, focusing on the effective and efficient utilization of technology.

The participants from Group 9 expressed the belief that in order to utilize technology for educational purposes in an efficient manner, it is necessary to receive training. They suggested that this training may be provided by the authorities in a regional office.

The participants from Group 5 and Group 6 expressed similar perspectives. Specifically, individuals from Group 5 emphasized the importance of students engaging with their e-tutors and fellow students inside their separate online groups as a means to achieve high academic performance. Similarly, participants from Group 6 echoed this sentiment. In order to optimize the utilization of the learning platform, it is imperative that students engage in daily logins and actively participate in discussion forums to enhance their

familiarity with the educational material. This will assist us in enhancing our preparedness and achieving high grades in our academic courses.

In summary, the consensus among the participants in Group 8 was that optimal online learning occurs when students engage in regular interactions with their peers and e-tutors, actively contribute to a learning management system (LMS), and participate on a daily basis.

The individuals in Group 7 had a distinct response when prompted, as they articulated their thoughts in the following manner: We hold the perspective that learning management systems (LMSs) are not capable of enhancing the learning process. Although we do not personally utilize learning management systems (LMSs) and do not endorse a pedagogy centered on data analysis, we acknowledge that exploring different facets of technology and applying acquired knowledge remains a novel experience for us. The participants in Group 7 expressed skepticism over the efficacy of technology in enhancing the learning process. Upon further inquiry, the individuals expressed their continued belief in and heightened confidence in conventional approaches to instruction and knowledge acquisition.

The efficient utilization of technology has the potential to enhance the communication abilities of students. The aforementioned finding was disclosed by participants belonging to Group 8 in response to an inquiry regarding the potential impact of data-driven pedagogy on learning outcomes. According to their statement, it is believed that the proficient utilization of technology has the potential to enhance students' communication abilities. It is posited that through consistent interaction with fellow students, their language proficiency will experience improvement.

The enhancement of language skills can be facilitated through ongoing interaction between users, including students and e-tutors, within a learning management system (LMS). Participants from Groups 10, 11, and 12 exhibited a convergence of perspectives when prompted to elucidate the extent to which technology enhances the process of learning. According to the statements provided by the participants in Group 10, it was observed that it is imperative for students utilizing online learning platforms to consistently check in and actively engage with the diverse tabs available within the platform. This will assist individuals in becoming acquainted with the virtual portal.

Participants from Group 11 expressed their desire to promote the regular utilization of technology among other members of the group, citing its constant evolution as a key reason. Conversely, participants from Group 12 emphasized the importance of consistent practice and everyday engagement with technology as a means to acquire new knowledge and skills.

In summary, the participants of the group emphasized the significance of maintaining consistency in utilizing a learning management system (LMS) as a means to enhance student learning outcomes and achieve higher scores in assignments and tests. According to their statement, it has been suggested that students who demonstrate discipline by consistently logging into the Learning Management System (LMS) multiple times will be able to stay updated with the latest knowledge provided by e-tutors, hence leading to an improvement in their learning outcomes. Significantly, engaging in daily login activities multiple times within a Learning Management System (LMS) will aid students in becoming acquainted with the newly updated educational content within the LMS. Consequently, the attainment rate of students participating in an open and distance learning (ODL) environment will be enhanced.

4.2 The results obtained from the quantitative analysis.

4.2.1. Availability of Data

The subsequent section provides a summary of the results obtained from a sample of forty students residing in an urban locality regarding the accessibility of data. These students were questioned regarding the accessibility of data in their respective localities. Approximately 88% of the participants responded affirmatively, indicating that they perceived data accessibility to be satisfactory. Conversely, just 12% of the participants expressed negative views regarding data accessibility. Based on a statistical analysis, it has been determined that a significant proportion of cities, specifically 88%, offer complimentary access to wireless internet connectivity. This provision of free WI-FI has proven to be crucial in facilitating the effective implementation of data-driven pedagogical approaches within these urban areas. The study patterns of urban students differ from those in rural settings. The students excel in their academic pursuits as a result of the convenient availability of data. The implementation of data-driven pedagogy has been found to enhance the process of learning. The variable under consideration elicits differing opinions, with some individuals expressing disagreement while others express agreement.

