Review Paper

EFFECT OF HEUTAGOGY FACILITATED BY MOBILE TECHNOLOGY IN TEACHING AND LEARNING OF AUTOMOBILE MECHANICS IN HIGHER EDUCATION OF SOUTH EASTERN NIGERIA

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Abstract

The study focuses on the facilitation of Heutagogy by Mobile technology. Specifically, this study was amid at finding the effect of heutagogy facilitated by mobile technology on Polytechnic students' achievement in automobile mechanic. The population of the study was 154 final year students - 80 students were selected using a simple random technique as the study sample size. MCATAMS questionnaire for data collection was employed, Data were analyzed using t-test and it was observed that there was no significant difference between mean achievements of the groups at 0.05 level of significance. The effect size of post – test was determined using Cohens'd. The result of the finding showed that only the experimental group pre – test scores departed significantly from the normal distribution (W(40) =-889, P =-001), indicating a moderate increase on the experimental students' achievement test. It was found that adopting heutagogy as a teaching and learning method moderately increased students' achievement in automobile mechanics. It is recommended that the present study be replicated among adult and young learners to increase confidence in the study.

Background

Science and technology is the leading agent of change in the world today. At present all over the world, the advancement in science and technology have driven change and shaped the growth and development in many industries especially the automobile industries (Abd-el-aziz, 2013).For instance, the automobiles assembled or imported into Nigeria have complex designs; the mechanical, electrical and electronic systems are designed and fixed with sophisticated devices. Some motor cars of these days do not have driver, they are computer – based driven cars. The technological developments in automobile industries are so spontaneous that the traditional skills and former techniques used in servicing and maintaining them had been rendered obsolete and inadequate. Thus automobile mechanics could be finding it increasingly difficult to meet their customers' demands. This calls for new methods of training bearing in mind the demands of the 21st century workplace in the automobile industries development to meet the recent market demand.

To this end, emphasis has been placed on providing automobile students with versatile, broader learning and fluid-like problem-solving skills in order to prepare them for wider range of challenges posed by the dynamic technological advancement (Szczurkwska, 1997). This is in line with Ogwo and Oramu (2006), citing United Nations Educational, Social and Cultural Organization (UNESCO) and International Labour Organization (ILO) (2002) who advocated for change in methods of producing workers and recommended that all technical and vocational education system in the 21st century should be geared toward lifelong learning. There had been clarion calls by scholars for a change in learning and teaching methods to re-articulate and capture the types of skills and knowledge needed by the learners in

today's World. Market demands for new innovation toward technological development mainly automobile. In support to his view, Barnett (2011) noted that employers all over the world need their workforce to put on global outlook, that is, to be equipped in such a form that any worker can be transferred to any of their branches globally and be ready to fit in or function. Li (2008) asserted that the quick evolution in engineering technology and globalization process has changed educational roles and teachers expectations, thus, necessitating curriculum and teaching reforms. Teaching reform implies seeking new methods in instructional technology delivery. In summary, there is a general call for a change in the methods of producing graduates (workers) in our various schools and nations to meet the demand of the 21st century workforce. This call for change therefore, propelled the present researcher to examine the current pedagogical approach to instructions in our nation's higher education with respect to the production of automobile mechanic graduates.

At present automobile mechanics' programme in our Technical schools, Polytechnics and Universities involve the application of scientific knowledge in the design, selection of materials, construction, operation, and maintenance of automobiles (Federal Republic of Nigeria, 2004). At technical college education level in Nigeria, automobile mechanics programmes is planned to produce craftsmen and master craftsmen who should be competent and skillful to carryout routine services and repair of all types of vehicles (NBTE, 2003). The trade involves repair and maintenance of brake, transmission engine, fuel, cooling and lubrication systems of a vehicle. According to the Nigeria Board for technical Education (NBTE, 2003), automobile mechanics craftsmen are expected to test, diagnose, service and completely repair any fault relating to the conventional automobile assembly main units and systems to the manufacturers' specifications.

