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ENHANCING STUDENTS' LEARNING AND ENGAGEMENT THROUGH GAMIFICATION: A REPORT ON THE ADOPTION OF INDUSTRIAL GAMES (IGAMES) AT FUPRE

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Abstract

Purpose: The report showed the adoption and application of Industrial Games (iGames) at the Federal University of Petroleum Resources Effurun (FUPRE) for practical teaching and learning.

Design/Methodology/Approach: This report is purely based on observations and opinion of the authors.

Findings: This report does not set any research question or test hypothesis. However, evidence from observation of the iGames participants and reviewed literature showed that application of iGames in university for learning and teaching has positive effect on students' cognition and understanding.

Implication: The report showed the essence of adoption of games in university which would improve students understanding and application of learned objects.

Originality/Value: This report is the first on the adoption of industrial games (iGames) in Federal University of Petroleum Resources Effurun (FUPRE) being among the leading institutions and University in Nigeria. iGames is not tailored towards library instruction, but it exposed the impact of gamification in learning and teaching in the 21st century.

Keywords: Industrial Games, Gamification, Students' Learning, University Library, FUPRE

Paper Type: Opinion

Introduction

The organization of the university as a 'knowledge centre' and the current trend in the use of ICT in teaching and learning with budding interest of students in computer games has increased the need to introduce games into the university programme. Students in the 21st century are highly engrossed in computer games using their computers, phones and iPad among other IT gadgets which affect their learning and research either positively or negatively. The IT gadgets no doubt come with games that are fascinating to students. Students getting addicted in computer games is no more news; a scenario which most universities in advanced countries are taking advantage by introducing educational games into students' learning (Porter, 2012; Mackay, 2013; University of Toronto Libraries, 2019). The attention and confidence that students devote to games is sometimes because of the satisfaction that they derive and less on its relevance. Gamification is fast becoming a new impactful method of teaching and learning in higher institutions all over the world.

Kim and Lee (2015) proposed a dynamical model for the gamification of learning (DMGL). The model emphasized some dynamism in educational effectiveness for the gamification of learning, and widely stated the right function of game in learning. The model tried to maximize educational effectiveness that correlates with curiosity, challenge, fantasy and control. The main idea of the model is based on the correlations of four major factors that are built on the foundations of separate theories: (1) game design features (2) key characteristics of a learning game (3) a theory of educational environment design also known as the ARCS (attention, relevance,

confidence, and satisfaction) and (4) the theoretical background of gamification known as the MDA (mechanics, dynamics and aesthetics) framework. The model showed that effective gamification of learning is educationally superior to traditional ways of learning in specific setting after an elapsed adaptive time period with reasonable relationship of four primary factors including attention, relevance, confidence, and satisfaction.

The ARCS elements are closely related with the goal of Industrial Games (iGames). The fundamental ideas in Kim and Lee (2015) model are also similar to the aim of iGames at the Federal University of Petroleum Resources Effurun (FUPRE) Nigeria. A very important case about iGames is that, it is student-career-oriented. Its dynamics stem from the fact that it is not too hard to understand and has bigger rewards for participants apart from the knowledge that students acquire. The iGames also agrees with the Nigeria educational policy since it supports the National Universities Commission (NUC) 2004 and 2014 Benchmark minimum academic standards for undergraduate programmes in Nigerian universities. The 2004 and 2014 NUC Benchmark emphasized dynamism in teaching through the use of technology. The game brings together professionals in all disciplines of the university system including those in Science, Technology, Library, Technical Unit, and ICT among others. The game was applied generally on all students of the university but mostly those that frequently visited the eLibrary. This report highlights the background, adoption and application of iGames at the Federal University of Petroleum Resources Effurun (FUPRE) Delta State, Nigeria.

