International Research Journal of Management and Social Sciences, Vol. IV, Issue 3, July – Sep 2023
ISSN (ONLINE):2710-0308 www.irjmss.com ISSN (PRINT):2710-0316
DOI: **10.5281/zenodo.10725219**

Learning Outcomes by Integrating Blended Learning Flipped Classroom Model: An Experiment on Secondary School Students

Masood Ahmad
Assistant Professor, Department of Educational Training, The Islamia University of Bahawalpur, Punjab, Pakistan.
Email: masood.ahmad@iub.edu.pk

Sabir Hussain
Ph.D. Scholar, Department of Educational Training, The Islamia University of Bahawalpur, Punjab, Pakistan.
Email: sabirjanmarri@gmail.com

Fakhar-Ul-Zaman
Visiting Lecturer of Education, University of Narowal, Punjab, Pakistan.
Email: malikfakhar717@gmail.com

Abdul Qahar
PhD. Scholar; Secondary Teacher Education, Allama Iqbal Open University Islamabad, Pakistan.
Email: abdulqahar045@gmail.com

Received on: 23-07-2023 Accepted on: 26-08-2023

Abstract

Blended Teaching Flipped Classroom Model is new teaching trend; if it is integrated with education, it will make teaching much more accessible, and it can also work as a teacher. Through Blended Teaching Flipped Classroom Model, students learn very quickly with pre-videos, lectures and learning material through already feed in Cellular Tablits and discussion in WatsApp group. The purpose of this research was to conduct a practical experiment on Blended Teaching Flipped Classroom Model to see the students' learning level and the level of students' excitement and engagement. This educational experiment was conducted on Boys Government High School No. 1 Dera Ghazi Khan Class 10th students. For this purpose, two groups of average intelligent students were formed by taking the pre-test. These groups consisted of 15 to 15 students who were given four months of treatment through Blended Teaching Flipped Classroom Model. Then, the data were collected and interpreted through statistical tools. From this experiment, it was found that the excitement and engagement of the students taught through Blended Teaching Flipped Classroom

ISSN (ONLINE):2710-0308 www.irjmss.com ISSN (PRINT):2710-0316
DOI: **10.5281/zenodo.10725219**

Model were very high, and the scores on the achievement test were also very high. It is recommended that teachers should be aware of this new teaching method in educational institutions. The government should also allocate a specific budget for Blended Teaching Flipped Classroom Model.

Keywords: Blended Teaching; Flipped Classroom Model; Secondary school students, Learning outcomes; Pedagogy.

Introduction

A more well-rounded education for children may be achieved via blended learning, which combines online and offline components. This includes a mix of classroom-based activities and online materials (Kumar et al., 2019). "Blended learning is the intentional blending of classroom face-to-face learning experiences with online learning experiences," according to a formal definition of the term proposed by Garrison and Kanuka (2004).

A more well-rounded education may be provided to pupils via blended learning, also known as hybrid learning, which combines traditional classroom teaching with online technological learning. Most public institutions, including junior colleges, colleges, and universities, adopt this "blend" approach to teaching and learning (Aksel, 2021).

This kind of instruction has been gradually included into the foundation of higher education with the advent of digital technology in the twenty-first century and the ubiquitous usage of mobile devices in all facets of daily life (Shurygin et al., 2022). By providing an integrated learning experience that is both valuable and tailored to the requirements of learners, its application aims to facilitate simpler and more successful learning.

The purpose of blended learning is to better assist students in achieving their learning objectives and meeting their individual requirements. Instructors and students alike may get many benefits from blended learning courses when done well (Bouilheres et al., 2020).

The presentation of learning materials and the delivery of synchronous or asynchronous online training are both given more leeway to educators. Also, since it's self-paced, students may study whenever it's convenient for them and adapt their approach based on their individual learning preferences (Moorhouse & Wong, 2022).

