Chapter 4

Sharpening the Digital Platform for Sustainable Virtual Learning in Higher Education in Ghana

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Abstract

The world is currently battling the worst pandemic, Novel Corona Virus (COVID-19). Coronavirus is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Although the use of virtual technologies for learning was already a reality in most Universities on specially designed courses, the current pandemic led virtual technologies to become a ubiquitous requirement for students to continue learning and for universities and teachers to continue teaching. Such a new paradigm led universities and teachers worldwide to change their ways of teaching in a very short period, which has led to both challenges and opportunities. Teaching means that others should be interested in learning something. This study critically examined the following issues: technological tools for e-learning, virtual classrooms and Gamification. It also examined the use of Virtual and Augmented Reality and Artificial Intelligence as learning tools. Recommendations are also made based on the findings to help universities to design and use modern technologies in the era of post-covid-19. One of the most challenging situations faced by those who are in contact with students is to be able to capture and retain students' attention, in such a way that they can assimilate the concepts and tasks proposed in the syllabus of the courses. Thus, all classroom experiences should be

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analyzed and evaluated to be able to change strategies and implement innovative ideas that make the teaching-learning process more effective.

Keywords: Digital Platform, Virtual Learning, Higher Education, Technology, Ghana

1 Introduction

The world is currently battling the worst pandemic, Novel Corona Virus (COVID-19). Coronavirus is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) It was first identified in December 2019 in Wuhan, Hubei, China. The current COVID-19 pandemic has forced companies, institutions, citizens, and students to rapidly change their behaviors and use virtual technologies to perform their working tasks. Although the use of virtual technologies for learning was already a reality in most Universities on specially designed courses, the pandemic led virtual technologies to become an ubiquitous requirement for students to continue learning and for universities and teachers to continue teaching. Such a new paradigm led universities and teachers worldwide to change their ways of teaching in a very short period of time, which has led to both challenges and opportunities. Teaching means that others should be interested in learning something.

With the growing concerns over COVID-19, many school districts have moved classroom instruction online for the foreseeable future. Some tools are recommended that may help make the transition to digital learning during these difficult times. These resources include general e-learning tools for educators, subject-based tools for students, and extensions to assist students with learning differences. Some of these tools are Age of Learning, Biteable, EdModo, Factile, FlipGrid, Kahoot, Nearpod, Padlet, Quizlet, Screencast-O-Matic, Seesaw, TesTeach, DocsTeach and Learn. Genetics (*E-learning Manual* 2020). Today's IT-intensive enterprise must always be on the lookout for the latest technologies that allow academic institutions to run with fewer resources while providing the infrastructure to meet todays and future student needs. Academic institutions will continue to adopt virtualization for many reasons: collections of inefficient servers can be replaced with fewer machines; software can be tested while isolated in harmless virtual partitions; and data centers can

gracefully (and virtually) conform to shifting work models, new technologies and changing corporate priorities.

The guiding objectives for this study are as follows:

1. To find out the technological tools for virtual classrooms
2. To establish technological tools for gamification
3. To ascertain the use of virtual and augmented reality as a learning tool
4. To ascertain the use of artificial intelligence as a learning tool

This chapter tries to review comprehensively the stainable virtual technologies in Higher Education after Covid-19. This chapter is significant in different dimensions and it has dealt with the following: Technological tools for e-learning, Technological tools for virtual classrooms, Technological tools for Gamification, The use of Virtual and Augmented Reality as a learning tool and the use of Artificial Intelligence as a learning tool. Today's IT-intensive enterprise must always be on the lookout for the latest technologies that allow academic institutions to run with fewer resources while providing the infrastructure to meet today's and future student needs.

2 Technological Tools for E-Learning

Dyer (2019) mentioned that there is no shortage of strategies, techniques, and tools available to teachers who use formative instructional practice in their classrooms. She stated some technological tools for e-learning are AnswerGarden, Buncee, Dotstorming, Five Card Flickr, Flipgrid, Kaizena, Micropoll, Nearpod, Piazza, Quizalize, Remind, ShowMe , Spiral, Survey Hero, Verso and Voxer among others.

Oye, Salleh and Iahad (2012) conducted a study on e-learning methodologies and tools. They discussed three types of e-learning tools namely: curriculum tools, digital library tools and knowledge representation tools. Curriculum tools provide a systematic and standard environment to support classroom learning; their functions are particularly helpful in the initiation and selection stages; digital library tools facilitate effective and efficient access to resources to support exploration and collection while knowledge representation tools focus on formulation and representation.

The growth of e-learning leads to the creation of special authoring tools that help authors and fulfil the needs for easily creating courses. To create a proper course for e-learning, you need an authoring tool to facilitate this work; a program that helps you write using hypertext or multimedia applications and enables you to create a final application merely by linking together objects, such as a paragraph of text, and an illustration. In order to achieve this, Haghshenas, Khademi & Kabir 2012 categorized the authoring tools into unspecialized authoring tools (Microsoft PowerPoint, Flash, Front Page and Dreamweaver) and specialized authoring tools (Articulate, Adobe presenter/Captivate, GLO Maker) (Haghshenas, Khademi & Kabir 2012).

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Sánchez, Hueros and Ordaz (2013) investigated the factors that control the acceptance of the WebCT learning system among students of the faculties of Business and Education Sciences at the University of Huelva. The most noteworthy outcomes highlight the need to reexamine the first auxiliary model regarding the relations of specific factors, in spite of the fact that the creators likewise build up the significance of the immediate impact of specialized help on apparent convenience and saw value among the understudies. The researchers also approve that WebCT usage and acceptance are legitimately affected by perceived usefulness and indirectly by perceived ease of use. The discoveries in this investigation have inferences on the virtual learning systems managers at the University of Huelva, and for other tertiary institutions that use online tuition systems. This paper mirrors an absence of specialized help in which understudies need to utilize WebCT all the more productively and shows that instructional classes and specialized help for understudies must be broadened.

Lin and Wang (2012) proposed a research framework to investigate the relationship between perceived fit and system factors that can inspire learners in the continuous use of an e-learning system in merged learning instruction. As students have the face-to-face learning opportunity in communicating with

teachers, the examination targets exploring the basic highlights the e-learning framework can give in helping to learn. The study used the qualitative and quantitative approaches to gathering data from respondents. The findings revealed that information quality and task-technology fit to impact the validation of system acceptance. Perceived usefulness and system satisfaction have major influences on continuance intentions.

