Development and Validation of Flipped Classroom Modules for Teacher Education Course

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Abstract
Flipped Classroom Instruction is based on the concept of blended learning where students get familiar with the content at home and work on activities through it during class time. It helps to effectively use the class time for working on higher-order thinking skills. In this study, flipped classroom modules were developed for an undergraduate course. For one undergraduate course, eight modules were developed based on eight units of the course. Each module consisted of different sections depending upon the number and the nature of topics covered in each unit. Each section consisted of seven segments: learning outcomes, resources at home, scaffolding, class quiz, class activity, feedback, and further reading resources/task(s). The 'learning resources at home' which were used included chapters/pages from the reference books, YouTube/pre-recorded videos, class notes, and the website content. The class quiz and class activities were based on the pre-class readings (i.e., learning resources at home). The role expectations of teacher and students were clearly stated in class activity segment. There was a reflection form at the end of each section. After completing the modules, the responses of the students collected in the form of qualitative data were positive about various segments. They perceived that the modules helped them to understand and apply the course concepts. The challenges related to the student role in class tasks and the out-of-class readings were dealt by adding more clarity and practice time in class tasks and by providing instructional videos with subtitles. It is recommended to adopt the structure of flipped classroom module keeping in view the context, nature of the subject and the characteristics of the students.

Keywords: Flipped Classroom (FC), blended learning, higher-order thinking skills, class routine, learning experiences, modules, instructional videos, teacher-student interaction.

1. Introduction

Traditional instruction may be helpful in a situation where the learners may have little or no prior knowledge about a concept and the procedure of a task is required to be taught before they can apply it (Gilboy, et al. 2015) in a given or unexpected situation. However, the traditional lecture method has been criticized for a number of reasons. For example, the lecture

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method when used as a sole method of teaching, the course may take the class time away from challenging students' thinking, working on problem-solving tasks, and application of concepts in an active learning situation (Bergmann & Sams, 2012: as cited in Gilboy et al. 2015). The flipped classroom is one of the teaching and learning pedagogies that may overcome the limitations of traditional or lecture-based instruction.

Flipped classroom keeps students at the center of teaching and they are actively constructing knowledge (Masood et al. 2022). The constructivist learning theory recommended to expose students to learning experiences where they can create knowledge based on their previous learning. Flipped classroom engaged learners in pre-class phase through interesting learning resources, in-class phase through participation of learners in discussion/individual/group activities and post-class phase through reflection (Gerber & Eybers, 2021). Flipped classroom uses readily accessible technology to deliver the course content before class time and reserves the class time for learning activities that involve the application of course concepts (Roehl et al. 2013).

In flipped classroom (FC), the pre-class learning material in the form of videos, PowerPoint slides, notes and readings (articles, books etc) is shared with students for studying before class time while the teacher is in contact with his/her students through Learning Management System (LMS). The teacher emphasizes on higher learning levels during face-to-face class time (Cevikbas & Kaiser, 2020). The students may be more engaged in the course activities as compared to the traditional classrooms where students are passively attending the lectures. However, the students asked for more real-life examples, more and shorter conceptual questions, and more summaries to be included in the content for the flipped classroom (Cho et al. 2021).

Although the flipped classroom offered the opportunities to interact with content and to interact via content, there is a need to anticipate and make arrangements for circumstances when the things do not go as planned for class due to technical or other problems (Jiang et al. 2022). The researchers have found some other challenges associated with flipped classroom including the duration of the videos for topics, the time required by teachers to arrange the learning resources, and the time required by students to learn the concepts (Al-Samarraie et al. 2020). It can be concluded that although the concept of flipped classroom seems very simple to understand but its use in the classroom requires technological skills, pedagogical and content expertise to implement it effectively (Shimamoto, 2012).