The efficiency and efficacy of meaningful learning experiences may be significantly improved via the use of blended learning methodologies, according to research. Students are more likely to participate and learn from one another when teachers and students are able to communicate via email, message boards, or chat rooms (Ayob et al., 2023).

Teachers in a blended classroom may see their students' progress more clearly and fill up any knowledge gaps with the use of digital resources. Because of this, they are able to tailor their educational experiences and pedagogical approaches to better suit their unique requirements and areas of interest (Ashraf et al., 2021).

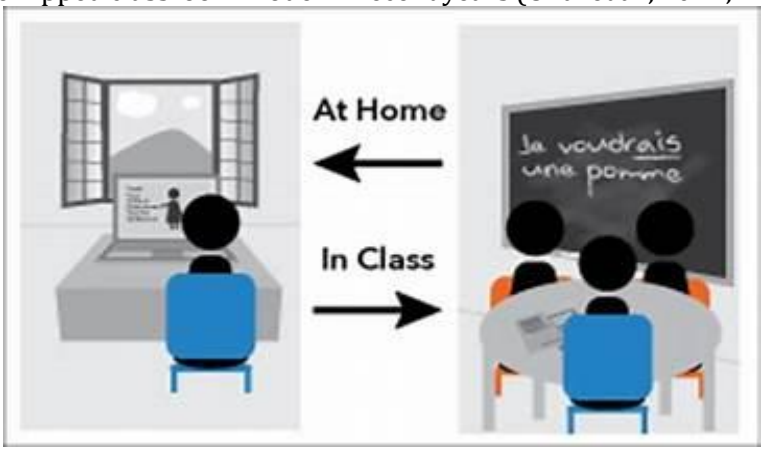
A blended learning strategy drastically reduces the amount of time students spend in-person with teachers. Teachers are able to contact more students and take more of them under their wing when 30–70 percent of the learning takes place online (Bornkamm et al., 2021).

Blended learning has several advantages, one of which is the fact that it helps educational institutions and businesses save money. Educational organisations and institutions may significantly reduce expenses related to travel, venue rentals, and learning material printing by embracing digital learning (Chowdhury, 2020).

One innovative and widely used approach to education is the "flipped" or "inverted"

ISSN (ONLINE):2710-0308 www.irjmss.com ISSN (PRINT):2710-0316
DOI: **10.5281/zenodo.10725219**

classroom, in which students work on assignments that would typically be assigned at home instead of in class and vice versa (Al-Samarraie et al., 2020). Instead of the instructor only lecturing at the students, in a flipped classroom model, the students take charge of their own education and choose their own pace (Bursa & KOSE, 2020). Teachers may involve students in various learning activities including discussion, problem solving, hands-on activities, and coaching instead of using class time to impart information via lectures. Numerous fields (math, sociology, the humanities, etc.) and educational institutions all over the globe have begun to use the flipped classroom model in recent years (Unal et al., 2021; Amir et al., 2022).



Active learning has been equated by some with the flipped classroom model. The flipped classroom model is just one of several strategies for making lessons more interactive and engaging for students. The fundamental tenet of a flipped classroom is the rejection of traditional methods of teaching that rely on teacher-led lectures. Instead, students are provided with the necessary materials before class, allowing teachers more time in class to focus on activities that promote higher-order thinking (Li et al., 2023).

The most challenging aspect of establishing a flipped classroom, according to many instructors, is locating or creating resources for students to utilise outside of class. What really matters in a flipped classroom, as opposed to a traditional lecture hall, is the actual learning that takes place there. Therefore, before you start looking for materials for students to use at home, you need to determine how you will spend class time. Students are expected to put in significant effort outside of class time in a flipped classroom format. If students do not see how this activity allows them to have more instructional time in class, they will dislike it (Lee et al., 2023).