Background to iGames at FUPRE

FUPRE was established in March 2007 by the Federal Government of Nigeria. The aim for establishing a specialized university such as FUPRE was to produce unique high-level manpower and relevant expertise for the oil and gas sector in Nigeria and worldwide. The University became operational in October 2011 after the recruitment of staff. Currently, the University has two major colleges: College of Science and College of Technology with ten (10) academic programmes including Mechanical Engineering, Petroleum Engineering, Chemical Engineering, Marine Engineering, Electrical and Electronics, Computer Science, Environmental Science and Toxicology, Geology, Physics and Chemistry. FUPRE was chosen for a pilot approach of iGame because of its uniqueness in the petroleum industry and the programmes it offers cutting across Science and Technology.

Identifying the importance of gamification on students' learning and understanding, the Management of FUPRE in Nigeria signed a memorandum of understanding (MoU) with Total Automation Concept (TAC) Limited in 2016 to customize and integrate a real-life scenario of the petroleum industry into games known as "Industrial games (iGames)". After the signing of a partnership agreement, iGames applications were installed by TAC with the support of the Systems Librarian on some designated computer systems at the FUPRE e-Library after which students were allowed to register, practice and learn to utilize the applications. The maiden competition of iGames was held at the eLibrary of FUPRE in 2016. iGames is made up of highly competitive computer-based oil and gas applications that are simulation of real world industrial facilities which encompasses production platform, loading depot and refinery among others (see Figures 1-3). iGames provides a clear view of the activities performed daily in the oil and gas sector including production, processing, management and distribution of oil and gas products. It is a simulation that captures the role that operators play in an actual industrial facility tailored towards students' educational career and it's meant to engage students who would otherwise be wasting their time or playing computer games that are not educative and career-based. iGames is thus meant to bridge the gap between the industrial and educational sector for better knowledge delivery. The game session is held separately from the normal lecture hours of the University. The introduction of iGames at FUPRE also opens a new vista for

the training of students in the use of ICT tools since it is computer-based. At every state of the competition, the Library personnel supported the students in the registration and ensured the appropriate use of the computer systems. The 2019 edition of the iGames was held in two stages at the e-Library with the use of the production platform and loading depot (see Figures 1 and 2) while the final stage (grand finale) – Refinery (see Figure 3) was held at the Twin Building on November 27, 2019. The students from the Department of Geology were the eventual winners after beating the Department of Mechanical Engineering to pick up the first position.