There has been a rising trend towards the use of web-based learning materials such as videos and documents in teaching-learning process over past few years especially during COVID-19 period. It has provided the access and the opportunities to the students and academia to take advantage of varied sources of learning materials (Feijoo et al. 2021). However, some meaningful interaction between teacher and student is required for effective learning process. This interaction would be helpful for providing support for the individual student needs and dealing with potential problems such as social distancing (Younghee & Thomas, 2007), poor quality of programs and/or materials, cost for developing and/or accessing the resources and use of technology for the sake of technology (Feijoo et al. 2021). Students faced difficulty in performing assigned work in remote situation and a decrease in the comprehension of the applied subjects in the absence of classroom interaction and weak motivation for distance

education. Further, the performance of struggling students was adversely affected during remote teaching (García-Alberti, Suárez, Chiyón, Mosquera Feijoo, 2021).

The flipped classroom instruction requires carefully developed modules or lesson plans for its effective implementation where step-by-step procedure, nature of task, time allocated for the task, and the role of teacher and students is explained. Keeping in view these challenges mentioned above, the researcher worked on the development of flipped classroom modules so that the process of development of modules and the experiences of students with these modules may be shared with the academic and research community for future work in this area. This paper would help to deal with various types of challenges faced in flipped classroom.

2. Review of Related Literature

The flipped classroom was found helpful by students for learning the course content (Cho et al. 2021). The students preferred flipped instruction over the traditional instruction for learning (Gilboy et al. 2015). Albert & Beatty (2014) reported an improvement in the achievement scores of the students in the management course at the university level as a result of the flipped classroom. The students in a partial flip course performed higher than students of the control group in formative assessment and final examination questions. Further, the below and above-average students equally performed well in the formative assessment in a partial flip course (Lax et al. 2016). The result of the research work on the flipped classroom reported a positive effect on the cognitive, affective and soft skills of the learners (Birgili et al. 2021).

Instructors adopting the flipped classroom model, provide class lectures or course material as homework. So, for preparing for the class, the students are required to consult and understand the lecture material. Flipped classroom model utilizes a variety of technologies for the delivery of instructional material (Roehl et al. 2013). During class time, the students engage in solving problems, in-depth engagement with the concepts and collaborative learning activities (Tucker, 2012: as cited in Roehl et al. 2013). A flipped classroom model can be adapted for disciplines and courses where the lecture method is used for sharing the information and learning occur when the learners apply the information to solve a problem or complete a task (Roehl et al. 2013).

In the active learning classroom, the students must engage with what they are learning, write about it, relate it to their previous experiences and apply it to their daily lives (Chickering & Gamson, 1987). The knowledge is not a ready-made product, but it is constructed and reconstructed by making sense of new information while keeping in view the previous knowledge and experiences. The construction and reconstruction of knowledge may be possible through use of active learning strategies such as problem-solving, simulation, think-pair-share etc. (Gilboy et al. 2015). Active learning is continuously developing new methods of delivering the material (Roehl et al. 2013). Active learning can be encouraged through in-class activities such as structured exercises, challenging discussions, team projects and peer critiques, and through out-of-classroom tasks such as internships, independent study and cooperative job programs (Chickering & Gamson, 1987).