4.2.2. Data driven pedagogy improves learning

Variable	Disagree	Agree
1.In our city there is a problem of network coverage which makes learning difficult	2 = 5 %	38 = 95%
2. New technologies enables online student to access study material with ease	4 = 10 %	36 = 90 %
Total	**N=6**	**N=74**

The questionnaire administered to a sample of 40 urban students enrolled in online education programs investigated the variable of network coverage and its impact on learning outcomes, specifically examining the potential benefits of utilizing data-driven technologies. Approximately 95% of the participants concurred that they do not encounter network coverage issues within urban areas due to the presence of a strong network signal. Additionally, they reported encountering minimal disruptions to their studies resulting from power outages, as they reside in industrial zones. Moreover, a significant majority of students, almost 90%, who were surveyed as part of a contractual agreement expressed their agreement that the utilization of new technologies has facilitated their access to study materials in a convenient manner. According to the literature research, it has been asserted that proficiency in using technical devices is a necessary skill for individuals in the fourth industrial period.

4.3 The process of triangulating research findings

Both online students residing in urban and rural locations derive benefits from pedagogy-driven teaching. The majority of students residing in rural locations, similar to their urban counterparts, benefit from reliable network connections. Consequently, they are able to submit their assignments on time using the Learning Management System (LMS) without encountering any difficulties. Students who live in close proximity to urban areas have the opportunity to avail themselves of complimentary wireless internet access provided by municipal libraries. Certain online students residing in rural areas have encountered challenges related to network coverage and load shedding. This difficulty, however, is not faced by their urban counterparts, who reside in proximity to industrial locations. Both online students residing in urban and rural locations derive benefits from pedagogy-driven teaching. The majority of students residing in rural locations, similar

to their urban counterparts, benefit from reliable network connections. Consequently, they are able to submit their assignments on time using the Learning Management System (LMS) without encountering any difficulties. Students who live in close proximity to urban areas have the opportunity to avail themselves of complimentary wireless internet access provided by municipal libraries. Certain online students residing in rural areas have encountered challenges related to network coverage and load shedding. This difficulty, however, is not faced by their urban counterparts, who reside in proximity to industrial locations.

5. Conclusion

Based on the findings of the research, it is evident that in the context of the fourth industrial revolution, pedagogy has become increasingly reliant on data analysis. Consequently, a technological disparity has emerged, particularly between online students residing in urban and rural areas. The former group enjoys greater accessibility to new technologies due to the availability of freely accessible data, whereas the latter group faces more limited access. Rural regions face various hurdles that impede the implementation of data-driven pedagogy, such as the high cost of data and a significant unemployment rate. In poor nations, there persists a notable prevalence of unemployment and poverty, which therefore impedes learners pursuing online education from procuring the necessary data due to financial constraints. The escalating levels of interest rates pose challenges for individuals, including those from affluent backgrounds, in acquiring data bundles. As a consequence of the substantial electrical demand, certain nations encountered load shedding, resulting in the unfeasibility of establishing connectivity. The primary challenge in certain nations pertains to network connectivity, which consequently hinders the effective implementation of a data-driven pedagogical approach. Technological devices such as laptops, iPods, and mobile phones are likewise characterized by high costs.

One of the solutions proposed by the researcher for the successful implementation of e-learning involves the utilization of technological devices capable of offline functionality. The learning management system known as Moodle has the capability to be utilized both in online and offline settings. The recently developed applications have the capability to function both online and offline. These applications can play a substantial role in addressing data issues, network coverage limitations, and power outages experienced by online students. Learners have the option to download the educational resources and utilize them offline, particularly in situations where internet connectivity is unavailable. The government has the potential to exert substantial influence by implementing the provision of complimentary wireless internet access to address connectivity issues faced by learners, particularly those who live in rural regions. This measure is particularly crucial as students in urban areas encounter fewer obstacles related to data connectivity. The integration of quantitative and qualitative findings through triangulation provided a comprehensive understanding of the potential enhancements that can be made to data-driven teaching.

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