

Flipped learning as an alternate learning pathway for effective and efficient technical and vocational education and training (TVET): Evidence from Koforidua Technical University – Ghana.

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Abstract

An essential part of equity and inclusion in education is to allow learners from different backgrounds options through flexible modes. With flexible modes, girls, the poor, disadvantaged and the marginalized would not be left out in education. Flexibility in learning primarily seeks to remove barriers to education and to give the learner choice in terms of what, where, when and how to study. One intrinsic benefit in doing this is building self-confidence and esteem of the learner. It is done by creating the right environment for learning to take place and making the facilitator/lecturer/teacher the guide on the side and not the sage on the stage. The paper therefore seeks to assess the efficiency and effectiveness of “Reverse Learning or Flipped Classroom” in Koforidua Technical University, a technical vocational education and training (TVET) institution. One hundred and forty-six (146) students were randomly selected whereas five (5) facilitators were purposely sampled for the study. Students’ results from the selected courses were compared with results of same students in courses taken in the traditional mode. Results from the study show that there is significant difference (p -value < 0.01) in scores obtained in flipped lessons than the traditional face-to-face methods. The most utilized material for learner preparation was video and students showed more preference for materials with graphics than those with text. The study also revealed that facilitators believed flipped learning can gradually replace tradition teaching methods with the right technology. The study recommends the institutionalization of reserve learning/flipped classroom in the Ghanaian educational systems to help build the self-esteem of learners and inculcate into graduates the soft skills for solving real world problems.

Keywords: e learning, flipped classroom, flipped lessons, reverse learning and TVET.

Introduction

Flipped classroom concept has been used among developed countries for several years due to technological advancement. Bland (2006) maintained that technological advancement is changing the scope and form of teaching and learning in technical and vocational education and training (TVET). This is due to the increase in technological savvy learners and facilitators and demanding socio-cultural roles teachers and learners are expected to play (Olatoye, 2006). One major benefit in advancement in technology is that, if effectively used, it opens access to education to more learners, more especially girls and under privileged. Again, advancement in technology results in increased confidence for the learner to learn on his or her own once the right environment is created (Baker. 2000).

Indeed, Ahmed and Quazi (2011) indicated that more learners are gaining confidence in learning on their own in technical and vocational related subjects in Ghana. Learners can do

more on their own through Kinesthetic, team-based, experiential, collaborative e-learning, or reverse/flipped learning.

According to Lorliam and Ode (2014) learners gather soft skills for solving real problems through flipped learning and this reduces the cost of education in rural Asia by 30%.

Reversed learning or flipped classroom is an instructional strategy and a type of blended learning that reverses the traditional learning environment by delivering instructional content, often online, outside of the classroom. It moves activities, including those that may have traditionally been considered homework, into the classroom. Learners are introduced to learning material before class, with classroom time then being used to deepen understanding through discussion with peers and problem-solving activated facilitated by the teacher. The teacher can easily query individual learner's performance, learners have opportunity to prepare on their own and pick up rough edges from class and build self-confidence. This is what learners and teachers in Africa needs and TVET institutions in Ghana are not exception.

With the conversion of Polytechnics in Ghana to Technical Universities, more lecturers are assigned new and more demanding roles. Frequency of travels for in-service training and capacity building is on the rise but there is constraint on government budget to employ more staff. This means teachers are multi-tasking and are required to be efficient than before. At the same time, student's enrollment is increasing, and government is happy to see access increased for learners with more girls and under privileged learners getting the opportunity for TVET in Ghana.

How do management of technical universities manage the ever-increasing enthusiastic students for effective and efficient technical education? Again, how do teachers effectively handle courses and manage additional roles in their new environment? Lastly, how can learners derive the best from their teachers with technology and build their self – esteem?

According to Afrane (2015) the increasing high cost of education and constraint on government funding of TVET in Ghana demand that teachers develop innovative and efficient methods of teaching. In our quest to find innovative and efficient methods of delivering effective and efficient teaching and learning process, the Institute of Open and Distance Education, Koforidua Technical University initiated a pilot of flipped classroom concept about five (5) years ago. As pioneers and lead advocates of flipped classroom concept, this study seeks to assess the flipped classroom concept from the perspective of the learner, facilitator, management and policy makers in Ghana.