The big questions include: Do present Nigerian automobile mechanics possess the skills set required for their job? Have they consistently met the demands of their job especially in terms of effective service delivery and customers' satisfaction? If not, what could be responsible? The answers to these pertinent questions appear to be on the negatives as noted before. This could be as a result of the adoption of out-dated traditional paradigms that predominantly overshadowed our educational system (Hase & Kenyon, 2000). Furthermore, it is a well-known fact that the success of the learners is greatly dependent on the instructional strategies applied by their teachers. The extent to which instructional paradigm is effective can be determined by the degree of changes noticeable in the learner. Presently, automobile mechanic students in our higher institutions are taught via traditional talk-chalk method with very limited practical practice experience. Traditional teaching practice is also known as behavioral or classroom-based teaching. It was anchored on the teaching and learning theories discovered in the early 20th century meant to cater for the demands of industrial revolution (Blashchke & Hase,2016). This teaching method is characteristically teacher-centered as teacher is seen as the only source of knowledge. Learner's job is to listen to the teacher, respond to question when asked and take notes. Such teaching method makes it impossible for learners to retain the knowledge and extend the application of learned knowledge in a new environment (Oderinu, Adegbulugbe Oernuga & Butali, 2020).

Given the disengaging nature of traditional teaching method especially in automobile education, it may be difficult for a student who passed through such learning system to compete in the workforce and workplace of the 21st century. In corroboration, the National Business and Technical Examination Board (NABTEB 2004, 2006) reported that automobile mechanics trade in Nigeria technical colleges is a subject in which the students have shown low achievements both in cognitive and performance tests. Again, there is a clear evidence of service problems in the understanding of some seemingly difficult concept in both theory and practical activities in technical college, especially in automobile mechanics trades.

More still, it is a common observation that many automobile mechanics business start-ups are not sustainable. Many of these start-ups fold soon after they were started due to lack of service skills and unprofessional attitude of their owners. This raise doubts on the effectiveness of the existing instructional approach in our institutions responsible for the production of automobile mechanics. This is because academic

achievements and even practical breakthrough of learners may rest largely on the type of instructional strategies adopted by the teachers. Therefore, the present study proposes the utilization/adoption of heutagogy and mobile technology method as possible alternative to the prevailing traditional teaching method for automobile education in our schools.

Literature Review

'Heut' etymologically is an ancient Greek word meaning "self". Hence, heautagogy is the teaching of self. It is a learner- centered, holistic, future- focused learning with the major aim being for the learner to learn how to learn or acquire 'lifelong learning' skills through active and proactive learning processes by himself. It places emphasis on learners' autonomy, advocates learners' active –engagement in authentic contexts for creating new knowledge, resulting in a learning process where the learner is central to the creation of contents and contexts (Hase, 2011,Blaschke, 2012). Heutagogy is a self-education born out of the frustration of monopolization of education by a process known as teaching-learning. It is a self-discovery learning process that is out to revolutionize education from 'teaching-learning' process to 'learning-teaching' process. Thus, Heutagogy is a learner-centered learning system. It believes that for education to achieve its meaningful goal especially on learners, the learners must be committed in the dictation, initiation and direction of the process of learning in their chosen field of study.Most importantly, given the rapid development in the field of science and technology, especially the emergence of mobile technologies, no time is better than now to support the adoption of heutagogy as a learning strategy for effective automobile education.

Mobile technology is defined as any device with internet facility that is accessible from anywhere the user is whether in a static or dynamic state. It refers to a technology that are both transportable and offer instantaneous access to information (Coates et al, 2009).According to Adeep and Hussani (2009), mobile technology deals with wireless devices like cell phones, smart phones, laptops computers amongst others. The distinguishing characteristics of mobile technology are its portability, flexibility, simplicity of use and the unique ability for integration with other technology systems (Alder & Fotheringham, 2012). Because mobile technology devices such as mobile phone combines the elements of telephoning, computing, internet and networking in a single portable handheld device, they are increasingly being adopted in teaching and learning as multimedia instructional tools. Mobile technology in education makes the learning process purely more individualistic, at the same time more interactive and more engaging. Though technology has been making inroads into education for decades but mobile technology is revolutionizing education in a simple, funny manner as it has succeeded in changing the way we learn and think of learning (Conole,2013). In addition to its size and amenity, mobile technologies permit multiple tasks such as note taking, telephoning, email, music, video/audio recording, picture taking, and Global Positioning System (GPS) navigation (Akkerman &Filius,2011). It needs less structure- which makes it easier to use compared with the traditional computers (Carillo et al, 2011).