ŠUmak, HeričKo and PušNik (2011) conducted a systematic literature review of 42 independent papers, mostly published in major journals. Furthermore, in order to view the research context by combining and analyzing the quantitative results of the reviewed research studies, a meta-analysis of the causal effect sizes between common Technology Acceptance Model (TAM)-related relationships was conducted. The main findings of this study, which is the first of its kind, are: (1) TAM is the most-used acceptance theory in e-learning acceptance research, and (2) the size of the causal effects between individual TAM-related factors depends on the type of user and the type of e-learning technology. The results of the meta-analysis demonstrated a moderating effect for user-related factors and technology-related factors for several evaluated causal paths.

Martínez-Torres *et al.* (2008) conducted a survey on the technological acceptance of e-learning tools used in practical and laboratory teaching, according to the European higher education area. The objective of this research is to examine the Technology Acceptance Model (TAM) of web-based e-learning tools used in practical and laboratory teaching. The use of logical instruments to examine the utilization of Internet-based e-learning tools in scholastic settings is overlooked. E-learning tools are actually an up-and-coming topic as an effect of the new ideas introduced by the European Higher Education Area. Lifelong learning is the new pattern of learner-centred education. In this context, e-learning tools can represent an effective way of supporting this new movement in education. The research hypotheses derived from this model have empirically been confirmed using the responses to a survey on e-learning usage among 220 users. The results strongly support the extended TAM in predicting a student's intent to use e-learning and define a set of external variables with a significant influence on the original TAM variables. Surprisingly, perceived ease of use did not posit a significant impact on student attitude or intention towards e-learning tool usage. In this way, early assessment of e-learning material is viewed as fundamental to giving a structure to advance enhancements of the instrument.

Button, Harrington and Belan (2014) reviewed the literature on e-learning and information communication technology (ICT) in nursing education. The objective of the study was to examine primary research articles published between January 2001 and December 2012 that focused on the issues for students and educators involved with E-learning in preregistration nursing programs. The review highlighted that beginning preregistration nursing students required ongoing education and support surrounding nursing informatics. This would help empower students to advance and be furnished with the deep-rooted learning skills needed to give safe proof-based consideration. The review also acknowledged the expanded time and aptitude requests put on nurture instructors to adjust their present training systems and instructing techniques to consolidate E-learning. They further stated that E-learning is debatably the most important revolution to occur in nursing education since the transfer from hospital training to the tertiary sector. Changes in computer and information literacy for both students and educators influence the success of the implementation of E-learning into current curricula.

Building customized e-learning programs place high demands on design, programming skills, and time. An alternative to this can be a deployment of courses within learning management systems. One such system that has been gradually gaining worldwide popularity is Moodle (Modular Object-Oriented Dynamic Learning Environment), a course management system for online learning. Moodle is 'open source', allowing developers to tailor the system to individual needs. It also communicates extremely well with many web-based resources (Facebook, YouTube, Wikipedia, JClik, Hot Potatoes, etc.), allowing developers creativity and versatility. The design of Moodle is based on socio-constructivist pedagogy. This means its goal is to provide a set of tools that support an inquiry- and discovery-based approach to online learning.

Park (2009) conducted a study to analyze the Technology Acceptance Model in understanding university students' behavioral intention to use e-learning. A sample of 628 university students took part in the research. The outcome showed TAM to be a good theoretical tool to understand users' acceptance of e-learning. E-learning self-efficacy was the most important construct, followed by subjective norm in explicating the causal process in the model. Many colleges execute e-learning for different reasons. Clearly, the number of e-learning openings given by higher instructive foundations keeps on developing in Korea. However little exploration has been done to check the cycle of how college embrace and use e-learning. In the era of globalization of

goods and services difficulties in knowledge diffusion still remain. The effective exchange of experiences and skills is not guaranteed by the enormous potential of internetworking systems and devices. E-learning technologies represent a good opportunity to reduce the digital divide and to ensure faster and higher development trends. Several universities and companies are currently involved in using e-learning systems to provide a valid solution; this notwithstanding several problems related to e-learning activities remain open (Campanella *et al.* 2008)

Brady, Holcomb and Smith (2010) studied the use of different social networking sites in higher educational. The survey comprised graduate students enrolled in distance education courses using Ning in Education, an education-based social networking site (SNS), based on their attitudes toward SNSs as productive online tools for teaching and learning. The results of the study propose that education-based SNSs can be used most effectively in distance education courses as a technological tool for improved online communications among students in higher distance education courses. Distance education as a primary means of instruction is expanding significantly at the college and university levels. Simultaneously, the growth of SNS including Facebook, LinkedIn, and MySpace is also rising among today's college students. An increasing number of higher education instructors are beginning to combine distance education delivery with SNSs.

3 Technological Tools for Virtual Classrooms

Ekaran (2018) wrote on tools for the digital classroom. He stated that there is certainly no shortage of tech-based tools to use in the classroom. He examined some of the best eLearning tools, focusing specifically on those that are designed for encouraging, enhancing, and managing to learn such as Socrative, Scratch, Prezi, SelfCAD, Quizlet / Quizlet Live, Google Classroom, Adobe Spark Video, Khan Academy and Class Dojo. Today's world has been affected by the process of digitization, modern technology has taken over our lives on a daily basis, from shopping to bank transactions, to payment of bills (Abah 2019). What modern technology enables us to do is to introduce elements of gamification into the education process, which should improve student motivation and information retention, as well as their ability to do their own research and work in teams. It also allows for individualization of learning and encourages students to seek out the content that they like. Upon this background

Bartee (2016) put together a list of 12 digital tools for digital classrooms namely; Learn Boost, Moodle, ClassDojo, Cacoo, Pixton, VoiceThread, Socrative, Engrade, Top Hat, Trello, and Kahoot.

According to Falloon (2011), organizations have utilised an array of asynchronous online learning systems such as WebCT, Blackboard, Moodle, or InterAct to deliver course content to their students. This, in some cases, is enhanced by online discussion forums, synchronous one-to-one text-based chat, and break out rooms such as online cafés. Parker and Martin (2010) cited in Al-Nuaim (2012) states that 'virtual classrooms are becoming progressively prevalent, as members can dialogue and sight each other through a webcam, use emoticons, and work together in break-out rooms all of which allow them to feel more related to one another'. Among the virtual classroom software options on the market, today are Elluminate, Webex, Adobe Connect, Horizon Wimba and Centra. Freeware virtual classrooms include Wiziq and DimDim. The interactive nature of the virtual classroom addresses the main challenge of distance education.