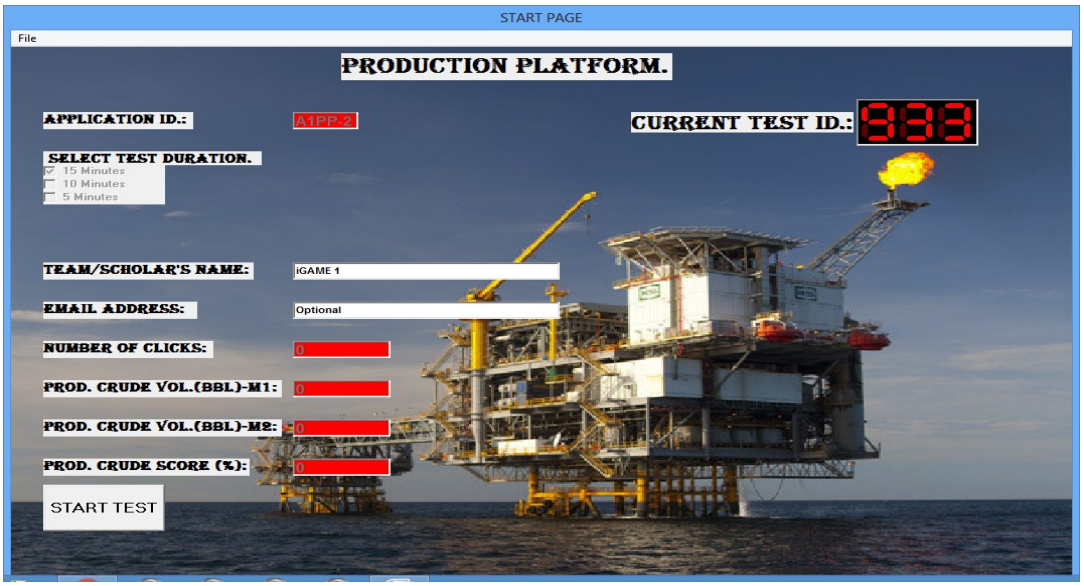

Figure 1: iGames Production Platform Interface

Literature Review

Evidence in study has shown that games have the capacity of teaching people a wide variety of abilities including critical thinking, problem-solving, and discovery-based learning. Those abilities are connected to the learning outcomes that instruction librarians address with students by way of information literacy (Porter, 2012). Indiana University (2019) noted that some games aim to increase content knowledge by letting the players "live" the scenario. Furthermore, 2011 Horizon Report cited by Indiana University argued that games are a ubiquitous part of life in our culture, helping people to develop a disposition toward collaboration, problem-solving, communication, experimentation, and exploration of identities, all attributes that promote success in a rapidly-changing, information-based culture. Educause's article on '7 Things you should know about game-based learning (GBL),' specified that gaming could create an impression that can inspire learners to develop skills and competencies as they focus on the activities of the game. Montiel-Overall (2005) noted that the basis of education is for students to learn, understand and apply every learned object; hence the adoption of games to simplify teaching in the university is not out of place. iGames provides students with the skill and knowledge to face real-life scenario in the operations of the oil and gas sector right from the production to the distribution level.

The importance of the games in teaching and learning has been emphasized in several literature. For instance, Dadheech (2019) noted that the growing usage of digital games and applied sciences into learning environments has affected both the teaching of educators and the learning of students. She stated that GBL can be successfully used to improve both learning and teaching. According to Teyssier (2016), five advantages of using games in learning include: being less expensive, more flexible to deploy in classroom; enhance motivation; help setup engaging scenarios; establish educational goals and help in the evaluation of learners in many ways.

