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INTERACTIVE FLIPPED EXAM: A NEW LEARNING APPROACH

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Abstract

Existing employment needs and accelerating technological developments require advanced skills and qualifications. Traditional teaching and learning methods are developing from instructor-centred to student-centred learning. E-learning platforms such as Coursera, Udemy, etc nowadays are gaining more popularity. Flipped Classroom is different from traditional education by demanding some activities before going to school, and using class time for consolidating knowledge and deep learning. This method aims to improve students' performances. The "Flipped Exam" is part of the "Flipped Classroom" although it is performed by a timely graded group discussion to solve the exam questions. Our proposed contribution the "Interactive Flipped Exam" is a new method that depends on students' creativity and evaluation capability of the topic studied. The students after each chapter have to critically review its contents and design "4" freestyle exam questions matching the learning objectives of the chapter within the time frame of the intended exam, then they have to submit the designed exam to the teacher for grading. The experiment was conducted on "12" undergraduate female students, and it resulted in students' improved learning, performances, and made them think as a teacher, besides removing their fear from exams (Examinophobia). Moreover, the proposed method assisted the teacher in acknowledging the students' preferences of exam questions types, also it showed the level of students understanding of a particular topic.

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1 | INTRODUCTION

With the advancement of technology, social media, and the existence of 5G, besides Internet, the need for advanced knowledge and training for satisfying the industry and market needs are vital. Education must coop with this development in technology to provide skilful workforce for satisfying the current and future market employability requirements. The traditional instructor-centred classroom teaching and learning method are no longer valid.

New interactive student-centred Flipped Classroom Method (FCM) has been introduced, whereby students prepare their study material before class via online lectures and prework activities. They spend their class time in meaningful discussions, problem-solving, and collaborating with other peers to solve complex use cases and gain more knowledge, at the same time being supervised and guided by the teacher [1].

FCM relies on students' independent learning, as they explore the topics by themselves and ask the teacher afterward. This method makes the students learn in their comfort zone. It requires pre-class activities including watching videos and reviewing relevant course material, then discuss the prepared activities during the class time [2]. The Flipped Exam Method (FEM) was extended from FCM whereby students collaborate as a group to solve questions. They construct knowledge by searching for answers using their resources while discussing with colleagues during exam time.

A study by [3] implemented FEM on Post-Baccalaureate Program students at Wayne State University School of Medicine. They found out that FEM increased the students' knowledge and transformed their exam motivations from avoiding receiving bad grades to learning the course material. Another study by [4] applied FEM on final year Pharmacotherapeutics undergraduate students to evaluate their performance. They found out that FEM has improved students learning satisfaction, knowledge, and assessment grades.

This research contributes in adding another learning method which is "Interactive Flipped Exam Method (IFEM) that is based on "Flipped Classroom" and "Interactive Teaching", whereby students are involved actively in the teaching, learning, and assessment process, using their critical analysis and creativity to design the assessment of the topic studied. The reason for the development of the new method is to overcome students' fear of exams, enhance their learning performances, and critical thinking.

Most educators face complaints from the students regarding exams [5] such as the exam is hard, unclear, not related to what is being studied or given in class, or as homework. These types of complaints draw my attention to the possibility that the students' way of studying is lacking in-depth understanding. As a result, we decided to conduct the IFEM experiment to enhance the students' ability to study with critical analysis, focusing on how to extract meaningful use of the information being given in class, online, or as homework.

The IFEM extends the FCM and Interactive Teaching by adding a new novel method. Furthermore, both of FCM and Interactive Teaching student-centred models depend on the educator's less involvement in the teaching process, and more students' discussions and problem-solving activities.