Objectives of the Study

The objectives of the study are:

- (i) To determine factors influencing participation in flipped classroom lessons in Koforidua Technical University.
- (ii) To determine student's academic performance in flipped lessons at Koforidua Technical University.
- (iii) To assess stakeholders' perceptions of flipped classroom concept at Koforidua Technical University.

Research Questions

The research questions guiding the study are:

- (i) What are the factors influencing participation in flipped lessons at Koforidua Technical University?
- (ii) Are students improving academically through flipped lessons?
- (iii) What are stakeholders' perceptions of flipped classroom concept?

Methodology

Both quantitative and qualitative methodological approach were used in this work. Out of fifteen departments at Koforidua Technical University, five (5) departments were purposely selected due to the availability of workshops and required laboratories and gender representation of students. One hundred of forty-six (146) students were randomly selected whereas twelve (12) facilitators who are practicing flipped learning concept were purposely selected. Data of three conservative academic years (2015/2016; 2016/2017 and 2017/2018) was sought from the examination and records office of the University for a total of one hundred of forty-six (146) students. Follow up interviews were conducted on students and facilitators where necessary. Data collected was analyzed with the Statistical Package for Social Sciences (SPSS) version 16 and resultant statistics presented by appropriate charts and tables.

Results and discussion

Demographic characteristics of respondents

The demographic characteristics of respondents are presented in Table 1.

Table 1: Demographic characteristics of respondents

| Characteristic | Response | Students | Facilitators | Total |
|---------------------------|---------------------|-----------|--------------|-----------|
| | | Freq. (%) | Freq. (%) | Freq. (%) |
| Gender | Male | 81(55.46) | 7(58.33) | 88(55.70) |
| | Female | 65(44.52) | 5(41.67) | 70(44.30) |
| Age(years) | Less than 20 | 36(24.66) | - | 36(22.78) |
| | 20 – 29 | 60(41.10) | - | 60(37.97) |
| | 30 – 39 | 38(26.03) | 3(25.00) | 41(25.95) |
| | 40 – 49 | 7(4.79) | 8(66.67) | 15(9.49) |
| | 50 – 59 | 5(3.42) | 1(8.33) | 6(3.80) |
| Level of ICT competence | Low (1) | 5(3.42) | 0(0.00) | 5(3.16) |
| | Average (2) | 34(23.29) | 1(8.33) | 35(22.15) |
| | High (3) | 45(30.82) | 3(25.82) | 48(30.38) |
| | Very High (4) | 47(32.19) | 4(33.33) | 51(32.28) |
| | Advance (5) | 15(10.27) | 4(33.33) | 19(12.03) |
| Department of respondents | Automotive | 12(8.22) | 3(25.00) | 15(9.49) |
| | Mechanical | 66(45.21) | 3(25.00) | 69(43.67) |
| | Hospitality | 28(19.18) | 3(25.00) | 31(19.62) |
| | Computer Science | 25(17.12) | 2(16.67) | 17(10.67) |
| | Applied Mathematics | 15(10.27) | 1(8.33) | 26(16.46) |

Table 1 shows the demographic characteristics of respondents, students and facilitators. From Table 1 gender distribution of respondents is fairly distributed with about 55% being males and 45% as females' students. 42% of facilitators were females and 58% being male facilitators. There is an overall representation of 56% for males and 44% for females. From this it can be stated that there is fair presentation of males and female participation in flipped lessons.

The age distribution shows that majority of students (60 respondents, representing 41%) were between 20 – 29 years. Cumulatively, about 90% of student participating in flipped lessons were less than 40 years of age. It is instructive to record that about 10% of students participating were between 40 and 59 years. This is to say that adult-students participation is appreciable at Koforidua Technical University. This is also reflective of the presentation of facilitators as majority of them are aged between 40 to 49 years of age and about 8% are in their fifties.