Simon, Haghirian and Schlegelmilch (2003) studied the usage and effectiveness of virtual classrooms in the global marketing curriculum and empirically investigated the antecedents of successful teaching in such an environment. The study is grounded on case instruction activities involving up to three university classrooms in different countries. In all, 90 students partook in the combined teaching sessions. The study offered was done in four countries (Spain, Austria, France and China) over a period of one year. The findings of the study indicate that teaching empathy and classroom communication have the highest effect on teaching efficiency in the virtual classroom.Global marketing education is embedded in an inexorably worldwide cutting-edge business environment. Strategic policies and advertising training are unequivocally impacted by these turns of events. New technologies are successfully implemented in university curricula to improve the effectiveness of teaching and the cooperation between universities in management teaching. Business practices and marketing education are strongly influenced by these developments (Simon, Haghirian & Schlegelmilch 2003).

Potts (2019) conducted a case study to understand profoundly gifted students' perceptions of virtual programs. The partakers for this study were 5 profoundly gifted students who were registered in a fully virtual writing course held by a school that serves the profoundly gifted populace. Data was collected through focus groups on an online discussion board, individual interviews and

observations of synchronous sessions in their virtual classroom. The partakers said they preferred frequent interaction with the teacher and classmates, but expressed worry about the absence of social openings. While technical difficulties did occur, these were generally because of administrator mistakes or neglect of accessible tools. Finally, in relation to syllabus and training, the partakers saw little difference between brick-and-mortar and virtual classrooms, suggesting that for profoundly gifted students, the nature of the content and instruction exceeds the real factors of the learning environment. This information can be utilized either to improve online gifted training or make new programs, consequently enhancing chances.

Tomei (2011) states that online learning is the exemplification of applied innovation and ought to be coordinated into whatever number of degrees of the online educational program could be allowed. To get ready students for the future, instructors must take advantage of each chance to imbue the innovations their students will utilize at whatever point conceivable. Above all, instructors must recognize what works best in an online classroom circumstance, i.e., podcasting, interactive whiteboards, blogs, wikis, social networking, and virtual classrooms among others.With little dread of logical inconsistency, innovation has gotten pervasive, contacting almost every part of teaching and learning. Faculties at all stages of education continue to integrate technology into traditional classroom learning. Still, others are simply starting to investigate the genuine potential that different advances offer for expanding students learning results. When appropriately applied alongside sound course improvement standards, technology helps in the procurement of abilities required for understudies to get by in the complex, exceptionally mechanical data-based economy of the 21st century. Incorporating technology into classroom guidance envelops more than showing fundamental computing skill levels or utilizing technology for joints. Genuine innovation incorporation happens regularly on the side of four key segments of understudy learning: dynamic commitment, bunch cooperation, criticism, and replication of certifiable circumstances.

Berry (2019) studied the role of video and text chat in a virtual classroom on how technology impacts the community. The researcher interviewed 20 students in an online doctoral program and analyzed over 50 hours of footage from six online classes. Findings indicate that the video and text talk highlights of the virtual study hall gave chances for consistent connection and expanded understudies' commitment and feeling of network.

Virtual classrooms permit clients in a closed network to communicate through talk, text, and video. While virtual classrooms empower simultaneous online learning, little is thought about.

Universities are progressively going to online advancements to oversee, have and convey scholarly substance. Web conferencing programming is progressively used to have virtual classrooms where understudies and educators can meet simultaneously. There is a lot of variety in the sort of virtual classrooms accessible at the present colleges. A few foundations depend essentially on sound just classrooms, while some use the programming that considers members to transfer coordinated video notwithstanding sound Virtual classrooms normally additionally permit members to extend and share documents and to communicate through text chat. Virtual classrooms offer many benefits to distance learners. They allow interdisciplinary groups from numerous places to come together to work collaboratively and change ideas.

Harper (2018) conducted a study of review of empirical research on technology and teacher-student interactions. This review surveyed studies published in peer-reviewed journals between 2005 and 2016. Findings showed that studies examined two types of teacher-student interactions that technology influenced: (a) face-to-face interactions in traditional classrooms; and (b) online interactions in traditional and virtual classrooms. Technology advances cooperation among teachers and students during learning exercises, and instructors who utilized technology utilized it to boost their employment of procedures pointed toward encouraging learning and advancing students' investigation of substances. As technology gets ubiquitous in education, it is basic to comprehend the manners by which technology impacts cooperation among teachers and their students. Online education is quickly growing in admiration across the world. Teachers and professors fight to participate with and build evocative relations with online students in the same way as having face-to-face interactions with students, and without this serious module in place, online students report an absence of concentration, and thus, they produce a lesser excellent of work and report fewer general fulfilment. There is a mass of tools and approaches that can be used by the online teacher to build evocative relations with students and rise these fulfilment levels (Martin 2019).

Borba, de Souza Chiari and de Almeida (2018) undertook a study to analyze the role of digital technologies in two specific contexts: how teachers, tutors, and students play a role in creating collaborative digital educational material and how digital technologies themselves can play a role in teaching

distance learning courses. Data were formed from virtual observations in virtual learning environments and virtual interviews. The results emphasize that both highlighted roles are related. They change teacher and student characters and involvement in the virtual classroom, and an 'agency of media' emerges in online mathematics education. The effect of a classroom setting on the possibility of being caught cheating is likened between face-to-face classes and online classes (Cahn 2018). Gutiérrez-Esteban *et al.* (2016) conducted an evaluation of teaching design in synchronous virtual classrooms. The study was developed to evaluate teaching designs and procedures used in a course of the University Lecturer Training Plan at the University of Extremadura (Spain) called Virtual Learning and the environments in Synchronous Virtual Classrooms (SVCs). The training was given in three editions on different university campuses. The key discoveries pointed to the necessity to lessen both connection time and the number of tools used, the importance of the use of free software, and a positive valuation of the likelihoods and advantages of SVCs for teaching and for data collection in qualitative research. Digital change resembles a quick-moving tidal wave, with the digitalization of numerous strategic policies making new connections among organizations and clients and modifying the promoting scene. It is basic that undergrads gain an introduction to such front-line innovations and imbue the theoretical, request, basic reasoning, imagination, and integrative learning aptitudes expected to include an incentive in reality as we know it where machines will work close by human experts (Crittenden, Biel & Lovely 2019).