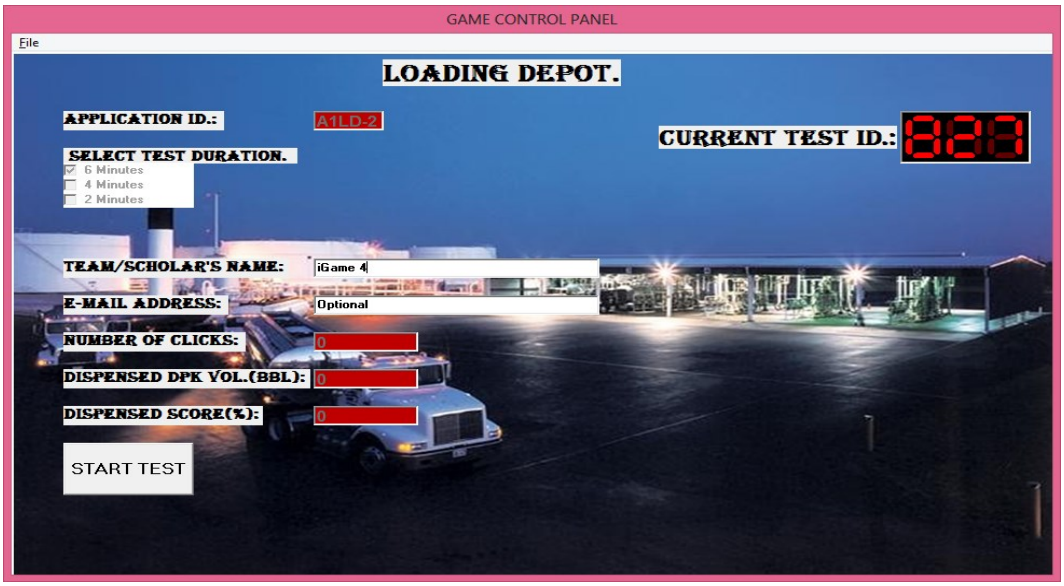

Figure 2: iGame Loading Depot

Similarly, Salem (2008) noted that games can easily be made fascinating enough to put over the dullest facts. Gamification is the ways to empower students through their participation in the creation, revision and playing of games which might improve their educational career, engagement, gaming literacies, world-building, knowledge sharing, collaboration, literacy, and social organization (Salem, 2008). A study was conducted by Dalmina, Barbosa and Vianna (2019) on systematic mapping of gamification models oriented to motivational characteristics. The study was an analysis of 70 papers that resulted in 17 primary studies that was published in September 2016. The study found out that most of the papers on gamification models focused on education, using gamification to increase the motivation of a learning process. The study also revealed that gamification mechanics and elements that were mostly used are badges/achievements and points/experience with most of the studies not validated, thus providing no empirical evidence of the impact of gamification on students' learning.

According to Kim (2012) gamification is the process of game thinking and game mechanics to engage users with a bid to solve problems. Computer games are designed to enrapture the interest and attention of a player, which is enough reason to model university pedagogical programmes into games as a means of communicating lectures that would create a lasting impression and intuitive thoughts in the learners for better understanding and application of what is learnt. Literature in the use of game in the library, university system and other areas of human endeavour abound, for instance, Jung and Won-Hyung (2015) proposed dynamical model for gamification in learning (DMGL). Haziri, Shabani and Chovancova (2019) focused their study on the impact of gamification and online purchasing on customer experience. However, not much if any has shown the use of gamification in the University in Nigeria despite the emphasis laid in the NUC 2004 and 2014 Benchmark minimum academic standards for undergraduate programmes in Nigerian universities. Therefore, this report emphasizes on the need to adopt gamification in students' learning in Nigeria universities.

Use of Games in the University

Games are currently one of the critical tools in support of students' research activities in the library. For instance, Porter (2012) in her paper on games as an alternative foundation for library instructional learning stated that games, where applicable, can help students who are conducting research identify areas for improvement when interacting with informational sources such as library databases or websites. A game catches the attention of the players and at the same time helps to improve their skill and confidence on a

continuous basis. Porter emphasized on the way game can enhance students' research activity in the library:

> For the students who are frustrated from searching in a database, unable to find journal articles, incorporating a game that emphasizes how to generate keywords can help them think about effective ways to approach the search process. For the students who are bored because the topic is on bibliographic citations, a puzzle can be a suitable analogy to guide the discussion. For the students with professors who frequently lecture, an instructional game offers a change from that type of learning to one that promotes learning where students are actively involved. The benefit for students in using games is in the simplifying of library jargon and developing familiarity with library resources. Alternatively, the benefit for librarians is that games offer another approach which encourages students to communicate with them. These are objectives instruction librarians seek to accomplish within information literacy, p.62.

Education World (2013) emphasizes five reasons for the use of games in classroom including: students learn through the process of playing the game; games provide a context for engaging practice; through games students can learn a variety of important skills while playing; students develop a variety of connections with the content and can form positive memories of learning, and games grab students' attention and actively engages them. Similarly, TeachThought Staff (2017) listed some basic benefits of game-based learning including: increase in a child's memory capacity; computer and simulation fluency; helps with fast strategic thinking and problem-solving; develops hand-eye coordination; beneficial specifically for children with attention disorders and skill-building. Again, Salem (2008) stated that game play is credited with fostering new forms of social organization and new ways of thinking and interacting. The game can be applied in all areas of teaching and learning to create a lasting memory in the learner and help a learner to understand learned objects as it would enrapture the learners in the age of technological distractions. Furthermore, Salem noted that the contributors work to situate this within a dynamic media ecology that has the participatory nature of gaming at its core. Academic institutions and libraries are today adopting tools that support the understanding of pedagogy. The University Library also contributed towards the realization of iGames at FUPRE by providing an enabling environment – e-library, computer systems, interactive board, projector, backup power supply and personnel for the guidance, training of participants during practice and actual competition.