In the educational strategy known as "flipping the classroom," students are required to do pre-classwork, such as reading the assigned materials or watching a recorded lecture, before attending class. In class, students are encouraged to actively participate, ask questions, and reflect on what they have learned in order to fully grasp, apply, and expand upon course material. During class time, students work together on assignments and make use of active learning tools including problem sets, case studies, and organised discussions. Classes are videotaped (either as video or as narrated screencasts). After seeing these lectures for homework, students work in small groups with the help of teachers and GSIs to complete problems or other highly engaging, organised activities during class time (Da Silva, 2023).

ISSN (ONLINE):2710-0308 www.irjmss.com ISSN (PRINT):2710-0316
DOI: **10.5281/zenodo.10725219**

A flipped classroom, as stated by Harvard University, is "based on the premise that lecturing or providing one-on-one guidance is not the most effective use of class time (Goksu & Duran, 2020). The time in class may be better spent on tasks that require higher-order thinking since students are now exposed to the material before class. The instructor often takes the lead during class time in a conventional classroom, with students sitting quietly and listening to lectures. After that, students go home and finish up any remaining homework, such as papers or projects. Homework or reading assigned materials constitute student work in a flipped classroom. Deeper learning activities, such as class discussions, laboratories, and teacher-student one-on-one time, take place during class time (Goksu & Duran, 2020).

The notion of flipped classrooms is fraught with myths. A common misconception is that instructors are being "replaced" with video lessons. This would never happen in an actual flipped classroom. Actually, classes are a great opportunity for instructors to get a lot more done, and they're usually even expected to. Complex laboratories, debates, and projects are supervised by them, and they modify education based on each student's requirements (Rehman & Lakhan, 2021).

The fundamental principle of the pedagogical paradigm known as the "Flipped Classroom" is to "flip" the traditional way of teaching. Prior to class, students are expected to study the assigned materials and attend the lectures so that they are prepared to actively participate in learning activities that are connected to their schoolwork. Make engaging, high-quality recorded lectures that cover all of the material (substantial pre-planning and prep work required before pilot semester). Lessons should be kept to a reasonable length (about 15 minutes) (Gopalan et al., 2022).

Make sure to include Active Learning into your classroom activities. The information that students have learned in class should be put into practise. (for example, educational games, speeches, debates, group projects, problem solving, presentations, individual homework, and case studies). Stay away from "busy job" that's just a time-waster. Keep yourself accessible throughout class time to help out and guide students. Go around, and be ready to lead and inspire student-centered, active learning. Participate in class discussions (Hussain et al., 2022; Bean & Melzer, 2021).

Literature Review

Around the last decade, the flipped classroom model has gained popularity across a wide range of academic fields, grade levels, and educational institutions all over the globe. With its official introduction in 1998, the flipped classroom model switches the traditional lecture format from in-person to pre-class delivery (Gillette et al., 2018). Students prepare for class by reading up on the material, rather than sitting passively while professors explain the fundamentals (e.g., through recorded lecture videos). This warm-up helps students get ready for in-class courses that use active learning strategies like problem-solving to help them grasp the material (Davies, Dean, & Ball, 2013; Fulton, 2012).

Despite the many claims made in favour of the flipped classroom model, it does have a few serious drawbacks. Time spent teaching is one of the most important of these concerns. It could be challenging to find the time and energy to produce high-quality video lectures and appropriate in-person activities for a flipped classroom model (Cheng, Ritzhaupt, & Antonenko, 2019). According to McLaughlin et al. (2014), compared to a standard lecture

ISSN (ONLINE):2710-0308 www.irjmss.com ISSN (PRINT):2710-0316
DOI: **10.5281/zenodo.10725219**

course, a flipped classroom requires a faculty member to spend 128% more time on planning and management and 57% more time on upkeep. A 12-to 13-minute film might be shot in two or three hours (Altaii, Reagle, & Handley, 2017).