From Table 1, it can also be seen that respondents have fair knowledge in ICT competence which is a basic requirement for successful flipped learning implementation. Cumulatively, about 90% of student respondents were graded with very high on ICT competence. The story is more appealing on the side of the facilitators. It was revealed that only 3% of facilitators are of low competence in ICT per the log in assignment check of the survey questionnaire. The implication is that majority of respondents have the basic competence to access ICT related document and navigate their way through the necessary tasks required of them. Lastly, majority, 66 respondents representing 45% of students came from the mechanical department followed by hospitality (19%), then 17% from computer science with 10% from applied mathematics and 8% from automotive engineering departments.

Research Question 1: *What are the factors influencing students and teacher's participation in flipped lessons?*

Table 2: *Factors that influence students' participation in flipped or reverse lessons.*

| | <i>SD</i> | <i>D</i> | <i>N</i> | <i>A</i> | <i>SA</i> | <i>Mean</i> | <i>Std Dev</i> |
|---------------------------------------|-----------|----------|----------|----------|-----------|-------------|----------------|
| Increase interaction | 3 | 4 | 4 | 63 | 72 | 4.34 | 0.836 |
| Revision of lessons | 75 | 71 | 0 | 0 | 0 | 0.358 | 3.578 |
| Because of busy schedule | 4 | 6 | 31 | 64 | 41 | 3.90 | 1.154 |
| Dealing with difficult topics | 57 | 53 | 15 | 0 | 1 | 0.761 | 2.35 |
| Exploring research potential | 19 | 7 | 49 | 34 | 37 | 3.44 | 1.275 |
| Due to comfortable classroom settings | 10 | 4 | 20 | 102 | 68 | 4.80 | 0.415 |
| Making learning more flexible | 4 | 0 | 0 | 38 | 156 | 4.74 | 0.657 |

Students strongly agreed that three (3) factors influence their participation in flipped or reverse learning at Koforidua Technical University. These include comfortable classroom

setting ($mean = 4.80$ & $SD = 0.415$) and flexibility in learning ($mean = 4.74$ & $SD = 0.657$); and increased interaction ($mean = 4.34$ & $SD = 0.836$).

Topmost among these is the comfortable classroom setting and environment under which flipped lessons take place. The students indicated that attention is shifted from the facilitator to the student, making the student feel more important and valued. Again, notes and check list students receive from their facilitators are mainly the key points students had difficulties in and would need attention on. The technologically aids used during flipped lessons allows students to access current information on the subject matter and this enriches their appreciation of issues. The flexibility that comes along with flipped lessons also spurred the students on. This was the second highest rated factor ($mean = 4.74$ & $SD = 0.657$).

According to the students, it gives them the flexibility to study at a time, place and at a pace suitable to their individual abilities and circumstance. Again, from Table 2, flipped learning concept allows for great interaction between the learner and facilitator and even among students. This increased interaction helps students who would have missed the chance of asking/answering question during a traditional face-to-face lesson to have done so. Again, interaction between facilitator and learners allows students to point out to facilitators their specific needs.

The study shows that students agreed that two factors influence their participation in flipped lessons. These were busy schedule ($mean = 3.90$ & $SD = 1.15$) and exploring research potential ($mean = 3.44$ & $SD = 1.725$). Obioma (2016) indicated that students alternate learning styles are sometimes influence by their busy schedule and multiple roles. From Table 2, Obioma (2016) conclusion is consistent with the findings that due to the busy schedule of TVET students in KTU, some students resort to flipped learning, which indeed is an alternative to the traditional face to face teaching and learning process.

The study reveals that students strongly disagree that their participation in flipped lessons were due to revision of previously taught lessons ($mean = 0.358$ & $SD = 3.578$); or to handle difficult topics ($mean = 0.761$ & $SD = 2.35$). Indeed, this is consistent with Hu (2017) who noted that the primary objective of flipped lessons is not to serves as revision but for primary learning to take place and later revision done with the teacher. This is where some people refer to the concept as “reverse” and students were motivated to do flipped lessons knowing that revision shall be done with the facilitator present on his or her input.