The academic space has continued to attract dynamic and educative tools that support and enhance teaching, learning and research activities of students. FUPRE was established to bridge the educational gap in the oil and gas industry and has continued to engage its constituents especially students in diverse ways towards improving their skill and knowledge for self-reliance after school. Such effort has resulted in several collaborations in solving real-life problems in the oil and gas sector. Studies have shown that goals, rules, challenge, and interaction can be used to engage students for increased learning outcomes (University of Toronto Libraries, 2019). Similarly, Porter (2012) is of the view that adoption of the game in library instruction and other courses offered in the university would offer students the opportunity and understanding of how to interact with information for problem-solving and discovery-based learning when using the library to conduct research (Porter, 2012). Learning is about gathering ideas and applying them to solving critical problems in the society. Universities are established as research institutes to proffer solutions to problems and challenges that are facing the society. Many computer games have been introduced into the market. Majority of the games are only meant for entertainment and to waste the time of users without entrenching the cause of education.

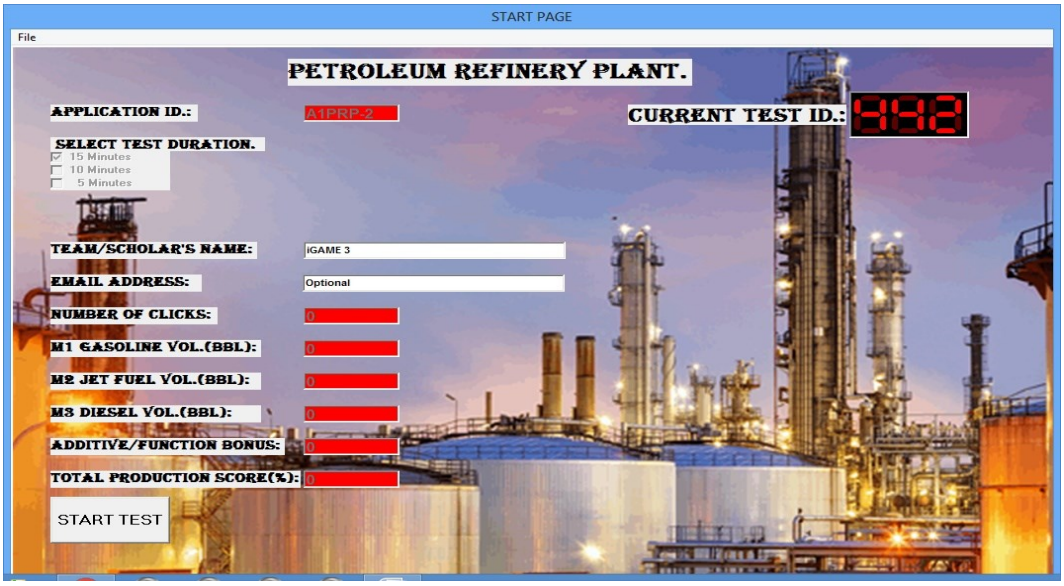

Figure 3: iGames Petroleum Refinery Plant

The use of games in teaching and learning in schools in the developed countries of the world is not a new phenomenon and its ubiquitous as emerging IT tools makes it imperative as a learning resource. Games can be used as a tool for interaction, increasing understanding and engaging students to increase their learning outcomes, building an emotional connection to learning, providing opportunity for feedback and practice and customization of individualized teaching and learning (University of Toronto Libraries, 2019).

In developing countries, especially Nigeria, literature in the use of game in classroom is relatively new with FUPRE being among the leading institutions. There is yet not much showing the use of game in learning in Nigeria universities. Although, iGames is not tailored to library instruction, however, the FUPRE e-Library is the focal point for the major programmes with the support of librarians who ensured that the computer systems earmarked for the iGames are available and ready for use.