The flipped classroom may encourage active learning, self-regulation, and students' engagement in the learning process. Through technology-enabled flipped classroom instruction and active learning, the students may develop higher-order thinking skills and creativity (Roehl et al. 2013).
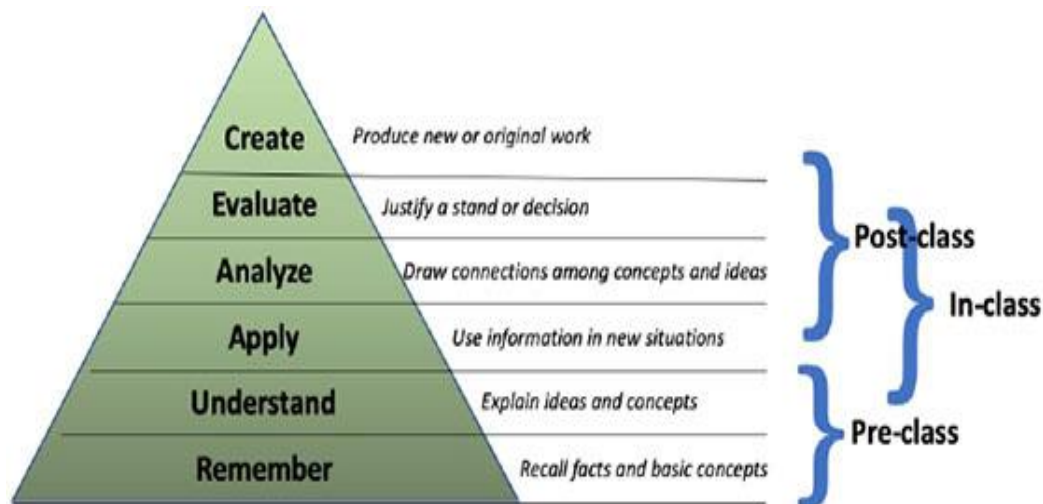
Flipped classroom model and active learning require the learners to take the charge of their learning experiences. Without understanding the learning material before class time, the students cannot successfully perform the assigned task in the class. Therefore, the teacher must share clear expectations and motivation for learning a concept and/or a course. The instructors, in flipped classroom, faced the challenge related to lack of motivation of students for watching the video lectures or studying the material before class-time (Zainuddin et al. 2019). Therefore, the purpose of the study was to develop the modules for an undergraduate course and assess their feasibility for the students' learning and learning experiences of students

3. Theoretical Framework

The flipped classroom is a unique pedagogical approach because it blends the traditional instruction in before-class time with the active learning strategies during the within-class time for a lesson. When implemented in a strategic way, it may help to achieve all the levels of the cognitive domain of Bloom's taxonomy (Gilboy et al. 2015), as shown in figure 01. The flipped classroom has three types of activities: pre-class, in-class and after-class activities. Pre-class activities are completed before class time, and it involves seeking knowledge and transfer or the first two levels of the cognitive domain of Bloom's taxonomy. The learning material should be provided through a multi-modal delivery and access mechanism. In-class activities are based on pre-class activities, and it involves advanced learning activities based on 'apply', 'analyze' and 'evaluate' levels of the cognitive domain of Bloom's taxonomy. Post-class are the further reading resources or tasks, and it reinforces the pre-class and in-class activities. Post-class activities involve 'apply', 'analyze' and 'evaluate' and in some cases, 'create' levels of learning according to Bloom's taxonomy (Gerber & Eybers, 2021).

Figure 1.
Flipped Classroom (FC) activities according to levels of Bloom's taxonomy


Source: (Gerber & Eybers, 2021)

Eppard and Rochdi (2017) elaborated the learning process in flipped classroom where various learning concepts such as active learning, collaboration, differentiated learning, and higher-order thinking skills may be evident. A flipped classroom heavily depends upon how the teacher, students and the teacher interact with each other. However, it showed that the flipped classroom is a fluid concept about the way learning theories are used in it.

The role of teacher and students, and the nature of interaction depends upon the subject, the topic covered in a lesson and nature of class activity student are working on. Further, the student experience with the flipped classroom affects the nature of interaction between teacher and students. In this study, the modules were developed keeping in view the model of Gerber and Eybers (2021), and the model of Eppard and Rochdi (2017).