Mobile technology empowers heutagogy with its ubiquitous, pervasive, personal and connected learning as it strengthens the learners 'motivation, focuses his attentions and validates the relevance of learning to performance (Wagner, 2005). For over ten years now, the transformation of the World Wide Web and the turbulent technological advancement in mobile technology has created a social revolution that is extremely changing our culture (Conole, 2013, Lewis, Pea, & Rosen, 2010;Sarples, Taylor, & Vavoula, 2010). The tablets in particular among them has five ways it is transforming education. It changes our perception of computing thereby making learning a fun, education gamified, provides real time feedback, communication becomes truncated, ensures immediate, interactive and engaging learning (Raj Vali, 2015). When applied in heutagogy, mobile technologies would facilitate the learning process by providing learners access to learning content at all time. This element of mobile technologies makes them appealing to the present researcher. The present researcher considers mobile technologies as essential educative tools that are capable of facilitating the adoption of heutagogy to solve the problems of the traditional teaching paradigms which is suspected to be responsible for the inability of our automobile mechanics to meet up to the standard of job requirements of the 21st century automobile industries. It is believed that when

heutagogy is facilitated via mobile technology, the problem of churning out unskilled artisans in the automobile department in our Polytechnics will be curtailed. Therefore the purpose of the present study is to determine the effect of heutagogy facilitated by mobile technology on Polytechnic students' achievement in automobile mechanics.

Research Method

Research Design

This was a quasi-experimental study conducted with a controlled pretest-posttest design to analyze the effects of utilization of heutagogy and mobile technology approach on teaching and learning of automobile mechanics in our higher education.

Area of Study

This study was carried out in South-East geo-political zone of Nigeria made up of five States, namely: Enugu, Anambra, Imo, Abia and Ebonyi. The reason for choosing the study area is because Southeasterners who predominantly are from the Igbo ethnic group were traditionally regarded as industrious with many artisans such as automobile mechanics found in the area. There are also about 5 State-owned Polytechnics in the South-Eastern geopolitical zone of Nigeria studying automobile engineering.

Population and Sampling Size

The target population of the study was 154 students made up of all the final year Polytechnic students of automobile mechanic. The study sample was selected through a simple sampling technique. The names of the five state-owned polytechnics in Southeastern Nigeria were written, folded and placed in a bow and three different people were instructed to pick one each. From each of the three sampled schools, three intact classes emerged, that is their final year students studying automobile mechanics. These gave a study sample of 80 students (Enugu-30, Abia-22 and Anambra-28). The reason for selecting final year students is that they must have gotten advanced lessons from the six main components of automobile to be able to attend to the research instrument. Through random sampling technique again, the students of the intact classes were designated into experimental and control groups each as follows 15 and 15 for Enugu, 11 and 11 for Abia while 14 and 14 is for Anambra.

Instrument for data collection

Multiple choices Achievement Test for Automobile mechanics specialists (MCATAMS) is the instrument used in this study. This was designed by the researcher and used as instrument for data collection for the research. It contains 30 items. This was made up of 5 items each drawn from the six major components of automobile systems- Transmission, Electrical, Braking, Steering, Cooling and Body respectively. For each question, there are four options for which only one option is the right answer. **Validation of the instrument:** The instrument was face-validated by three experts in automobile engineering. Their corrections were effected before the final draft of the instrument was trial-tested. The internal consistency reliability of the instrument was checked using the Kuder-Richardson formula 20 and it yielded a reliability coefficient of $\alpha = .85$. **Demographic questionnaire** was used also for data collection. This was used to collect participants' demographic information. Participants were asked to provide information about their gender, age and state where school is located.