Students' lack of engagement with pre-class activities is perhaps the second most important problem (Diwanji, Hinkelmann, & Witschel, 2018). Diwanji et al. (2018) found that out of all students in flipped classes, only 27.7% consistently completed their assignments before class. Seventy percent or more of flipped classroom students did not finish the assignments before class, and 39% said they did very little to prepare for their in-person meetings, according to other studies (Sahin, Cavlazoglu, & Zeytuncu, 2015). (Palmer, 2015). If pupils do not finish the assignments before class, the teacher will have to go over the content again. A "flopped classroom," rather than a "flipped one," would be the term to describe this situation, as it would make the whole flipped learning technique identical to a regular lecture.

The efficacy of flipped learning in enhancing student outcomes in comparison to conventional learning has been the subject of ongoing dispute despite much research on the topic (Chen, Lui, & Martinelli, 2017). The results of "half of the [flipped] experiments revealed no change in test performance," according to Seery (2015). (p. 763). Some studies found that students' learning was hindered by the flipped classroom, while others found no strong evidence that flipped learning was effective (e.g., Betihavas, Bridgman, Kornhaber, & Cross, 2016; Chen et al., 2017; DeSantis, Van Curen, Putsch, & Metzger, 2015; Gillette et al., 2018; Gundlach, Richards, Nelson, & Levesque-Bristol, 2015; Kennedy, Beaudrie, Ernst, & St. Laurent, 2015; Yong, Levy, & Lape, 2015). (Hagen & Fratta, 2014; McClelland, 2013).

Accurate estimations of the flipped classroom approach's impact on student outcomes should be prioritised, considering the substantial resources committed in flipped learning. To do this, it is conceivable to discover potential variables that alter this impact and to determine the overall mean effect by performing a meta-analysis of individual flipped classroom primary studies (Gurevitch, Koricheva, Nakagawa, & Stewart, 2018).

In flipped classroom research, meta-analyses are being used more and more. We are now aware of 19 meta-analyses pertaining to flipped classrooms (see Results). When comparing the efficacy of different interventions, meta-analyses are generally seen as a more reliable and impartial alternative to unstructured literature reviews (Rao et al., 2017). Research on the "impact" of the flipped classroom method on student results in comparison to more conventional, non-flipped classrooms has been the primary area of meta-analysis in this area so far. The primary goal of this research is to analyse and assess the methods used in published meta-analyses of flipped classrooms. Problems with meta-analysis technique are prevalent and often cast doubt on the reliability of the findings, even if meta-analyses are becoming more popular (Rao et al., 2017). The conclusions of a meta-analysis are very susceptible to the choices made at various points in the process (Pigott & Polanin, 2020). Despite the Cochrane Collaboration's best efforts, flawed meta-analytic technique continues to plague several disciplines and reputable organisations (Rao et al., 2017). It would seem that meta-analyses are becoming more unpopular in some industries, including healthcare (van Wely, 2014). For instance, meta-analyses have been deemed redundant and incorrect by several researchers (Ford, Guyatt, Talley, & Moayyedi, 2010; Park, Eisenhut, van der Vliet, & Shin, 2017; Siontis, Hernandez-Boussard, & Ioannidis, 2013).

Subject-specific information (e.g., facts, ideas, processes) is what we mean when we talk about

ISSN (ONLINE):2710-0308 www.irjmss.com ISSN (PRINT):2710-0316
DOI: **10.5281/zenodo.10725219**

cognitive consequences (Klein et al., 2005) Standardized tests and examinations, as well as those created by teachers, are often used to evaluate cognitive results (Davis, Curtis, & Tschetter, 2003) .