Figure 02. Learning process in flipped classroom by Eppard & Rochdi (2017)
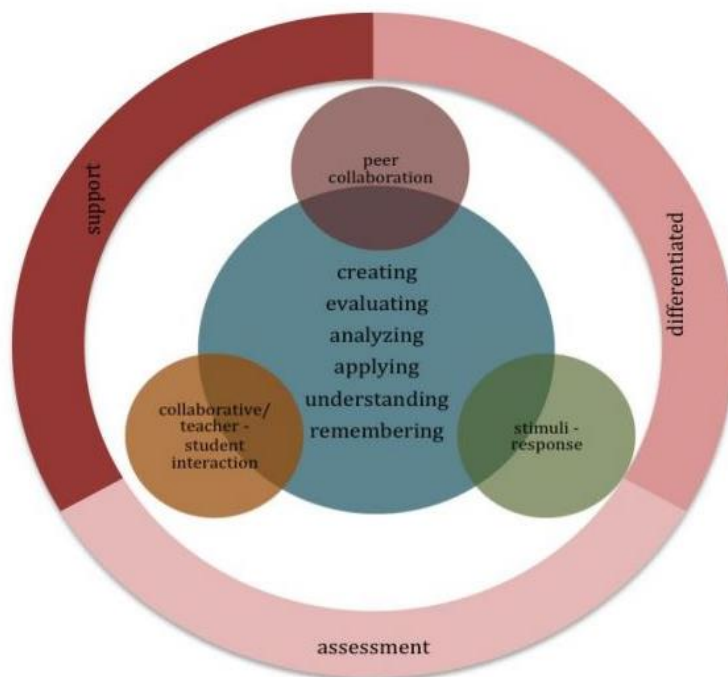
4. Methodology

The research utilized a developmental research approach for the design and development of modules. Research and development approach is used to develop a certain product and then tests its implementation (Adriani, Dewi Lubis & Abdillah Triono, 2018). In this study, one subject of B.Ed. (04 years) i.e., critical thinking and reflective practices, was selected for development of modules. The modules were developed for this subject, and the one class of B.Ed. program (who were studying this course in the subsequent semester) used these modules for one semester (Richey, Klein & Nelson, 2004). Their responses about their experience with these modules were recorded verbally through semi-structured interviews. The questions included in the semi-structured interview were validated by three experts from the field of education. The qualitative responses were analyzed by open coding and locating the patterns in their qualitative responses through thematic analysis.

i. Pilot-Testing of the Modules

Before using the modules for the mentioned class, one section of a module was pilot-tested on a group of pre-service teachers; this group was different from the group included in the sample of the study. It helped the researcher some adjustments in the modules such as the nature of the task and the instructions for the teacher and students for class tasks.

ii. Subjects of the Study

The population of the study were the students of B.Ed. (04 years) in Rawalpindi and Islamabad. The subjects of the study were one class of B.Ed. (04 years program) selected through purposive sampling technique. There were 23 students in the age range 18-21 years in this class. This class was selected as the subjects of the study because they were studying the same subject for which the modules were developed, in the subsequent semester. At the start of the study, the students signed a consent form for participating in the study. The students were not proficient in the use of technology for the learning process. Therefore, an orientation and training session was arranged for the participants for accessing and using online resources at the beginning of the semester before they used these modules for learning the course concepts.

iii. Development of the Modules

The modules were developed for the course 'Critical Thinking and Reflective Practice' (03 Credit Hours) of the B.Ed. program. The design considerations as suggested by Gerber and Eybers, (2021) provided a guideline for the development of modules. The course learning outcomes were reflected in the outcomes for eight modules. The contents of the modules are mentioned in the image below.

Table 1

Contents of the Flipped Classroom Modules

Unit of the Course	Content of Modules
Unit 01 Introduction to Critical Thinking	In this module, the concept of critical thinking was explained with the help of several definitions of critical thinking. The skills for critical thinking and barriers to thinking critically were discussed. Important concepts related to critical thinking such as argument, proposition, claim, reason, agreement/disagreement, conclusion and logical order were explained with the help of at least two examples. The difference between argument, description, explanation and summary were elaborated in this unit.
Unit 02 Strategies and Techniques to Develop Critical Thinking	In this module, the techniques for brainstorming and concept mapping, and the use of Venn diagrams for critical thinking were explicated. The generalization based on the available evidence was also discussed. The flaws in the generalization such as sweeping and hasty generalization were clarified with the help of examples.
Unit 03 Critical Thinking and the Art of Questioning	In this module, the different types of questions and their use for critical thinking was elaborated. Six types of Socratic questions by R. W. Paul were also discussed. The characteristics of 'Good' questions and the errors to avoid while asking questions were also explained in this module. The analysis of the point of view of a person was a section of this module where the perspective, values and purpose behind a statement were analyzed using sample texts.