Pilgrim and Pilgrim (2016) present virtual reality as a tool for classroom literacy instruction. Building on the traditional use of images as a way to scaffold prior knowledge, the study extends this idea to share ways virtual reality enables experiential learning through field trip-like experiences. It indicates that the use of technology tools such as Google Expedition, Google Street View and 3D glasses offers a way for teachers to engage students with content. For the reading/language arts teacher, virtual reality tools may provide an affordable way to support students through visual and experiential scaffolding. Radovan and Kristl (2017) examined the acceptance and use of learning management systems (LMS) among higher-education teachers and the relation between their use of such systems and their teaching approaches in the context of online learning, following the community of inquiry framework. A total of 326 teachers at the University of Ljubljana completed a questionnaire. The findings revealed that the| critical aspect of LMS acceptance by university

teachers is the immediate social influence at work, but the development of the learning process largely depends on the characteristics of the LMS tools and the perceived usefulness of the application.

Azhar and Iqbal (2018) undertook a study to assess teachers' perceptions on the effectiveness of google classroom. The qualitative research design (semi-structured interview method) was used in conducting the study with a sample of 12 higher education teachers who have applied Google Classroom for at least one semester in their classroom. The findings of the study revealed that teachers perceive it as only an enablement tool that can be used for document management and basic classroom management, without having a significant impact on teaching methods. The answers of the teachers specify that the lack of a user-friendly interface is the main reason for its inadequacy. They stated further that technology has become important in all phases of education yet educators have been unable to figure out which of the many available technological tools best fit their classroom practices. Google Classroom is one such tools that is free of cost and has gained popularity within a short span. Anekwe (2017) conducted a study on the impacts of virtual classroom learning on students of Nigerian federal and state universities. A descriptive approach was adopted to examine the impacts of virtual classrooms on students' learning. Virtual classrooms are technologically-driven classrooms that support self-directed and self-regulated learning. The study was carried out in two federal and two state universities in the South-East zone of Nigeria. The sample comprised 280 federal university students and 226 state university students given a total sample of 506 respondents. Stratified random sampling due to ownership (federal and state) was used. Other sample techniques used were; those students who have been involved in online programmes recently and those currently in the programme. Students' consent was also sought before the selection. The results indicate among others that virtual classrooms have positive impacts on the students of federal and state universities, they reported positively on their continued support and preparedness for virtual classrooms. Based on the findings, the recommendation was that many more students should be made aware of the impacts of the virtual classrooms. They should also be motivated to participate more in virtual classrooms.

Martin and Parker (2014) studied why instructors adopt synchronous virtual classrooms and how they use them after their adoption. An electronic survey was administered asking instructors from various institutions to describe their experience adopting a synchronous virtual classroom in either a blended

or online course. In describing their reasons for adopting the technology, respondents most frequently cited institutional resource availability, increasing social presence, enhancing student learning, and the availability of technology. Along with audio chat, the features that most influenced the adoption of virtual classrooms and were used most frequently by respondents were the ability to archive conference sessions, see participants through webcams, and use text-based chat interfaces. Open-ended survey responses revealed that instructors used virtual classrooms to promote interactivity, develop community, and reach students at different locations. There were also distinct trends characterizing the demographics of faculty members who reported using virtual classrooms. These discoveries make available meaningful data for teachers interested in providing synchronous components in their online teaching. Virtual classrooms allow students and instructors to communicate synchronously using features such as audio, video, text chat, interactive whiteboard, and application sharing.

4 Technological Tools for Gamification

Dyer (2019) mentioned that Kahoot, Wordables, and Duolingo are some technological tools for gamification. According to Kiryakova, Angelova and Yordanova (2014) there are many tools for gamification. Some of them are web-based (cloud services) and do not require the installation of special software and allow access at any time and from any location. Among the most popular gamification tools are Socrative, FlipQuiz, Kahoot!, Duolingo, ClassDojo, Ribbon Hero and Goalbook.Gupta (2016) mentioned that it is sad that education by evasion is considered to be a non-gaming area whereas technology incorporation can actually make things interesting by adding a gaming experience for kids to keep them engaged and also witnessing learning and teaching blooming. Tools such as KnowRe, ClassDojo, Socrative, MineCraft Edu, Play Brighter, Zondle, Virtonomics, Course Hero, Duolingo, Veri, Maven, Class Realm and Kahoot! can help you know more about gamification.

Gamification is progressively existing in the classroom, and it helps students to learn in a very simple and playful way. The use of gamification tools such as Brainscape, knowre, Cerebriti, Minecraft, Pear Deck, Kahoot!, Edmodo, Classcraft, CodeCombat, ClassDojo, ChemCaper, Quizlet, Toovari, Play Brighter, Quizizz, Trivinet, Arcademics and Genially can help students learn in a very simple way (*Essential Gamification Tools* 2020). Student engagement is very important. When students are engaged in a lesson, they pay

attention, ask questions, actively participate, and ultimately learn more. Students' engagement can be increased by using gamification apps, tools, and resources with your students. Students' engagement can be made possible by using gamification tools such as Socrative, Kahoot!, Play Brighter, Classcraft, Goose Chase, Minecraft, Breakout EDU and Quizizz (Lynch 2017).

Information technologies have constantly been progressing in recent years, and education systems cannot remain indifferent to these changes. Gamification is a promising line of research that provides many benefits to education, based on motivation, progressiveness, and instant feedback. Precisely, the motivation and the active role of students are key points to enhancing learning, which is one of the main challenges in education (Llorens-Largo *et al.* 2016). According to Chen (2014) gamification is the use of game and behavioral analytics, game mechanics, interactive media, and social networking to improve work performance and transform a business by engaging and training users to solve problems. Gaming techniques and strategies have been used in areas such as employee training programs, financial services websites, customer relationship management, project management, business intelligence, market research, online shopping, and education. The level of sophistication involved in the technology applied to these needs varies greatly. Garcia *et al.* (2019) undertook a study on gamified mobile experiences as smart technologies for tourism destinations to present gamified mobile experiences as valid tools to enrich the experience of tourists and to present the benefits provided to Destination Management Organizations (DMOs) by analytics tools integrated into gamified mobile experiences. The findings revealed that both DMOs and tourists can benefit from gamified mobile experiences. The integration of analytics tools to gain insights into the behaviour of tourists can be a relevant information source for DMOs. The findings confirm that personalizing a product through a gamified interface might have a positive impact in terms of experience during the process but also on patronage intentions. The rise of smart technologies is progressively grabbing the eye of scientists and professionals, particularly in retailing settings.