Again, there are some attempts by some facilitators, as posited by Kumi (2016), there is high tendency for facilitators to load perceived difficult subjects to students. However, results from this study suggest that students are not motivated to undertake flipped lessons when perceived difficult lessons are given them.

Responses from facilitation on factors influencing their participation in flipped lessons gives an interesting result as shown in Figure 1.

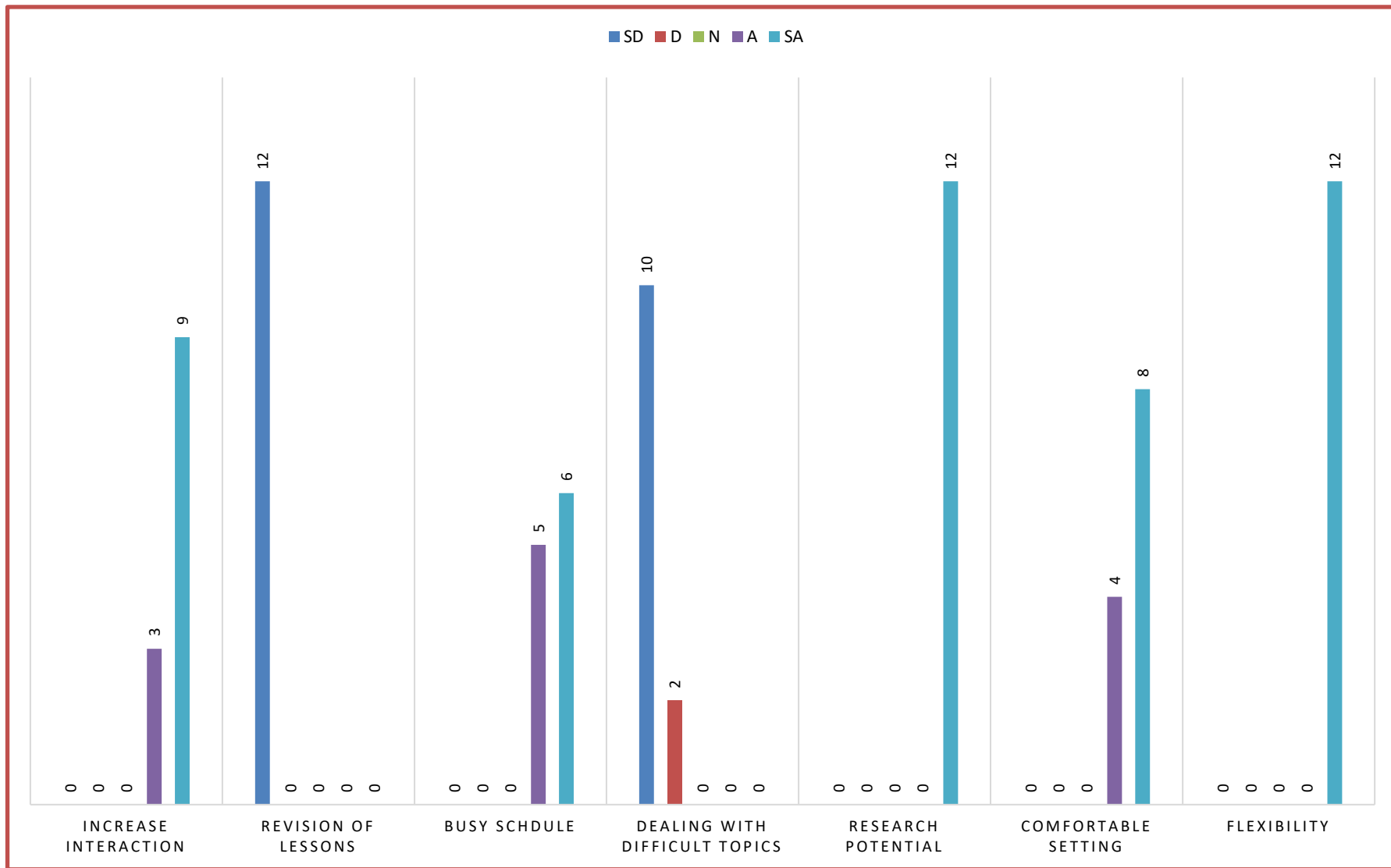


Figure 1: Reasons influencing facilitators' participation in flipped lessons

From Figure 1 it can be seen that all the facilitators (12 responses) are highly influenced by flexibility the flipped lessons give, and the desire to explore the research potential of students. These facilitators believed flipped lessons helps students to deepen their soft skills in research and problem solving. Students' ability in solving real time problem is an essential requirement of TVET graduates helping them improve on such skills is crucial as remarked by a facilitator. Again, the facilitators were not influenced in flipped lessons participation with the aim of students revising lessons. This is important and a healthy comment since it proves the facilitators are rightly influence by the key concept of having participatory lessons in the classroom, an essential part of reverse learning and posited also by Harden (2016).

One remarkable result is whereas 5 responses indicated they agreed they were influenced by their busy schedule and that flipped lessons relieve them of their tight duties, 6 facilitators indicated they strongly agreed to same. This basically means that facilitators' involvement in flipped lessons is highly influenced by their schedule and some remarked that it gives them time to attend to other important tasks.

From Figure 1, facilitators strongly agreed that their motivation for participation of flipped lessons is to increase interaction between students and teachers and among students. The students also share the same view in respect to interactions that flipped lessons create among students and between teachers and students as posited by Day and Foley (2006).

Research Question 2: Are students improving academically through flipped lessons?

Grade point averages of students were assessed to determine their performance in subjects where flipped lessons (after) are practiced and those that traditional (before) lessons take place. Again, the overall performance of students was also determined to assess the cumulative effect of students who practiced flipped lessons. The results are presented in Table 3.

Table 3: Factors that influence students' participation in flipped or reverse lessons.

| Characteristic | Response | GPA before | GPA after | p - value |