IFEM considers Blooms' Education Taxonomy. As shown in Figure 1, the IFEM is located at the top of Bloom's Taxonomy learning pyramid [6] whereby students' must create their assessment based on their evaluation and critical analysis of the learning content. The IFEM process occurs after class time and after the regular teaching or FCM. Flipped learning in Blooms' Taxonomy occurs by pre-classroom self-instruction via structured activities assigned to students at their homes and suitable time. This includes remembering and understanding activities, whereby, in the classroom, they involve in group discussions to apply knowledge gained with the assistance of the educator, followed by IFEM, then final assessment.

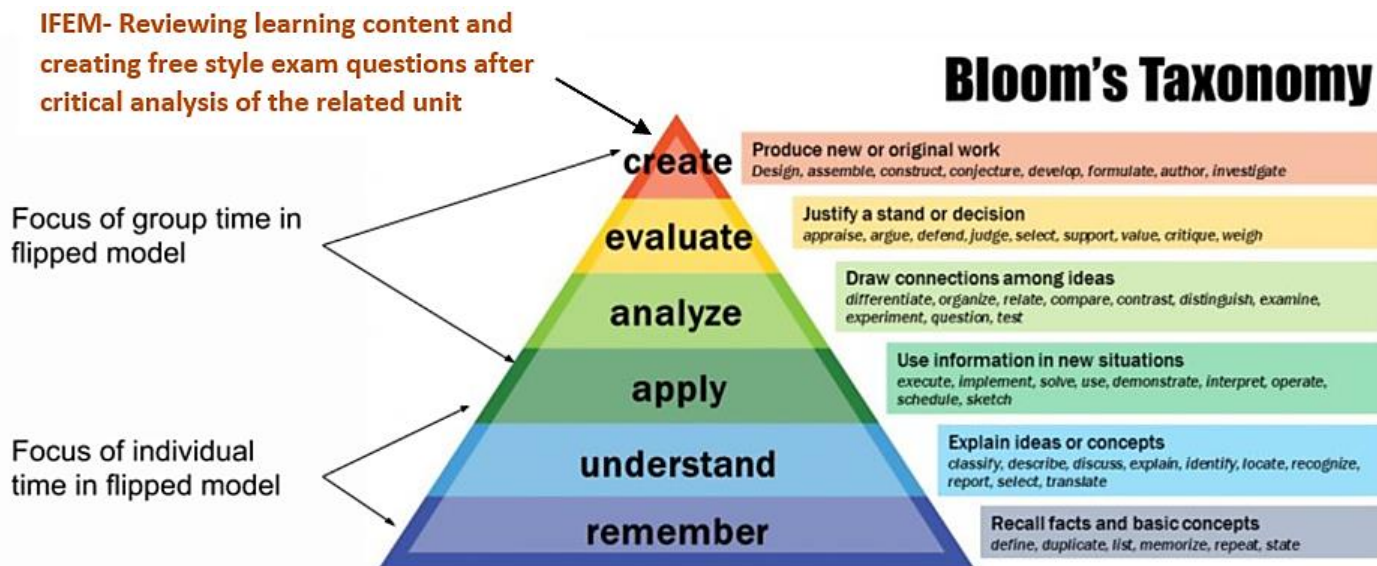


Figure 1: IFEM location in Bloom Learning Taxonomy.

Figure 2 Presents Blooms Flipped Learning Taxonomy activities including IFEM details as follows:

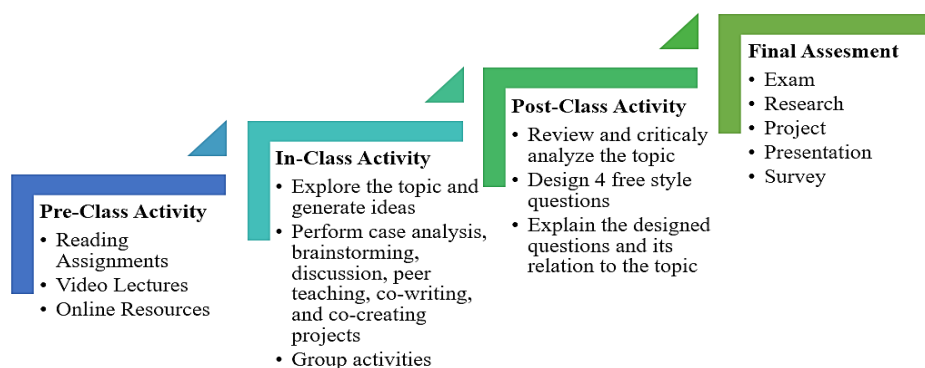


Figure 2: Blooms Flipped Learning Taxonomy activities including IFEM.