Fifteen of the seventeen meta-analyses found that flipped classrooms led to better academic performance. The meta-analyses' primary conclusions on the efficacy of flipped classrooms ranged from insufficient to robust. Impact sizes on cognitive results varied from 0.19 to 1.13 on average. Two studies published in Chinese-medium journals that included only nursing students from China had the two biggest impact sizes (1.06 and 1.13). These studies were Hu et al. (2018) and Tan et al. (2017). In contrast to the other meta-analyses, these substantial impacts stand out. Both the Hu et al. (2018) and Tan et al. (2017) investigations used cognitive tests, therefore the discrepancies can be attributable to changes in research design, quality, or psychometric components. One such explanation might be that traditional Chinese education is seen as having a stronger emphasis on memorization when contrasted with its Western counterpart (Phillipson & Lam, 2011). In order to ensure that their pupils do as well as possible on university admission exams, many teachers "teach for the test" by focusing on test prep (Phillipson & Lam, 2011, p. 24). Students are supposed to remain silent and refrain from challenging professors' material during lectures in this kind of setting (Sit, 2013). According to Hu et al. (2018), students' motivation to study is significantly reduced in a conventional, submissive learning culture, which further emphasises the contrasts between traditional and flipped classrooms. Because of this, it's not surprising that the flipped classroom model, which places more emphasis on active learning, has been more successful in China than this more conventional teaching method.

In four meta-analyses, researchers looked at how flipped classrooms affected student behaviour results compared to traditional classrooms (Chen et al., 2018; Hu et al., 2018; Tan et al., 2017; Xu et al., 2019). Behavioural outcomes refer to a learner's motor skills or competences in performing a task. When comparing flipped learning to more traditional approaches, three of the four meta-analyses indicated that it produced better behavioural outcomes (Hu et al., 2018; Tan et al., 2017; Xu et al., 2019). The average effect size of behavioural outcomes in these three meta-analyses ranged from 1.40 to 1.79. Even though just one meta-analysis (Chen et al., 2018) found no statistically significant difference in behavioural outcomes, the flipped classroom nevertheless had a favourable mean effect of 3.12. However, it is important to note that this finding was only reached by using these two primary sources of information (Chen et al., 2018).

A total of five meta-analyses (Lăg & Sæle, 2019; Liu et al., 2018; Tan et al., 2017; Xu et al., 2019; van Alten et al., 2019) looked at how flipped learning affected the perceptual outcomes of learners. Perceptual outcomes are the results of students' self-evaluations as evaluated by surveys, including how satisfied they are with their learning. According to one meta-analysis (SMD = 1.18, Liu et al., 2018), students reported better success with flipped classrooms compared to more conventional classroom settings. A study by Tan et al. (2017) found a substantial benefit of flipped learning (SMD = 1.51), however a study by van Alten et al. (2019) found no benefit (g = 0.36) in relation to students' perceptions of their own learning. Effect sizes for students' perceptions of satisfaction ranged from 0.05 (van Alten et al., 2019) to 0.16 (Lăg & Sæle, 2019). d. It seems that the impact of classroom flipping on student satisfaction is minimal, according to this. n. This could be because flipped classrooms make students feel

ISSN (ONLINE):2710-0308 www.irjmss.com ISSN (PRINT):2710-0316
DOI: **10.5281/zenodo.10725219**

like they have more work to do than they really have (Tune, Sturek, & Basile, 2013). The second meta-analysis looked at a plethora of different perceptual outcomes (e.g., the ability to work together, to be practical, to be interested in participating, and to think critically), and it found that flipped learning had positive and statistically significant effects on each of these outcomes. From 1.32 to 1.6, these effect sizes were recorded. 2.