Unit 04 Critical Thinking and its Applications	In this module, the characteristics of an academic text such as the use of formal language, avoiding short forms, emotive language and phrasal verbs were explained. The difference between primary and secondary sources of information was covered along with literature search and reputable sources such as journal articles and 'authorities'. The relevance/irrelevance of evidence, currency, reliability, validity and authenticity of evidence and triangulation were elaborated. Interrogating a given text for its currency, relevance, authority, accuracy and purpose, was discussed.
Unit 05 Introduction to Reflection	In this module, the concept, significance, and levels of reflection were explicated. The reflective practice in small groups and teams was also discussed.
Unit 06 Major Proponents of Reflective Practice	In this module, the contribution of John Dewey, D. Schon and L. Stenhouse in the field of reflection were discussed. Students evaluated their contribution to reflective practice.
Unit 07 Process and Techniques of Reflection	In this module, Gibb's cycle of reflection and Kolb's cycle of reflective practice were discussed. The skills for reflective practice such as self-awareness, description, critical analysis, and synthesis were explicated. Major techniques and strategies such as critical incident analysis, reflective journals, peer coaching and action research were discussed in detail for their characteristics and procedure.
Unit 08 Application of skills and approaches to reflection	In this module, systematic reflection throughout the coursework using Bloom Taxonomy (cognitive domain) was elaborated. The key questions which may help teachers to reflect on their teaching from time to time were discussed along with the issues faced by the teachers in becoming reflective practitioners.

For the development of content of the modules, student learning outcomes were stated for each topic. A deliberate search of relevant resources was conducted. The reference books, YouTube, websites, pdf files were compiled for each topic. Each module was divided into a number of sections. Each section consisted of seven segments as shown in figure 04. The allocated time for one section was 120 minutes. Learning outcomes at the start of each section were clearly stated for the guidance of teacher and the students.

The learning resources which were used for pre-class reading purpose, included chapters/pages from the books, YouTube videos, class notes, slides and the website content. The duration of one video was between 5-12 minutes. If the content required more time for learning, the instructional material was segmented into the chunks of the mentioned time limit to reduce the boredom and distractions.

The class quiz and face-to-face class activity (e.g., individual/group activity) were designed

according to the nature of topic and competencies required. Google Forms were used as the class quiz platform. The class quiz consisted of multiple-choice questions and it was auto-graded through Google Forms. The class activities in the modules were designed in a way that it involves applying the subject's concepts for solving the problem or completing the assigned tasks. Some activities were individual activities and some were group activities.

A set of role expectations of teacher and students, and nature of work to be accomplished by a student were also clearly written for a class activity. Teacher's feedback to students on their performance in class activity was based on nature of work to be completed by the students. Further learning material and the reflection form was a mandatory part of each segment.

Google Classroom was used as Learning Management System (LMS). Learning Management System provided access to the learning material, quiz, class activity and reflection form. WhatsApp was used as a platform for after-class communication such as comments, questions, and feedback.