Villagrasa *et al.* (2014) describe the utilization of gamification and visual advances in a classroom for higher education, specifically for university students. The objective is to accomplish a significant increment in student inspiration and commitment using different technologies and learning techniques dependent on game mechanics called gamification. Gamification is utilized to draw in students in the learning cycle. This examination includes

learning procedures like Learning by Doing to students' collaborative work, and mixes teacher support with new, accessible technology, for example, virtual reality and perception 3D on the web on account of webGL. This makes another management tool, called the Gamified LABoratorieS (GLABS), to aid the gamification of the classroom. Understanding the part of gamification and technology in training implies understanding under what conditions game components can drive an understudy's learning conduct with the goal that the person may accomplish better outcomes in the learning process.

Almeida and Simoes (2019) conducted a study to analyze the role of emerging technologies like serious games and industry 4.0 in the transformation of education 4.0 in higher education. A qualitative methodology was employed based on 25 case studies of innovative projects in Portuguese higher education institutions. The results indicate an outstanding adoption of serious games and gamification approaches only appear in less than 20% of the projects. It was additionally conceivable to recognize that most activities include a few partners, for example, teachers, students and college directors, and normally include multidisciplinary skills fields. The main benefits brought to the education context include greater involvement of students in projects, development of their skills and its application in a real context. Then again, the principle challenges are the improvement of this present reality made by these applications, the troubles innate to their incorporation in the didactical framework and the restricted abilities to offer more noteworthy intuitiveness without predefined outer boosts. The primary advantages brought to the education setting remember more noteworthy association of students for ventures, improvement of their aptitudes and its application in a genuine setting. Education 4.0 is another instructive worldview that plans to address the necessities and possibilities of the fourth mechanical unrest. Education 4.0 expands on the idea of learning by doing, in which students are urged to learn and find various things in particular manners dependent on experimentation.

Su and Cheng (2015) investigated how a gamified learning approach influences science learning, achievement and motivation, through a context-aware mobile learning environment, and explains the effects on motivation and student learning. A series of gamified learning activities, based on MGLS (Mobile Gamification Learning System), was developed and implemented in an elementary school science curriculum to improve student motivation and to help students engage more actively in their learning activities. The responses from participants indicate that students valued the outdoor learning activities made

possible by the use of a smartphone and its functions. Pre- and post-test results showed that fusing versatile and gamification advancements into a botanical learning process could accomplish a superior learning execution and a higher degree of inspiration than either non-gamified mobile learning or traditional instruction. Further, they uncovered a positive connection between learning accomplishment and inspiration. The relationship coefficient for ARCS measurements and post-test shows that the ARCS-A (consideration) is more noteworthy than ARCS-R, ARCS-C and ARCS-S. This implies the consideration (ARCS-A) of this framework is a significant measurement in this examination.

Poncin *et al.* (2017) examined the impact of two gamification mechanics, challenge and fantasy, on customer experience and patronage intentions. The findings confirm that personalizing a product through a gamified interface might have a positive impact in terms of experience during the process but also on patronage intentions. This research also shows that solely adding gamification mechanics such as challenge and fantasy in a smart interface is not enough to significantly enhance the quality of the perceived experience. The emergence of smart technologies is increasingly catching the attention of researchers and practitioners, especially in retailing contexts.

McCoy, Lewis and Dalton (2016) studied a landscape review on gamification and multimedia for medical education. A total of 5 electronic games and 4 mobile applications were identified for preclinical training, and 5 electronic games, 10 mobile applications, and 12 virtual patient simulation tools were identified for clinical training. Nine additional gamified, virtual environment training tools not commercially available were also identified. All improved learning outcomes have demonstrated virtual patient simulations. Games have the potential to promote learning, increase engagement, allow for real-world application, and enhance collaboration. They can also provide opportunities for risk-free clinical decision-making, distance training, learning analytics, and swift feedback. Medical instruction is quickly advancing. Understudies enter clinical school with a significant level of mechanical proficiency and a desire for instructional assortment in the educational program. Accordingly, numerous clinical schools currently fuse innovation upgraded dynamic learning and mixed media training applications. Instruction games, clinical portable applications, and virtual patient reenactments are together named gamified preparing stages. Many published studies suggest possible benefits of using gamified media in the medical curriculum.

Llagostera (2012) contributes to the discussion on gamification by understanding the gamification phenomenon from the viewpoint of the convincing enquires it poses, both as a discursive term and as persuasive systems. Nowadays virtual reality (VR) technology gives us substantial prospects to change new approaches to enhance outmoded physical therapy withstand valuable amount and quality of therapy. VR tools, like Leap Motion, have received great attention in the recent few years because of their inestimable applications, which include gaming, education, medicine etc. The foremost impression of gamification of hand rehabilitation is to help change the muscle tonus and increase accuracy in signals using the chances that VR offer by making the therapy procedure more effective and encouraging for patients.

The utilization of educational technology has been improving in schools since the turn of the century. The current instructive educational program has been patched up to incorporate information, communications and technology (ICT). The inundation has either been an independent subject or injected into components of different subjects, most conspicuously in Science, Technology, Engineering and Mathematics (STEM). In some instructive technology research, it has indicated that the imbuement of innovation has demonstrated differentiating results when it came to educating and learning. Moreover, with the issues, for example, trouble in getting to technology, instructor misguided judgment about technology utilization in study hall, and understudy separation towards learning in the classroom, we were unable to see the full degree of the instructive technology ability. Thus, this generates the presentation of games as an instructive apparatus; as it is connected with delight and is distant from its connection to work. With the implantation of innovation, it has created offshoots, for example, game-based learning, genuine games and all the more as of late gamification. As gamification alludes to the consideration of 'gamefulness' to existing frameworks instead of making a totally new game; subsequently prepares for simpler usage as an instructive device (Sanmugam *et al.* 2015).