|-----------------------|-----------------|-------------------|------------------|------------------|
| Gender | Male | 3.15 | 3.29 | 0.0571 |
| | Female | 2.78 | 3.11 | 0.0014 |
| Age | Less than 20 | 3.25 | 3.66 | 0.000 |
| | 20 – 29 | 2.89 | 3.36 | 0.000 |
| | 30 – 39 | 3.45 | 3.63 | 0.000 |
| | 40 – 49 | 2.98 | 3.45 | 0.000 |
| | 50 – 59 | 2.11 | 2.15 | 0.000 |
| ICT competence level | Low (1) | 2.05 | 2.08 | 0.177 |
| | Average (2) | 2.78 | 3.11 | 0.748 |
| | High (3) | 3.01 | 3.09 | 0.523 |
| | Very High (4) | 3.21 | 3.24 | 0.245 |
| | Advance (5) | 3.15 | 3.24 | 0.115 |
| Overall | | 3.04 | 3.17 | 0.000 |

Table 3 shows that the performance of students increased per gender, age group and level of ICT competence after engaging in flipped lessons.

From Table 3, the study reveals that even though performance both male and female students increased, the change was not statistically significant for the males. However, the study shows that there is statistically significant difference between the performance of female's before and after engaging in flipped lessons. This is to state that females perform well in flipped lessons. Facilitators attribute the significant performance of females to how meticulous females' students are. Females, according to facilitators, obey instructions more than then male counterparts.

Age consideration shows that there is statistically significant improvement on students' performance across the age cohort up to 60 years. Results from Table 3 show significant change improvement in performance from the young to old cohort. This means, in terms of age there are no differentials in students' performance, the young are improving just as the older students.

It is believed that due to massive involvement of ICTs in flipped classroom concept, the level of students' ICT competence can affect his or her performance in flipped lessons. We were interested to find out whether the level of a student's ICT competence would affect performance. Results from Table 3 shows improvement in students' performance in participating in flipped lessons. However, this change is not statistically significant.

According to Shah and Inamullah (2012) a student level of ICT does significantly contribute to academic performance. High competence students are doing equally well as low graded competence levels. This means that the level of ICT competence cannot be a barrier in implementation of flipped classroom concept among TVET students.

It is instructive to note that the overall GPA of students who participate in flipped lessons increased from 3.04 to 3.17 after two academic years. This change can be found to be statistically significantly different from before they engaged in flipped lessons. Flipped lessons increased the overall performance of students involved in the study.