1. **Pre-class** activities focus on each student remembering and understanding by assigning them structured tasks before class time. Students must watch recorded lessons, (Video lectures, online presentations, and texts).
2. **In-class** activities focus on students applying and analysing activities whereby students are assisted by the teacher and have group discussions, problem-solving, and peer to peer collaboration.
3. **Post-class** activities that focus on creating and evaluating activities whereby our contribution IFEM is performed. Each student has to review the topic and critically analyse its contents playing the role of the teacher, design 4 free style questions that covers the intended objectives and the learning outcome of the topic taught, finally submit the designed exam to the teacher for analysis and grading.
4. **Final Assessment** types that focus on selecting the student evaluation method such as a final exam, a research paper, final project, etc. to ensure that the learning outcomes have been achieved.

the questions, the educator can redesign her/his approach of teaching to add more tutorials, group discussions or engage FCM for some topics based on the students' level of understanding. Figure 3 Shows the IFEM students' feedbacks survey results on what they have benefited from IFEM Experience.

2 | METHODOLOGY

The proposed IFEM is based on creating an environment whereby the students think as a teacher and try to design exam questions that cover the objectives of the content learned. Students must discover by themselves the concepts and principles required to be learned. The experiment was conducted on an undergraduate Software Engineering course that has (12) female students. They were given an individual graded assignment as homework in which they must revise the course material and design (4) freestyle exam questions in any format (online or paper-based) which must fulfil the learning objectives of the unit. They also must indicate what they learned from this experience by answering a given survey for 5 minutes after submitting the designed exam. This will assist the teacher in understanding the difficult points in the topic which was not understood.

The proposed IFEM differs from Lijan and DiCarlo FEM [3] in the sense that students act as teachers and design exam questions according to their choice that covers the material being taught in the class. This will enhance their critical analyses and problem-solving skills as they must observe the learning content to obtain questions from it. Also, the student has to make efforts to design exam questions, select the type and format of the questions, then match it with exam time and ensure that it covers the content learning objectives. All of this will make the students fearless of exams since they are practicing being a teacher and seeing the learning contents from another point of view.

Moreover, this experiment can assist in acknowledging the students' level of understanding, by analysing the way they designed

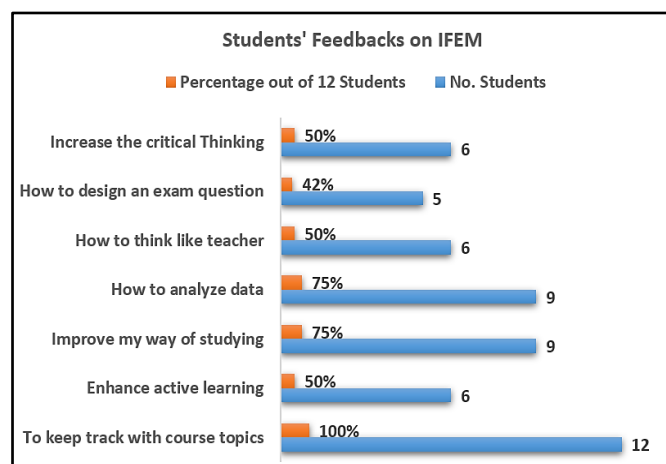


Figure 3: Students' Feedback on IFEM Experiment.