Rachels and Rockinson-Szapkiw (2018) studied the effects of a mobile gamification app on elementary students' Spanish achievement and self-efficacy. A quasi-experimental, pretest-post-test, non-equivalent control group design was used to examine the effect of a mobile gamification application on third and fourth-grade students' Spanish language achievement and student academic self-efficacy. In this study, the treatment group's Spanish language instruction was through the use of *Duolingo*®, a computer and mobile app that

uses gamification and adaptive learning technology to teach foreign languages. Students in the control group received their regularly scheduled English L1/Spanish L2 class learning activities. The study was 12 weeks in duration. Students were assessed with a 50-question, multiple-choice English to Spanish and Spanish to English pretest covering vocabulary and grammar to control for prior Spanish language achievement. Students were assessed with the Pattern of Adaptive Learning Scales' (PALS) Academic Efficacy subscale to control for prior academic self-efficacy. The same two instruments were used as post-tests. An analysis of covariance showed no significant difference in students' Spanish achievement or in academic self-efficacy between students who used *Duolingo*® and students who were taught with traditional face-to-face instruction. This demonstrates that *Duolingo*® is a useful tool for teaching Spanish to elementary students.

Oluwajana *et al.* (2019) studied the adoption of students' hedonic motivation system model in the gamified learning environment. The study addressed the perception and usage of the gamified learning environment from a hedonic motivation perspective by incorporating the Hedonic-Motivation System Adoption Model into Gamified Learning Environment. The results show that perceived usefulness, perceived ease of use, enjoyment and control all have a significant positive relationship with behavioral intention of use and focused immersion which indicates that the acceptance of Gamified Learning Environment could serve as a new educational tool to expedite the improvement of pedagogical and instructional technology. Also, increases students' motivation and engagement in learning. On the contrary, the study also found a negative relationship exists between enjoyment and focused Immersion. Llorens-Largo *et al.* (2016) undertook a study to get a customized student-centered learning model in which the student may have some autonomy. To achieve this goal, they proposed an innovative and adaptive gamified training model, *LudifyME*, which takes advantage of the benefits of gamification and has a strong technological component as a basis. Finally, as a case study, the researchers detailed *PLMan*, an online gamified system based on *LudifyME* in which a progressive prediction system of students' performance has been developed.

Kopcha *et al.* (2016) presented the course design and evaluative data associated with the learning experiences of practicing teachers engaged in a gamified approach to a graduate-level course on technology integration. Twenty-two teachers across three offerings of the course completed a survey examining their experience with the gamified course and course elements. The

survey mean scores were positive overall. Participants reported they were motivated by the gaming principles incorporated into the course, including the use of badges and awards and the opportunity to tailor course experience to their own interests. Participant responses to open-ended matters similarly revealed that recognition and autonomy were important aspects of their learning experience. The development of Smart Learning Environments is a complex software engineering process combined with pedagogical principles. Smart pedagogy requirements have advanced beyond the delivery of interactive-adaptive content, which in the past was delivered through single-media systems and applications, to complex multisensory experiences. Contemporary systems are designed to offer customized media-rich interactive scenarios often implemented over various media, featuring technologies that include augmented reality, virtual reality, and holograms. However, problems are introduced as the development process is complex and content experts often do not possess programming experience or application development knowledge (Deliyannis & Kaimara 2019). Kiryakova, Angelova and Yordanova (2014), state that today's learners are digital natives. They grew up with digital technologies. Teachers have to solve important issues related to the adaptation of the learning process toward students who have different learning styles and new requirements for teaching and learning. Gamification is one of the educational approaches and techniques that increase the motivation and engagement of learners.

5 Use of Virtual and Augmented Reality as a Learning Tool

Augmented Reality (AR) refers to a technology that gives the ability the user to sense the real world while interacting with virtual and physical objects. Mobile refers to the portability and usefulness of the application itself, thus mobile AR application can be referred to as a portable AR application. The real world can be enhanced by AR through the augmented virtual object into the real environment and providing some additional information for users (Tomi & Rambli 2013). Learning to play an instrument is challenging for both children and adults. Adding to this music education in K-12 oftentimes is subject to budget cuts (Serafin *et al.* 2017). Virtual reality (VR) and augmented reality (AR -- overlaying virtual objects onto the real world) offer interesting and widespread possibilities to study different components of human behaviour and cognitive processes. One aspect of human cognition that has been frequently studied using VR technology is spatial ability.

Kaufmann (2003) conducted a study on collaborative augmented reality in education. The research gave a brief insight into the potential and challenges of using collaborative Augmented Reality (AR) in education within the greater context of immersive virtual learning environments. Construct3D is based on the mobile collaborative AR system 'Studierstube'. The researchers described their efforts in developing a system for the improvement of spatial abilities and maximization of transfer of learning. Anecdotal evidence supports the claim that Construct3D is easy to learn, encourages experimentation with geometric constructions and improves spatial skills. Technological advances enable the use of innovative learning tools for education. Improvement in instructional practices through dynamic means of delivery remains a central consideration to technology educators. These technologies must simultaneously relate to course concepts while engaging and exciting students about technology. An emerging technology that has the potential to both engage and excite is augmented reality leading expert in the field (Thornton, Ernst & Clark 2012).

Tomi and Rambli (2013) presented the development of an interactive mobile augmented reality magical playbook for preschool children in learning numbers using old folklore literature, The Thirsty Crow, via mobile augmented reality application and interactive physical book interface design. By applying this concept to an AR storybook, the physical book (the real world) will be enhanced by augmenting the virtual object (3D models, animations, and sounds) viewed over a mobile device. Dutã *et al.* (2011) gave an overview of virtual and augmented reality in dental education. The researchers provide an overview of the use of one of these modalities, virtual and augmented reality systems in dental education and discuss the strengths and weaknesses of these systems. The review suggested that the use of virtual and augmented reality technologies offers the advantages of the reinforcement of theoretical dental knowledge, correct use of dental instruments, ergonomic positioning, students' self-evaluation, faster acquisition of skills and positive student perception. In general, any disadvantages arise because most of the dental simulators that use virtual and augmented reality are in an early and experimental stage. It can be concluded that virtual and augmented reality systems will play an increasing role in dental education. These technologies are likely to change clinical training and encourage the use of reflective forms of assessment, which involve students in a self-assessment process to identify individual learning needs and self-directed learning. These innovations promise not only to lower costs of the educational process but also to increase quality by providing a new set of

pedagogical tools for dental schools. Clinical dentistry is a complex area for education. This is because the development of clinical competence requires the assimilation of knowledge combined with the acquisition of clinical skills and problem-solving ability. In recent years, a variety of computer-based modalities including intelligent tutoring systems, medical simulation, and virtual reality techniques and the development of Web 2.0 collaborative authoring and social networking tools have become available (Dutã *et al.* 2011).