Figure 3

Structure of a Flipped Classroom Module
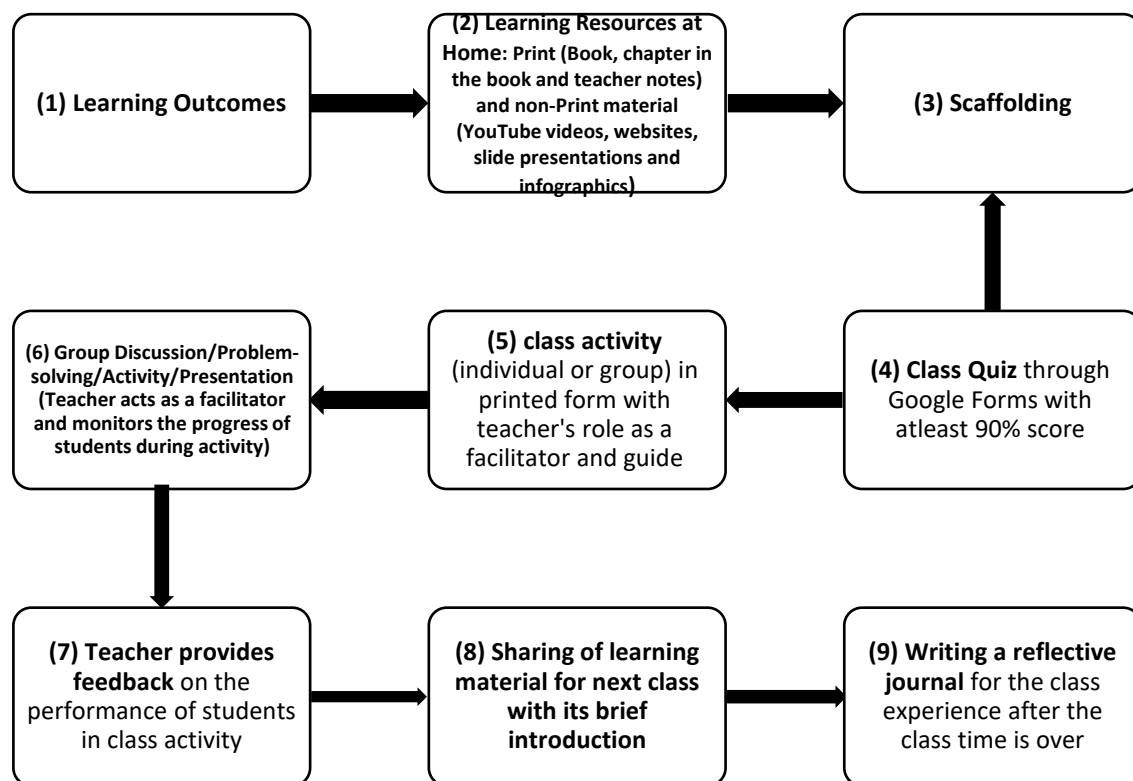
The students watched the instructional video(s) and/or read the learning material before class time. During class time, they attempted the class quiz to determine their minimum level of comprehension (i.e., 90% marks in the class quiz was the qualifying score to pass it). After successful completion of the class quiz, the students were given a briefing about class activity. When the students were working on the class activity, the teacher was available in the class as a guide and facilitator.

After the completion of the class activity, the students shared the output of the class activity with the teacher and the teacher provided them feedback on their performance. At the end of class, the students filled out an after-class reflection form consisting of three main sections: what they learned today, their reflection on what they learned, and their suggestion(s) for the upcoming class.

iv. Experiences of Students About Flipped Classroom Modules

After the successful completion of the course modules, the data about students' experiences was collected through audio-recording of their responses. Their responses were in favour of the modules and the way it helped them to learn in a better way, as shown in figure 05. Their suggestion was to include the pre-class video resources with subtitles so that the students can understand the concepts even if they are struggling with the English language.