According to Karagol ¨ and Esen (2019) and Laᾱg and Sæle (2019), the flipped classroom model seems to work better with smaller groups of participants. There was a 42% overlap in the main papers included in the two meta-analyses. As an example, Karagol ¨ and Esen (2019) discovered a statistically significant variation in effect size according to sample size (p =.01), leading us to assume that smaller samples probably indicate smaller classes. In samples with 1–30 participants, the flipped classroom had a larger impact on learning accomplishment (g = 1.06) compared to samples with 31–60 participants (g = 0.67) or 61 participants or more (g = 0.358). One probable reason for this might be that the intervention is applied with greater care in small studies, particularly when it comes to the amount of specific attention teachers provide each student (Shapson, Wright, Eason, & Fitzgerald, 1980) It's possible that the flipped classroom model works better with smaller groups of students than with larger ones, as instructors are able to devote more time and energy to each student. Because of the potential for publication bias, smaller studies also often have bigger effect sizes than big samples (Slavin & Smith, 2009) Compared to research with large samples, those with small samples are more prone to publication bias (Rothstein, Sutton & Borenstein, 2005) It's very improbable that a tiny research would be published if it finds no substantial impacts (Slavin & Smith, 2009) Statistical significance in short studies is often achieved with bigger effect sizes compared to large studies. Thus, if studies that find substantial differences are more likely to be published, then tiny studies with big effect sizes will also be published more often (Slavin & Smith, 2009) .

Statement of Problem

Teachers are looking for innovative teaching strategies to enhance teaching-learning in light of technological advancements. Teachers are investigators by nature; they plan lessons based on the IQ of each student. There are students who learn quickly and some who learn more slowly. Using cutting-edge technology can help deal with slow learners. It is a smart teaching method to incorporate the blended learning flipped classroom model, especially in science disciplines like biology and physics. It can be utilised to teach difficult theories and concepts in both college and in the classroom. The current study was an innovative investigation into the field of education, aiming to improve science education for secondary school pupils. This was an experimental study designed to investigate the effects of integrating blended learning into a flipped classroom model on students' academic attainment. The field of education and pedagogy will benefit from the study's findings.

Objectives of the Study

The following were the objectives of the study;

1. To see the impact of the Blended Teaching Flipped Classroom Model on students' excitement and engagement.
2. To see the learning outcomes by Blended Teaching Flipped Classroom Model in

ISSN (ONLINE):2710-0308 www.irjmss.com ISSN (PRINT):2710-0316
DOI: **10.5281/zenodo.10725219**

biology subject at the secondary school level.

Hypothesis of the Study

The following were the hypotheses of the study;

Ho.1 The Blended Teaching Flipped Classroom Model does not impact students' excitement and engagement.

Ho.2 There is no impact on learning outcomes by Blended Teaching Flipped Classroom Model in biology subject at the secondary school level.

Methods and Procedures

This research was an experimental investigation. The study sought to investigate how students' enthusiasm, engagement, and academic performance in the subject of biology were affected by the Blended Teaching Flipped Classroom Model. Students in class 10 at Government Boys High School No. 1 Dera Ghazi Khan were chosen for the experiment for this reason. The 10th Iqbal-Secon class was selected for the experiment using cluster sampling. First, only kids with average exam scores were chosen for this experiment; high and low achievers were not included in the study. Out of 73 students, only 30 intermediate scorer students were selected for the experiment in accordance with recommendations made by Krejcie & Morgan (1970). Two groups were created using the fishbowl simple random sample approach. A control group of fifteen students and an experimental group of fifteen students were selected.

Experiment Procedure

There was just one biology subject selected for the experiment, and the experimental group was given separate treatment in the computer lab for the entire biology time due to a shortage of classrooms. The experimental group had Dr. Qazi Abdul Ghafor teach the class using the Blended Teaching Flipped Classroom Model with the assistance of an IT teacher, while the control group continued their regular classroom instruction. Cellular tablets were provided by D.G. Khan, a Japan Electronics franchise, for the trial. The 10th biology class's video lectures, notes, and diagrams for chapters one through three were already loaded into those cellular tablets, which were also used to create WhatsApp groups. Experts in franchises also contributed to this experiment. Their goal was to promote these cellular tablets for usage in both private and public educational settings.

Treatment

The teacher would give the children a task like homework in every lesson to listen to these videos of the lesson, watch the charts, see the diagrams, read the notes and then answer the questions in the WhatsApp group. All children must participate in this group discussion. Then, the next day, the teacher would teach the same lesson in the classroom.