Lavrentieva *et al.* (2020) undertook a study on the use of simulators together with virtual and augmented reality in the system of welders' vocational training: past, present, and future. The findings revealed that the simulators allow not only training but also one can build neuro-fuzzy logic and design automated and robotized welding systems. The functioning peculiarities of welding simulators with AR have been revealed. It is shown they make it possible to ensure the forming basic qualities of a future specialist, such as concentration, accuracy and agility. The psychological and technical aspects of the coaching programs for the training and retraining of qualified welders have been illustrated. Possible directions for the development of simulation training for welders were revealed. Among them, the AR technologies have been presented as such that gaining wide popularity as allow to realize the idea of mass training in basic professional skills.

Chien, Chen and Jeng (2010) conducted a study on an interactive augmented reality system for learning anatomy structure. The study aimed to use augmented reality (AR) technology to create an interactive learning system, which helps medical students to understand and memorize the 3D anatomy structure easily with tangible augmented reality support. The researchers speculate that by working directly with a 3D skull model with visual support and tangible manipulation, this AR system can help young medical students to learn the complex anatomy structure better and faster than only with traditional methods. Advances in virtual immersive and augmented reality technology, commercially available for the entertainment and gaming industry, hold potential for education and clinical use in medicine and the field of medical imaging. Virtual and augmented reality technologies are a novel means to communicate and have the potential for supplementing radiology training; communicating with colleagues, referring clinicians, and patients; and aiding in interventional radiology procedures (Uppot *et al.* 2019). Fonseca *et al.* (2014) investigated the relationship between student profile, tool use, participation, and academic performance with the use of Augmented Reality technology for

visualized architecture models. They described the implementation and evaluation of an experiment with Augmented Reality (AR) technology in the visualization of 3D models and the presentation of architectural projects by students of architecture and building engineering. It was revealed that the use of mobile devices in the classroom is highly correlated with motivation, and there is a significant correlation with academic achievement. However, the difficulty of using and generating content is a complex factor that suggests difficulty when implementing more complicated models.

Martín-Gutiérrez *et al.* (2015) conducted a study on augmented reality to promote collaborative and autonomous learning in higher education. The learning scenarios described in this work reach further than any previous approach. The connections between augmented reality (AR) and traditional learning based on textbooks through the well-known augmented books also known as 'magic books', are already there. However, they are restricted to just a few isolated uses that commonly take place on a PC showing 3D information with few actions in higher education. It was revealed that students feel comfortable about it and consider that tools are nice, easy, and useful, according to the goal of learning contents, training on performance, and design of installations and machines.

Ibáñez and Delgado-Kloos (2018), performed a systematic review on augmented reality for STEM learning. This study presents a systematic review of the literature on the use of augmented reality technology to support science, technology, engineering and mathematics (STEM) learning. It synthesizes a set of 28 publications from 2010 to 2017. Qualitative content analysis is used to investigate the general characteristics of augmented reality applications in STEM education, the instructional strategies and techniques deployed in the studies reviewed, and the evaluation approaches followed in the interventions. This review found that most augmented reality applications for STEM learning offered exploration or simulation activities. The applications reviewed offered a number of similar design features based on digital knowledge discovery mechanisms to consume information through the interaction with digital elements. Kose, Koc and Yucesoy (2013) undertook a study to improve educational processes in abstract or technical courses, by providing a mobile Augmented Reality (AR) tool. This tool is a mobile software system aiming to provide supportive, e-learning material for students. By using the tool, students can view 3D animations, and specially-made videos to have more ideas about a course subject, or have a chance to improve their knowledge of the related

course content. In order to achieve this, students are enabled to use a mobile device camera interface on special signs placed in course books or any other supportive, physical materials that are given by course lecturers. Additionally, it is also possible to watch course materials after focusing on some physical objects in the real life. Consequently, the software tool has aimed to ensure an effective learning experience by employing the advantages of mobile devices and forming interactive sessions between virtual and real environments.

Popel and Shyshkina (2018) discussed the prospects of augmented reality use as a component of a cloud-based environment. The findings indicate that it has been established that the experience of augmented reality using the systems based on cloud technologies already exists. However, the success of such a combination has not yet been proven. Currently, laboratory tests are known, while the experiment was not carried out under natural conditions in control and experimental groups. It is revealed that the attraction of augmented reality for educators requires the development of new methodologies, didactic materials, and updating and updating of the curriculum. VR and AR technologies have the potential to radically augment human cognitive abilities (Zap & Code 2016). Alkhattabi (2017) states that today, primary school teachers face challenges when dealing with digital natives. As a result of the explosion and rapid growth in information technologies that can be used in education, there are increasing demands to adopt technology in education, in order to influence students to learn actively and motivate them to gain an effective learning process. Augmented reality applications show good potential in giving students more active, effective and meaningful learning processes. Moreover, augmented reality attracts research attention for its ability to allow students to be immersed in real experiences.

6 Use of Artificial Intelligence as a Learning Tool

Jain *et al.* (2014) in their study described a tool coined as artificial intelligence-based student learning evaluation tool (AISLE). The main purpose of this tool is to improve the use of artificial intelligence techniques in evaluating a student's understanding of a particular topic of study using concept maps. The need of the hour in the present-day education environment is adaptivity. Adaptive educational systems aim to customize the content and learning paths of students. These aid in minimizing disorientation and cognitive overload problems; thus, maximizing learning efficiency. Present learning systems are

lacking adaptivity; as they offer the same resources for all users irrespective of their individual needs and preferences. Students learn according to their learning styles and determining these is a crucial step in making eLearning or traditional education adaptive. To determine learning styles, learning models have been suggested in the literature, but there is no readily available software tool that provides the flexibility to select and implement the most suitable learning model (Bajaj & Sharma 2018).