Figure 4.
Responses of Students about Their experience of using Flipped Classroom Modules
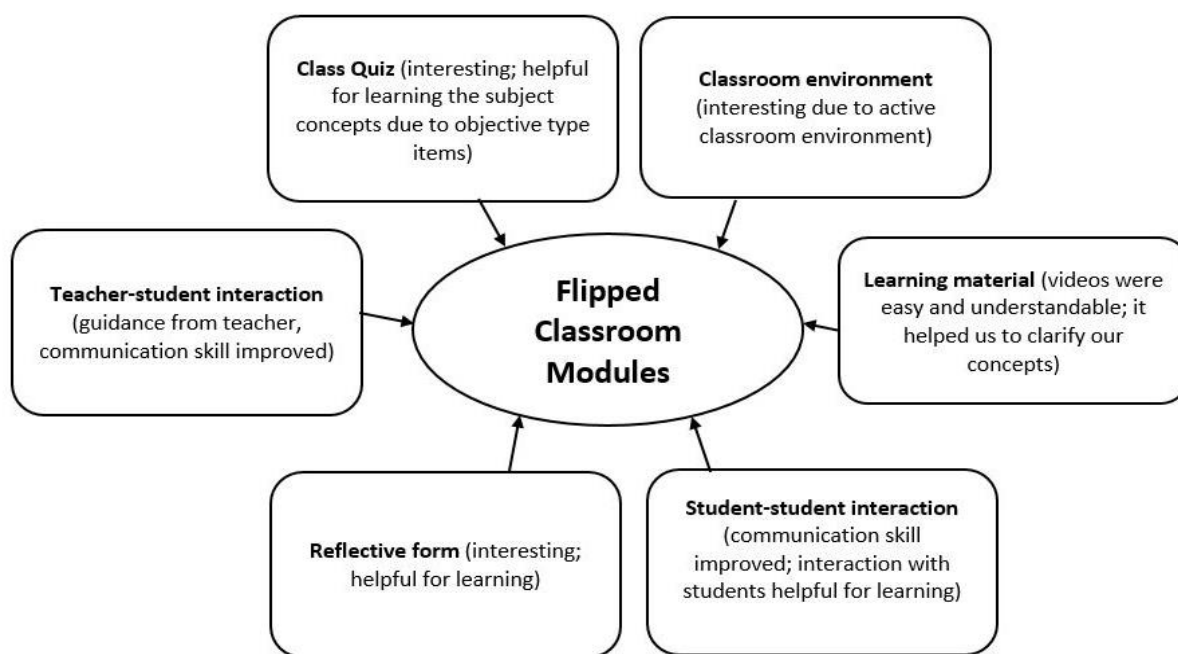
5. Discussion

Flipping a course requires advanced instructional design planning and considerable time for arranging course activities (Arslan, 2020). Further, updating the course content from time to time keeping in view the latest trends in the subject and the technologies used for delivering the content is a challenge for the instructor of the course involving flipped classroom (Roehl, Reddy & Shannon, 2013). The arrangement of the resources of the course for the first time was a very time-consuming process. However, once the instructional material has been assembled in one place, it can be updated with very less effort and time because the resources particularly Open Educational Resources (OERs) can be easily adapted for the flipped classroom in future. The

benefits of flipped classroom encompass the one-to-one interaction between the teacher and the student, students learning at their own pace, re-use of resources if the student missed the class, and active participation of students in the class content (Roehl, Reddy & Shannon, 2013). The videos and the print resources can be used by a student to slow down, pause, rewatch/re-read and learn at their own pace. Further, they could ask questions from the teacher in the WhatsApp class group for pre-class activities. The pre-class work must be comprehended by the students to successfully complete classwork. Therefore, they had to actively engage with the pre-class work. For motivating students for completing pre-class work, learning outcomes were shared with them and the class teacher was available online if students had any questions related to the topic. During the class time, there were either group activities or individual activities where students were required to participate and complete the assigned work. So, the students were active during class time and reported their work to the teacher during class time. The students were also helping each other if anybody needs help to complete the assigned activity.

One of the challenges of implementing flipped classroom is learning and accessing the latest technology tools for delivery of course content. The teachers may be provided training for the use of existing and the latest technologies for the delivery of course content (Roehl, Reddy & Shannon, 2013). In these modules, the technology tools used, was free and readily available for use on android phone and personal computers. The teacher was familiar with majority of the technology tools used in the modules; a brief orientation to the teacher further helped to work with the course modules.