Discussions with facilitators revealed wonderful outcome from students' behaviour and attitude towards learning. Facilitators indicated that students' attitude to learning has completely changed and they now pay attention to details. Facilitators were of the view that students now give more accurate answers than the introduction of flipped lessons and this makes teaching meaningful. Classrooms are now more organized, and students pay attention to details in a flipped class setting.

To make flipped lessons effective students need to own some gargets such as computers, smart phones and prepare for cost of internet connectivity where appropriate. This acquisition has brought enormous benefits to the students as they have now increased their reading habits and spend a lot of time reading and preparing before actual lessons with their facilitators. The students remarked this is putting them on their toes since they do not want to be caught unaware in class. This has shaped their learning style for the better as affirmed by the student's respondents.

Research Question 3: What are the perceptions of flipped classroom concept?

The flipped classroom concept is new to Ghanaian educational setting. The long-held notion that the teacher must deliver stuff to the learner is still strong among parents, teachers, education officers and even some students. The researchers were therefore interested in

finding out from respondents if they would recommend flipped learning to others. The response is as shown in Figure 2.

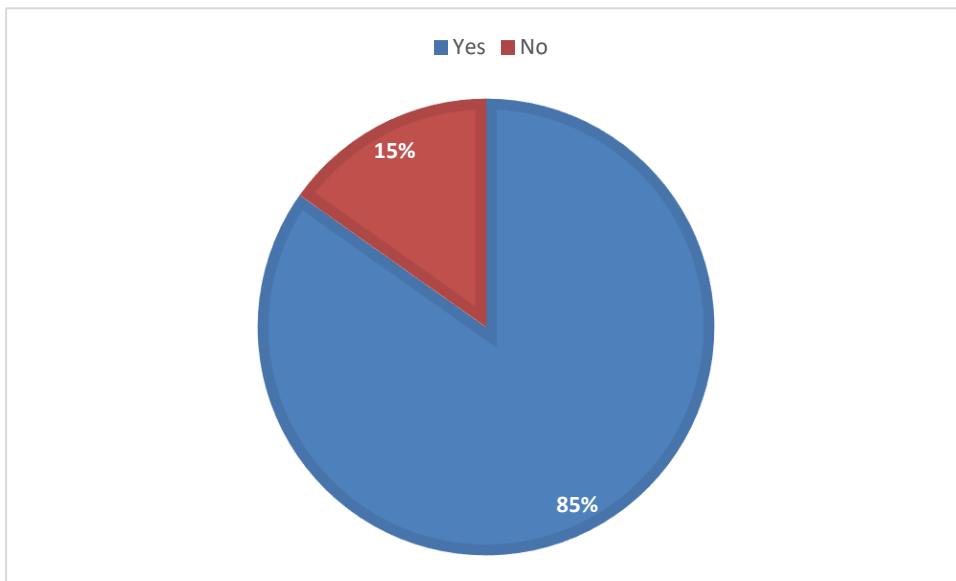


Figure 2: *Would you recommend Flipped classroom concepts to others?*

From Figure 2 majority of respondents (85%) indicated their preparedness to recommend flipped lessons to others. The researchers were interested in reasons why about 15% of the respondents would not recommend flipped lessons to other facilitators or students. The response is as shown in Figure 3.