The intervention lasted for seven weeks with one lesson per week. Each lesson takes care of one of the major components of an automobile system. On the seventh week, the MCATAS will be administered to the groups again having done so at the beginning of the intervention and the results of the students' response as usual will be collected on the spot. Each lesson lasts for two hours according to the lecture schedule of the institution. It took place every Saturday between the hours of 8.00am to 10.00am for three weeks and then 4.00pm to 6.00pm for another three weeks for the experimental group and vice-versa for the control group. At the end of the sixth week, a week is given to the trainees to reverse the whole lessons before the last administration of the questionnaire.

Method of Data Collection

Permissions were sought through writing from the HODs the departments of Automobile Engineering of the institutions and they gave their consents. The students choose the Saturdays so that the exercises will not affect their lectures as final year students. The researcher scheduled the times to reduce the interactive effects of the interactions of the groups might cause on the study if the two lessons were conducted at the same time as both groups are from the same school. Six research assistance

were trained, two Automobile mechanic lecturers each from the same school. One is to take care of the experimental group while the other is for the control group.

In the experimental group, the opinions of the students were sought on what they want to know or taught on each of the six components in question and the researcher incorporate their written demands adequately into the lesson packages accordingly to be posted on a created group Whatsappp platform at the agreed time, one every week throughout the intervention period, The research assistant for the experimental group ensured that the students adhered to assignment submission deadline through sending of constant reminders in the online platform. Students are encouraged to study theweekly learning package sent and collaboratively interact and reflect on the content at any time they deem fit. Research assistant ensured that each student sends back a feedback to the researcher if need be within the scheduled time. Questions and clarifications are shared in the group for general participation and contributions.

In the control group, the research assistant who is also a lecturer in the department taught Sstudents the lesson designed by the researcher within the given time each week accordingly, answer their questions conventionally and also takes attendance. This he does for six weeks. On the seventh week, he will administer the MCATAS to the trainees again and collect the response on the spot.

Method of data analysis

At first, data was screened for missing values or outliers. There were no missing values or outliers. Then, participants' demographic variables (age in particular)and baseline data were compared across the groups using independent samples t-test. Since there was no significant difference between mean achievement of the groups at pre-test as measured by MCATAMS, the impact of the pre-test scores on the post-test scores was not considered. Hence, post-test data were analyzed using independent sample t-test. Effect size was determined using Cohen's *d*.We ensured that the assumptions of the chosen statistics were met. Shapiro-Wilk test suggested that onlythe experimental group pre-test scores departed significantly from a normal distribution ($W(40) = .889$, $p = .001$). At post-test, participants' achievement as measured by MCATAMS in both groups did not significantly differ from a normal distribution ($p > .05$). All data analysis and screening for missing values and violation of assumptions were done using SPSS version 20.

Results:

Table 1

Participants' demographic information at baseline

Characteristis		***Participants' group (M ± SD)***		***t(78)***	***Significance***
		Experiment	*Control*		
Age		23.13±1.16	23.28± 0.82	-.669	.505
	Levels	**Experiment N(%)**	**Control N(%)**		
Gender	Male	36(50)	36(50)		
	Female	4(50)	4(50)		
State where school is located	Enugu	15(50)	15(50)		
	Abia	11(50)	11(50)		
	Anambra	14(50)	14(50)		

From table 1, participants' demography at baseline showed that mean age of students in the experimental group ($M = 23.13$, $SD = 1.16$) was not statistically significantly different from the mean age of studentsin the control group ($M = 23.28$, $SD = 0.82$), ($t(78) = -.669$, $p = .505$). Similarly, gender and the state where schools are located were equally distributed between the two groups.

Table 2

Results of independent samples t-test examining the group differences in students' achievement in automobile mechanic.

Measurement time	Control group		Experimental group		*t*(78)	*P*	Cohen's *d*
	M	*SD*	*M*	*SD*			
Pre-test	8.57	2.74	8.53	2.85	-.080	.936	0.014
Post-test	15.25	3.57	17.55	3.21	3.029	.003	0.644

Note. Mean parameter values for each of the analyses are shown for the control group (n = 40) and experimental group (n = 40), as well as the results of t tests (assuming equal variance) comparing the parameter estimates between the two groups.