Few challenges the teachers face while implementing flipped classroom include adapting the traditional content to online mode using different media for the flipped classroom, and clear expectations for students learning (Roehl, Reddy & Shannon, 2013). Challenges associated with the flipped classroom technology include cost, time, technology resources and skills for utilizing, developing and/or arranging technology in the classroom (Pellas, 2018). In this study, the modules included the already available resources in the course such as YouTube videos, Dailymotion videos, pages/chapters from the books, PowerPoint presentation slides, Prezi, Powtoon, and other website materials. The researcher used platforms and software for this course which were available free of cost. The instructional material provided for the pre-class component clearly stated the learning outcomes for the students. Further, before the start of the semester, a short orientation training was provided to the students about using technological resources for course activities.

The instructor serves as a facilitator of the learning process and s/he can provide the facilitation by providing the context and the support for the learning process, anytime (Gerber & Eybers, 2021). As the role of the students change from passive to active learner (Arslan, 2020), they are also required to be trained for it. In this study, the modules of the course have clearly stated learning outcomes for pre-class and in-class activities. When the students were clear about the expectations of their role, they were engaged in working to achieve it. It took a few classes to train them for their new role. Once they were ready to adopt this shift in their role, they were more engaged in the class as depicted through their classroom behavior and the reflective journals submitted by them.

Social networking and communication with the students and the instructor play an important role in the learning process. Being a facilitator is a skilled job (Gerber & Eybers, 2021). The availability of the teacher for the facilitation of course activities is required beyond the class time.

For this purpose, some synchronous and asynchronous communication sources may be helpful. For this study, the WhatsApp class group was used for teacher-peer and peer-peer communication and collaboration beyond the class time. It was a low-cost medium for the subjects of the study. An important aspect of facilitation was the realization of when and how much support should be provided to the students.

Due to the COVID-19 pandemic, the higher educational institutions moved to remote and online teaching modes. In this scenario, the flipped classroom can be helpful (Gerber & Eybers, 2021). The modules were designed in such a way that the students had flexible access to the learning resources using a mobile network. For example, the YouTube videos were downloaded and shared through WhatsApp by the instructor which helped the students to access it because the mobile networks offered very reduced rates for the use of WhatsApp as compared to other platforms such as Google Classroom, Gmail and YouTube. The printed instructional material was shared through Google Classroom and the WhatsApp class group for all students. The students were provided in-class activities to the students in printed form during class time. It can be shifted to the online platform where the group activities can be carried out through a WhatsApp group call or Zoom sessions. The synchronous and/or recorded sessions depending upon the need of the students and the resources available to them may be helpful for the in-class component of the flipped classroom.

The Google Docs can be used for an in-class/online group activity where group members can contribute to the group work on the assigned task. The work completed by the students can be submitted through LMS or Google Docs to receive feedback from the teacher. The teacher-student interaction and peer-peer interaction can be carried out through WhatsApp class groups and through the discussion board on LMS. The students may share their daily reflections through Google Forms, or any other online Survey form shared with the students through LMS. In these modules, the students shared their reflections through WhatsApp and Mobile text messages which was a low-cost source for the students.

6. Conclusion

The flipped classroom modules were developed for a class from a digitally divided developing country which distinguishes the characteristics of this research from the majority of the literature available in this field. In these modules, learning resources, activities and tasks were provided keeping in view the pre-class, in-class and post-class phases of flipped classroom for an undergraduate course. The flexible access to the learning resources, use of freely available technology for the course, role expectations of the teacher and students, and use of social networking platform (i.e., WhatsApp), and in-class and out-of-class communication were the key considerations in developing the modules for the course. The students shared their positive experiences about the course modules. The students suggested that instructional videos with subtitles must be provided for before-class segment of the module if the videos are in English language.

The modules were implemented in a small-group class and their effectiveness for a larger group of students may be tested in the future. The researcher also plans to evaluate the effectiveness of the modules for tracking of course learning outcomes by the students. The feasibility of modules in diverse classroom contexts and inclusive classroom settings may be investigated. These modules may be helpful for preparing modules based on flipped classroom instruction for other courses of B.Ed. (04 years) program. However, the classroom context

nature of the subject, and the competences of students must be kept in view while designing the course material and the class tasks.

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