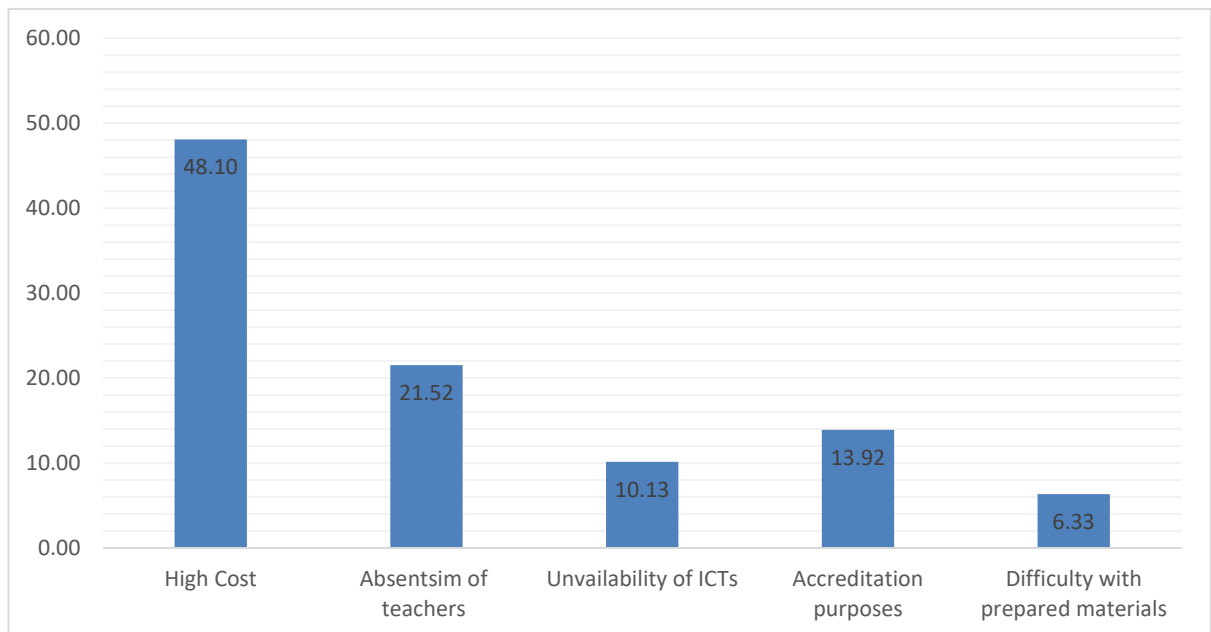


Figure 3: *Reasons for not recommending flipped classroom concepts.*

From Figure 3 about 48% of respondents indicated that flipped lessons comes with high cost and for this reason, they were not ready to recommend it to others. It was revealed that many

of the learning materials prepared need to be loaded and accessed online. In Ghana where internet cost is high and unstable, this brings additional charges to both facilitators and students. Again, it is highly viewed that teaching is done well when the facilitator stands and talk to students for hours. It is surprising to note that about 22% of respondents believe flipped lessons can lead to teacher absenteeism.

Respondents explained that the confidence a teacher has that students would prepare and do learning at home may influence their regular attendance to lessons. They maintained there is the need of assured social interaction with teachers which is consistent with Pradhan and Pradhan (2016). If teachers are aware that all the processes depend on them, they would ensure attendance to class regularly.

From figure 3, about 14% of respondents maintained that flipped classroom concept is new to the Ghanaian system and would approval of accreditation by the National Accreditation Board of Ghana before recommending it or can be fully practiced. Again, about 10% of respondents maintained that unavailability of ICTs brings additional burden to both the facilitators and students. Respondents indicated the teacher factor must be hugely present during teaching and learning and the more attention is drawn from the teachers, quality of learning can be compromised. This gives credence to the fact that teacher centered teaching methodology is still paramount among respondents.

Again, about 6% of respondents indicated that they were facing some difficulties in accessing videos, audios and relevant material to aid flipped lessons. Some facilitators were worried about the size and appropriate format that would suite student's preference over time.

From Figure 2 about 85% of respondents indicated that they would recommend flipped lessons to others. Their reasons are as presented in Figure 4.