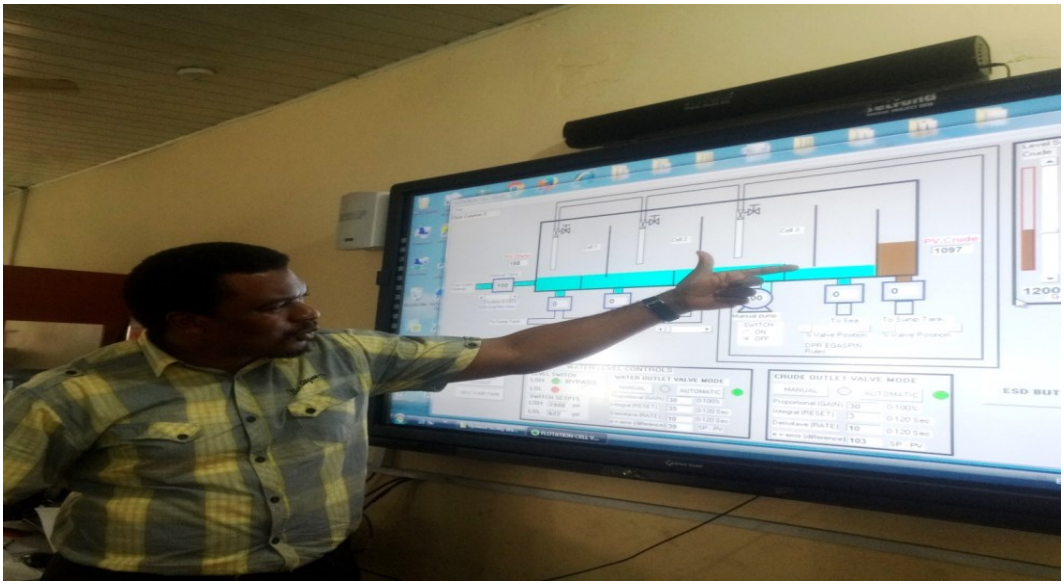

Figure 4: Engr. Paul Ugoji, Representative of TAC demonstrating the operations of the iGames Crude oil production platform to participants during a training session at the FUPRE eLibrary

Adoption of Games in Teaching

Games have been adopted in some universities around the world and were found to address problems in students' learning. According to Kim (2012), providing and applying gamified services in the library is not a problem if it will make the library a more friendly and interesting place to patrons. He further advocated the use game dynamics in transforming a more serious task or project (such as learning how to cite research literature for a term paper) into something less painful and even enjoyable. Kim (2012) noted that games can help in learning because people are more motivated, engaged, and achieve more in games than in the real world. Games have the capacity of teaching people a wide variety of abilities including critical thinking, problem-solving, and discovery-based learning. These abilities are connected to the learning outcomes that instruction librarians address with students by way of information literacy (Porter, 2012).

In the university library, Omeluzor, Alala and Omeluzor (2019) noted that librarians like other instructors in the university have continued to develop interest in different models and methods in the delivery of library courses. This is not without the use of games. According to Porter (2012), one reason instruction librarians have taken an interest in games is that they are useful for bridging students' understanding of library research concepts. There are evidences of the use of 3D virtual simulation Second Life to support distance and use of games in the field of Library and Information Science for Distance Education at the Syracuse University School of Information Studies. (Haycock, 2008, Porter, 2012). Furthermore, Porter (2012) noted that two faculty members at the San Jose State University School of Library and Information Science reported of co-teaching a library and information science course in Second Life. The class was offered as a way for students to show "mastery" of the program's "core competencies" including "demonstrating proficiency in the use of current information and communication technologies (Haycock, 2008). However, a survey in 2007 on the role of gaming in libraries revealed that 7 out of 10 public libraries in the U.S. support gaming. The finding further showed that Web-based games are more enjoyed by patrons, while women over the age of 40 are more likely to play online games than other demographic groups. Library Jeopardy was introduced at the Pennsylvania State University by a Librarian. The game was made to engage students who answer questions from categories connected with the library such as *Library Homepage* and *Information Literacy IQ*, with a point reward system for each category ranging from 200 to 1000 points (Walker, 2008). Porter (2012) noted that Library Jeopardy was incorporated as part of an end of the class review to help students remember points about the library that were introduced earlier in the session.