Mrówczyńska *et al.* (2019) conducted a study on the use of artificial intelligence as a tool supporting the sustainable development of local policy. The aim of the study was to determine the delimitation of the areas that exceed a permissible noise level around the sanatorium on the example of a health resort in Inowrocław. The determination of the exceedance of permissible noise levels allows us to develop directly effective local policy tools to be included in planning documents. In order to reduce noise infiltration, it is important to define environmental priorities. Taking into account their impact on the health of users in the protection area, environmental priorities enable us to introduce additional elements to street architecture. In order to properly manage space, in accordance with the idea of sustainable development, zones of environmental sensitivity – and their socio-environmental vulnerability—have been designated for assessing the damage (exceeding permissible noise in health facilities) and defining methods of building resilience (proper management). Thus, the study results in establishing buffer zones where it is possible to use varied land utilization in terms of form and function, as described in the planning documents. Such an activity would limit the spread of noise.

Digital technologies have already become an internal part of our life. They change the way we are looking for information, how we communicate with each other, and even how we behave. This transformation applies to many areas, including education. Many of the network data visualization tools or applications are designed and being applied in network data visualization systems which are particularly for users with advanced network knowledge even though the tools are indispensable to diverse computer users (Hooi-Ten Wong & Chai 2010). Bellemo *et al.* (2019) conducted a study on artificial intelligence using deep learning to screen for referable and vision-threatening diabetic retinopathy in Africa. The findings revealed that a total of 4504 retinal fundus images from 3093 eyes of 1574 Zambians with diabetes were prospectively recruited. Referable diabetic retinopathy was found in 697 (22·5%) eyes, vision-threatening diabetic retinopathy in 171 (5·5%) eyes, and

diabetic macular oedema in 249 (8·1%) eyes. The AUC of the AI system for referable diabetic retinopathy was 0·973 (95% CI 0·969–0·978), with corresponding sensitivity of 92·25% (90·10–94·12) and specificity of 89·04% (87·85–90·28). Vision-threatening diabetic retinopathy sensitivity was 99·42% (99·15–99·68) and diabetic macular oedema sensitivity was 97·19% (96·61–97·77). The AI model and human graders showed similar outcomes in referable diabetic retinopathy prevalence detection and systemic risk factors associations. Both the AI model and human graders identified a longer duration of diabetes, higher level of glycated haemoglobin, and increased systolic blood pressure as risk factors associated with referable diabetic retinopathy. Radical measures are required to identify and reduce blindness due to diabetes to achieve the Sustainable Development Goals by 2030. Therefore, one has to evaluated the accuracy of an artificial intelligence (AI) model using deep learning in a population-based diabetic retinopathy screening programme in Zambia, a lower-middle-income country.

The next-generation wireless networks are evolving into very complex systems because of the much-diversified service requirements, and heterogeneity in applications, devices, and networks. The network operators need to make the best use of the available resources, for example, power, spectrum, as well as infrastructures. Traditional networking approaches, i.e., reactive, centrally-managed, one-size-fits-all approaches, and conventional data analysis tools that have limited capability (space and time) are not competent anymore. A novel paradigm of proactive, self-aware, self-adaptive, and predictive networking is much needed. The network operators have access to large amounts of data, especially from the network and the subscribers. Systematic exploitation of the big data dramatically helps in making the system smart, and intelligent, and facilitates efficient as well as cost-effective operation and optimization (Kibria *et al.* 2018). Next-generation wireless networks must be able to support ultra-reliable, low-latency communication and intelligently manage the internet of things (IoT) devices in a real-time dynamic environment. Such communication requirements and mobile edge and core intelligence can only be realized by integrating fundamental notions of artificial intelligence (AI) and machine learning across the wireless infrastructure and end-user devices (Chen *et al.* 2017)

Anthony and Lashkia (2003) proposed a novel computer software tool that can assist in the understanding and construction of technical papers, by automatically identifying the structure of writing in different fields and disci-

plines. They tested the system using research article abstracts and is shown to be a fast, accurate, and useful aid in the reading and writing process. When faced with the tasks of reading and writing a complex technical paper, many nonnative scientists and engineers who have a solid background in English grammar and vocabulary lack adequate knowledge of commonly used structural patterns at the discourse level.

7 Conclusion

In the present new economy portrayed by modern change, globalization, expanded serious rivalry, information sharing and move, and data innovation upheaval, traditional classroom education or preparation doesn't generally fulfill all the necessities of the new universe of deep-rooted learning. Learning is moving from teacher focused to student-focused, and is undertaken anywhere, from study halls/classrooms to homes and workplaces. E-Learning provides people with a flexible and personalized way to learn. It offers learning-on-demand opportunities and reduces learning costs. E-Learning furnishes individuals with an adaptable and customized approach to learning. It offers learning-on-request openings and decreases learning costs. Equipped with serious data and correspondence advances, e-Learning is having an extensive effect on learning in the new thousand years.

The rapid growth of technology encourages teachers, especially those who teach English as a foreign language to use it while presenting material and giving instruction in the classroom. Technology, as the newest instructional media developed in this globalization era, presents a situation which helps the students to have new authentic and meaningful learning experiences engaging their effort and behavior by providing more fun and effective learning atmosphere. In addition, it provides the opportunity for the students to work collaboratively and easily access the information that can supplement their learning experience. Those benefits become the central part of 21st-century education which should be optimized in order to create sophisticated learning immersion and maximize the quality of students in the future. Some media technologies such as Prezi as an online software presentation, Glogster as a visual online poster, Edmodo as an online networking application, Toondoo as online cartoon strip making and Goanimate as animated video creation, are known as web-based instructional media which can be used to teach English as a foreign language, are introduced to one hundred student-teachers having Technology Enhanced Language Learning class.

Indeed, e-learnig has become undeniably significant learning and showing a mode in ongoing decades and has been perceived as a proficient and successful learning technique. The speedily rising number of Internet clients with smartphones and tablets around the globe has upheld the spread of e-learning, in advanced education and professional preparation as well as in essential and optional schools. E-learning and traditional distance education approaches share the emphasis on 'any time, any place' learning and the assumption that students are at a distance from the instructor. The plan of the underlying e-learning courses would in general reproduce existing separation training practices dependent on content conveyance. Be that as it may, the literature seems to indicate that long literary talks were plainly not reasonable for the online condition.

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