Figure 3 shows that 50% of the students ensured that IFEM has enhanced their active learning, critical thinking, and made them think like a teacher. 75% acknowledged that IFEM made them more knowing how to analyse data which improved their way of study. All the students ensured that IFEM made them keep track of the learning content and what is required from them to achieve. However, 42 % stated that IFEM enhanced their way of thinking about how to design exams. It made them think why they chose this specific question, is it direct or indirect, will overall questions be answerable according to exam time, and so on.

As shown in Figure 3, various positive impacts on the students that changed their learning approach. Students said that they were able to track what has been given which illustrates the advantage of making the students independent and be more focused on their learning. Another benefit from this experiment was the types of questions students designed. Figure 4 presents the exam questions design preferences among the experience sample that is presented in the result and discussion section. Table 1 presents the IFEM process and the responsibilities of the teacher and students in the teaching, learning, and assessment education pedagogy. Whereby, Table 2 shows the comparison between various current exam methods.

Table 1: Interactive Flipped Exam [IFEM] Process.

1. Introduction to Learning Content		2. Flipped Classroom		3. Interactive Flipped Exam		4. Final Assessment	
Educator	Student	Educator	Student	Educator	Student	Educator	Student
Introduce the learning content	Understand curriculum	Develop, present review the course content	Participate in classroom activities	Organize the learning contents to be assigned to students	Identify the course number of units and its contents	Design the exam based on the analysis of the IFE	Answer the questions
Explain the teaching, learning and assessment methods used	Listen, understand, question and answer	Upload the course content in the Learning Management System (LMS)	Review and understand the uploaded material on LMS	Assign the IFE to each student after the end of each course unit	Critically analyze the contents	Ensure the learning outcomes are achieved	Provide complete and clear answers
Define the learning outcomes	Acknowledge objectives of the course to be achieved	Explain the course content uploaded in the (LMS)	Listen and understand	Evaluate and grade IFE	Design the exam questions	Inform students on their scores	Learn from their negative and positive performance
Group the students	Identifying their colleagues	Review the students' feedbacks	Give feedback	Analyze which is the best questions formed	Selecting type of questions format	Completion of course progress survey	Completion of course evaluation survey

Table 2: Interactive Flipped Exam [IFEM] Comparison with Existing Ones. [7]

Traditional Exam	Flipped Exam	Interactive Flipped Exam	Online Exam
Each student answers the exam alone using Pen, Paper and in the institution exam hall or classroom.	Group discussion during exam time to discover and answer the questions [3].	Students must design free style 4 exam questions after each unit which will be submitted analysed and graded, then added in the exam bank.	Students do the exam at their preferred location and time within the availability window. They are supervised in real time, using video, audio and screen-share technology.
Aims to measure students' performance and understanding.	Aims to s improve students' knowledge, skills, and personal adjustment.	Aims to remove students fear of exam, make students think as a teacher, measure students' critical analyses, performances and understanding.	Aims to facilitate more authenticity, accessibility and flexible exam experience [7].
Relies on surface learning whereby students' objective is to pass their exams [8].	Relies on deep learning whereby students' objective is gaining knowledge not only passing the exam.	Relies on students' creativity, deep learning, and critical thinking, whereby student's objective is gaining knowledge not only passing the exam.	Relies on deep learning whereby student's objective is gaining knowledge not only passing the exam.
Supervised hard-copy exams.	Supervised group discussion exam.	Mix mode supervised exams platform.	Online supervised exams platform.
Cause fear of failure, increases anxiety, undercuts interest, reduces intrinsic motivation, heightens competitiveness, and depresses creativity.	Enjoyable since students learn better by collaborating with others to answer complex problem and gain real-time feedbacks.	Remove the fear of exams, increase the critical thinking and problem-solving skills, students play the role of a teacher.	Less stressful, done at students' own comfort zone.