Figure 5: Dr. (Mrs.) Omoleomo Omo-Irabo, Director of Linkages and Representative of the Vice Chancellor, 4th right, the FUPRE iGames Chair, Dr. Anslem Amadi 4th left and participants in the 2019 edition of the competition.

Games can be useful in bridging understanding for library research concepts, with numerous online resources and examples already available for faculty members and librarians to assist in the design of games (Porter, 2012). Mackay (2013) emphasized that those non-cognitive skills – that are not what you know but how you behave – are far better suited to a game context than to a traditional classroom and textbook context. Literature abounds on the use of games to advance the frontiers of knowledge in library instruction. The attention that students give to iGames shows the relevance of gamification in students learning. The use of games in learning would help in building students' confidence about their understanding, adoption and application of learned object. Metwally, Yousef and Yining (2019) investigation on students' perceived satisfaction, behavioural intention and intrinsic motivation of 53 primary school children at fifth grade (23 boys, 30 girls) after they achieved their homework by using Pomawin indicated that gamification can be used as an educational tool to improve student's satisfaction, behavioral intention and intrinsic motivation.

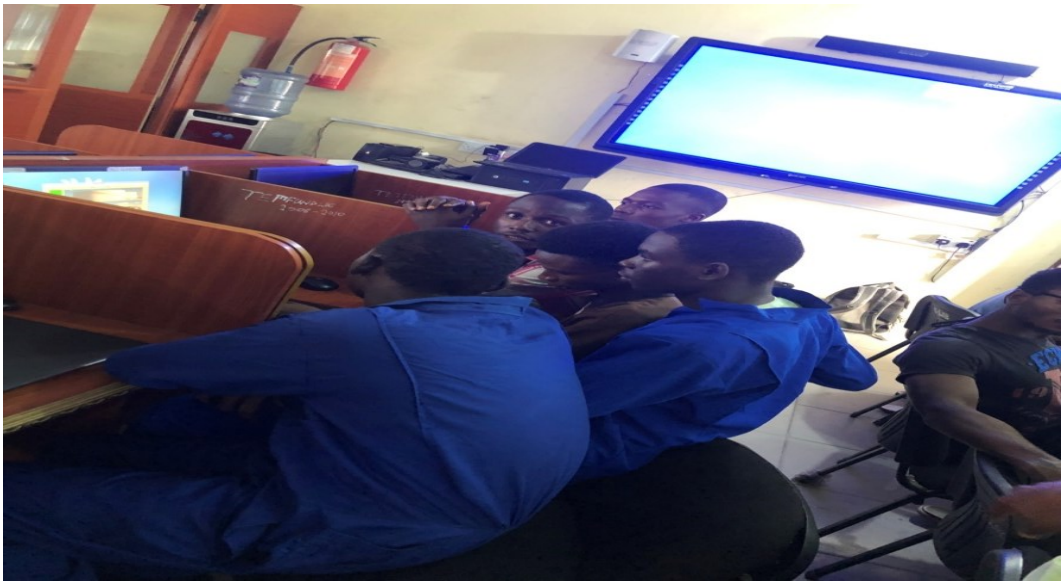

Figure 5: One of the group of students who participated in iGames during training Session at the e-Library

Figure 6: Students participating at the 2019 edition of iGames at FUPRE

Conclusion

This report emphasizes the importance of games in teaching and learning in the 21st century. As useful as games are in developing students' non-cognitive skills, Mackay (2013) argued that it stopped when students go out of school and often so does the learning. Therefore games design should be learner-oriented that would cause the learner to internalize learned objects. Emphasis in today's teaching should be focused on the adoption or modification of methods that are viable and captivating to learners in order to achieve desired objectives. The adoption of iGames in learning and teaching in universities across the world would be impacting and would improve students' assimilation and critical thinking beyond the classroom. Adoption of games in courses offered in the university would provide students with the opportunity and understanding of how to interact with information for problem solving and discovery-based learning when using the library to conduct research (Porter, 2012). It is therefore crucial for universities in Nigeria and other parts of the world to adopt iGames along other educative tools that will enhance students' academic excellence in their chosen career.

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