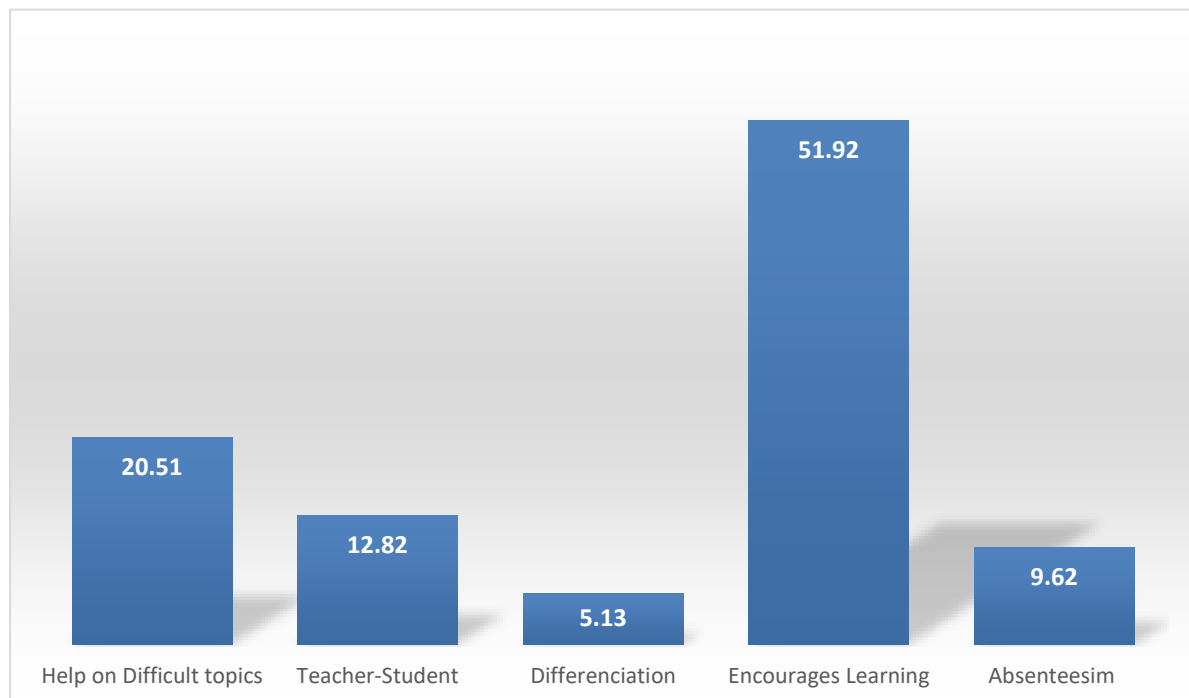


Figure 4: Reasons for recommending flipped classroom concepts.

From Figure 4, about 52% of respondents indicated that flipped learning encourages learning among teachers and students and for that matter they were ready to recommend to others. That is flipped learning introduces some form of flexibility and a shift from the traditional instructions. This means information is no more disseminated, but the classrooms become hubs of learning and inquiry. The primary goal of TVET education in Ghana is to stimulate learning since TVET education is seen as primarily for the low graded schools and the corresponding stigma and non-recognition of the crucial role TVET plays in national economy.

From Figure 4, about 21% of respondents realized that flipped lessons help students to deal with most of the difficult topics in the subject area while another 13% maintained that flipped lessons increase the teacher – student interaction. That is having interaction outside the classroom frees up more times for teachers to interact one-on-one or in small groups with students. In relation to material usage, it was realized that the students mostly prefer video and graphic incorporated material to full text-based materials.

While 10% maintained flipped lessons helps create more time for learning whenever a student or a teacher is absent from class, about 6% maintained that flipped lessons create differentiation in learning. Learners needs defer and it is important teachers can have individualized approach to learning. This has been achieved and some respondents found it worthy to recommend flipped lessons based on this experience.

Conclusion

The objective of this paper was to determine factors influencing flipped lessons, assess students' academic performance and determine teachers and students' perception of flipped lessons in TVET at Koforidua Technical University. Factors influencing flipped lessons participation include economic, technological and social dimensions of learning. It is evident that one does not necessary flip every lesson. At the initial stages, introduction lessons with less difficulties could be flipped, and once students have acclimatized themselves with the process, courses that the teacher finds repeating could be flipped to bring variety. It is instructive to note that there was statistically significant difference in academic performance of students who engage in flipped lessons. Learning attitudes of students involved in flipped lessons affect other lessons that are not flipped. There is also mixed perception of both teachers and students on flipped lessons and this brings to fore the need to encourage discussions on how best flipped lessons could be integrated into the Ghanaian educational systems for general acceptance.

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