3 | RESULTS AND DISCUSSION

The findings of the current investigation resulted that the IFEM had a positive significant effect on improving the students' deep learning, way of studying, active learning, and critical analysis. This assessment approach, along with instructor interaction, consistent feedback, and supportive collaboration, can produce positive results in making the student analyse the course material from a different point of view not as a learner but as a teacher with full responsibility to design an exam considering time, level of difficulty and material given.

Figure 4 shows the diversity in students' exam question preferences, 67 % selected (true and false define, explain) types of questions that require thinking and in-depth understanding as well

as memorising of learning content, whereby, 58% preferred list questions which are direct and depend on memorising. However, 45% chose to select the chose the best question with 33% compare. By analysing the attitude and students' preferences, the teacher has more inputs on the capabilities of his/ her students and can develop his and her teaching and assessment methods to coop with that to provide the best education practices.

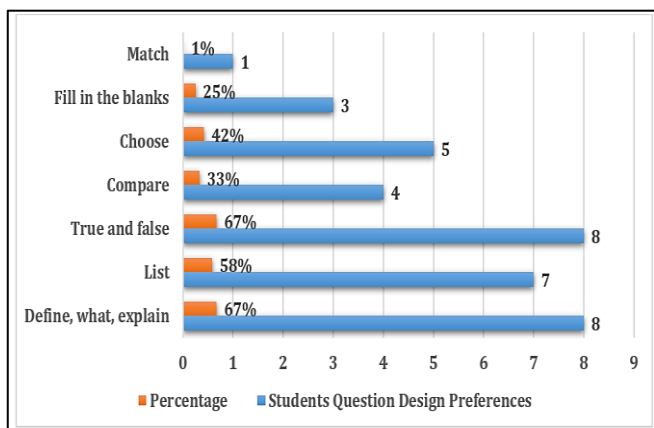


Figure 4: IFEM Design Question Preferences.

The FCM is required nowadays with blended learning the consists of a traditional classroom and online learning, to train and empower learners to face future skills and market demands. Figure 5 presents the advantages and challenges of FCM according to [9] has several advantages and challenges that need to be acknowledged since our proposed IFEM relies on FCM, also it can be implemented alone with the traditional learning.

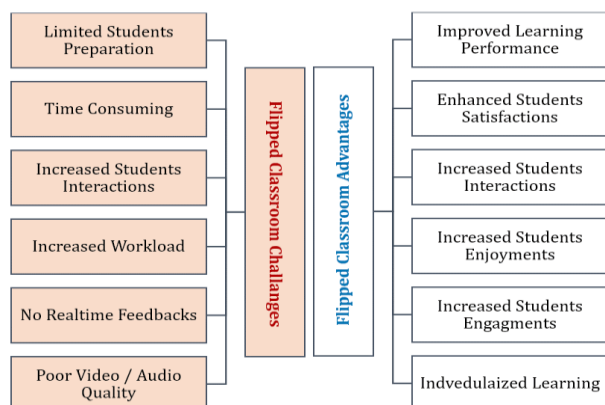


Figure 5: FCM Advantages and Challenges [9].

4 | CURRENT EDUCATION CHALLENGES

Current learning is becoming more interactive and requires new ways of teaching and assessments. The current COVID-19 situation has pressured the people globally to be isolated at homes and E-learning is becoming a must. Institutes and schools are closed due to the corona-virus pandemic, this caused severe personal and economic consequences. The alternate solution was using digital learning. FCM and online learning became so popular. However, several challenges raised regarding E-learning, FCM, and IFEM as follows:

4.1 | EDUCATORS

In digital education, the teacher must prepare online materials and deal with LMS. He/she should be well trained and qualified in doing so, and this is quite a challenge since most teachers have graduated by conducting traditional education. They are required to attend several trainings to adjust to the digital teaching requirements. As for the proposed IFEM, the teacher collects the designed exam questions by students to grade them, analyse the questions types chosen, then decides if the student understood the intended

learning contents. This also requires a qualified teacher who can understand the student’s preferences of exam questions and their level of difficulties as well as acknowledging the level of their understanding of the subject matter. Currently, educators must work virtually at least until the COVID-19 curfew is eased and people can go back to normal life, then they can use blended learning in teaching and assessment procedures. Another challenge is the diversity in students learning styles, culture, background, and skills that require different methods in teaching, assessment, and communication skills to deliver the information properly. Additionally, there is a verity of technology types, each one of the learners, educators, and facilitators access the online learning platform from his or her device, depending on the inter-net speed and availability. The challenge here is how to overcome the learners’ fear of trying new things, or failure by making learning an easy process that becomes enjoyable to practice.

4.2 | STUDENTS

Digital teaching and learning require the implementation of FCM whereby the students are more interactive with the learning process. They must work independently utilizing their digital skills. This is a challenge as each student has her and his own capabilities, preferences, culture, not to mention the type of their digital devices, internet availability, and financial state. Is it compatible with the E-learning platform, does it support the streaming capacity required for accessing the LMS to prepare the pre-class activities?

4.3 | CURRICULUM DESIGN

Several Concerns the educators face when designing the learning material especially with the existence of digital learning. The curriculum must adjust to education standards, also it must involve blended learning that includes videos, online material, and virtual real-time assistance. Moreover, it should evolve according to students’ feedback. Students do not have the same understanding capabilities or learning styles [10]. The learning material should be designed to be learner centred. The design must be enjoyable, informative, and engaging which includes online games, storytelling, and scenario-based learning to engage students’ in the learning process. Moreover, there is a need to know about the market, industry, and social skills and training required to be included in the curricula. Jobs are currently lacking employees since graduates were not taught the required courses. Moreover, the course learning outcomes must be integrated into the curricula to fulfil the overall program objectives.

4.4 | ASSESSMENT DESIGN

Learners’ assessment is a very important process in the education era. It provides students with feedback on their progress in a course, identifies their strengths and weaknesses, measures if students achieved the course’s learning objectives. That is why it should be well designed and must engage the students to be prepared for future life and employability skills. For the assessment design (is the intended objectives of the assessment measuring students’ knowledge acquisition or application to related or new situations or both?), (what type of assessment is best for the related course which covers the learning outcomes?), (how to design the assessment according to students level of understanding, creativity, and difficulties?) [11]. IFEM is a new type of assessment that depends on student’s creativity, critical analysis, also understanding, and remembering. Other challenges raised with digital assessment involves question paper generation, internet connectivity, communication with students, security, and privacy, which must be managed to maintain successful online assessment.

4.5 | TECHNOLOGY

The current modern education platform relies on Just-in-Time learning that can be accessed from any digital smart device, anywhere, anytime, with the precise topics. There are diverse types of devices ranging from mobiles to laptops, each of them has its own features. Online learning should be accessible on all devices, understandable and clear for all related parties and that is not an easy task. Sometimes games are used for learning purposes which need huge storage, besides mobile devices have special application design requirements with small learning text contents. Some other technology challenges involve adaptability to the use of technology and overcoming the resistance to change, technical issues, slow Internet bandwidth, weak Internet connection, etc. [12].

5 | CONCLUSION

This article introduces a new method of Interactive Flipped Exam teaching and learning method that aims to overcome the students' fear of exams as well as empower their critical thinking and understanding capabilities. When the students act as a teacher and review the topic in-depth to obtain questions that match the learning objectives of the chapter, also that must be distributed according to exam time, they will increase their learning performances. Moreover, from the teacher side, by examining the students' questions design, she/he will know the level of their understanding and the type of questions they prefer. This experiment is conducted on a small scale; however, it showed a huge improvement in students' understanding of the topic and more excitement in doing the exam with no objections as compared to the formal method. In the future the intent is to implement in a large scale, also perform more data and behaviour analysis.

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