From Table 2, at post-test, the intervention group (M = 17.55, SD = 3.21) compared to the control group (M = 15. 25, SD = 3.57) appear to achieve significantly higher in automobile mechanics (t(78) = 3.029, p =.003, CI = .788, 3.812). The effect of heutagogy on the experimental group was moderate with Cohen's d = 0.644. Therefore, we may conclude that adopting heutagogy as a teaching and learning method moderately increased students' achievement in automobile mechanics.

Discussion of the Findings

The study determines the effect of heutagogy facilitated by mobile technology on polytechnic students' achievement in automobile mechanic. It was found that adopting heutagogy as a teaching and learning method moderately increased students' achievement in automobile mechanics. Specifically, students who were taught automobile mechanic using heutagogy achieved statistically significantly higher scores at post-test compared to students in the control group. A number of reasons may have accounted for the findings of the present study. First, since heutagogy is a self-driven learning (Richardson, McGowan&Styger, 2017), learners are directly involved in determining what exactly they want to learn, how they would learn it, when they will learn it, and how and when their learning is evaluated. Thus, given this extended ability to control their learning, automobile students were able to factor in individual learning styles and with the affordances of the mobile technology, they could achieve not just personalized learning but also collaborative co-creation of knowledge.

Second, heutogogy is focused on developing students' capacity to learn rather than competency in learning. As noted by Blaschke (2016) competent learners can demonstrate what they have learned, for example, a skill or set of knowledge within a specific context, while capable learners exhibit their capabilities by applying skills and knowledge in new and unfamiliar situations or contexts. In the present study, automobile students where taught and tested to determine the extent they could not only apply their skills and knowledge to familiar contexts but also to unfamiliar context bearing in that the automobile industry demands such ability because of the rapid change in technology experienced within the industry.Thus, while students in the control group who were taught using conventional approach may have developed competencies to solve familiar problems only, students who were taught using heutagogy had the advantage of developing learning capacity; learning how to learn, thereby being able to tackle both familiar and unfamiliar problems.

Just like the findings of the present study, previous studies have shown that the use of heutagogy has provided many positive learning experiences. For instance, Bakare (2018) reported that when University of Western Sydney in New South Wales Australia used heutagogy in its teacher preparatory program, there was improvementin teachers´ overall outcomes in their preparedness, capability, increased confidence in perception, and general competence in engagement.Similarly, Jazeel (2016) found that e-content with heutagogical approach for learners of higher education in Sri Lanka were effective. In all, it appears that applying heutagogy as a teaching and learning approach may yield some positive gains. However, heutagogy is a teaching and learning strategy is yet to gain popularity among researhers. Presently, Brandt (2020) observed that assessing 21st century skills such as

self-directed learning (heutagogy) is challenging. He further noted there appears to be no empirically validated developmental trajectories associated with self-directed learning skills. As such many questions remain unanswered, such as how do self-directed learning skills develop and progress? Are there differential effects associated with levels of self-directed learning and achievement in specific content areas? Given these observations, the result of the present study though significant would best taken as foundational especially in Nigeria where so little is known yet about heutagogy.

Conclusion

The aim of this study is to determine the effect of heutagogy facilitated by mobile technology on polytechnic students' achievement in automobile mechanic. It was found that adopting heutagogy as a teaching and learning method moderately increased students' achievement in automobile mechanics. This study should be replicated among adult and young learners to increase confidence in developing new innovations towards automobile mechanic framework for market oriented demand.

Recommendations:

1 As human being and all that concerns him is dynamic, his methods of being taught and learning should not only reflect his current situations but inclined towards his predicted future.

2 Heutagogy should be fully developed and factored into the 21st Century Teaching and learning skills as it proves to be a force to be reckoned with in the Individualization and Lifelong learning which Educational technology, ICTs and emerging technologies are clamoring for.

3 Curriculum must Provide authentic content/contents from trending issues, not necessarily syllabus-based; bringing topics from a lot of online discussions. Opting for relevant and entertaining topics that are either more serious or rather most needed, like environmental issues, job markets ideas etc.

4 This study should be replicated among adult and young learners to increase confidence in developing new innovations towards automobile mechanic framework for market oriented demand.

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