Experiment Duration

The actual duration of the experiment was six months; in the first month, the pre-test was conducted, and groups were made; treatment started in the second month, the total duration of actual treatment was four months, and the last month's data were collected and analyzed,

ISSN (ONLINE):2710-0308 www.irjmss.com ISSN (PRINT):2710-0316
DOI: **10.5281/zenodo.10725219**

and final results were concluded.

Development of Tools

Two achievement tests were made for data collection; both tests were teacher-made as usual. The first test was made for the pre-test, and the second was from chapters 1 to 3 for the post-test; both were traditional achievement tests.

Validity and Reliability of the Tools

Experts validated both tests. Then, reliability was checked through SPSS; the reliability of the first test was .91, and the second test was .89, which was excellent.

Data Analysis Procedure

Two achievement tests were made to assess the student's achievement in biology. The first test was used for the pre-test, and the second for the post-test. Only post-test results were correlated with each other; for this purpose, mean score, standard deviation, and independent sample t-test were applied. Students' excitement and engagement levels were checked through the observation method.

Results of the Study

Ho1. The Blended Teaching Flipped Classroom Model does not impact students' excitement and engagement. Finding: All fifteen students in the experimental group were more excited and engaged than the control group students; the null hypothesis was not accepted.

Table No. 1

Ho2. There is no impact on learning outcomes by Blended Teaching Flipped Classroom Model in biology subject at the secondary school level.

Independent Sample t-test					
Groups	*f*	μ	σ	t	α
Experimental	15	3.8952	.33050	11.161	.000
Controlled	15	2.6286	.28977		

Table No. 1 describes the experiment results. It was found that the experimental group's mean was higher than the control group's, and a significant difference between both mean scores was found. The mean value of the experimental group was (3.8952), and the standard deviation was (.33050). The mean value of the controlled group was (2.6286) and the standard deviation was (.28977). The t-test value was (9.313), $p < .05$; the null hypothesis was not accepted.

Research Conclusions

It was concluded that the experimental group's mean score was higher than the control group's. The results of the t-test were found to be significant. There was a significant difference between the achievement scores of the experimental and control groups.

Recommendations

According to the study conclusion, some recommendations were made as follows;

1. It is suggested that teachers learn about Blended Teaching Flipped Classroom Model.

ISSN (ONLINE):2710-0308 www.irjmss.com ISSN (PRINT):2710-0316
DOI: **10.5281/zenodo.10725219**

2. The public and private sector schools should promote Blended Teaching Flipped Classroom Model.
3. There is a need to promote Blended Teaching Flipped Classroom Model in education.
4. The government should be interested in promoting Blended Teaching Flipped Classroom Model in education, especially at the school level, and sufficient funds should be allocated for Blended Teaching Flipped Classroom Model in the education sector.

References

1. Aksel, A. (2021). A study on the effectiveness of a blended learning model in English language learning in higher education: Student attitudes and opinions.
2. Algarni, B. (2018). A meta-analysis on the effectiveness of flipped classroom in mathematics education. In *EDULEARN18 proceedings* (pp. 7970-7976). IATED.
3. Al-Samarraie, H., Shamsuddin, A., & Alzahrani, A. I. (2020). A flipped classroom model in higher education: a review of the evidence across disciplines. *Educational Technology Research and Development*, *68*, 1017-1051.
4. Altaii, K., Reagle, C. J., & Handley, M. K. (2017, June). Flipping an engineering thermodynamics course to improve student self-efficacy. In *2017 ASEE Annual Conference & Exposition*.
5. Amir, M., Hussain, S., & Muhammad, S. (2022). Identification of the Need for Teacher Training at The Primary School Level. *International Research Journal of Education and Innovation*, *3*(1), 165-176.
6. Ashraf, M. A., Yang, M., Zhang, Y., Denden, M., Tlili, A., Liu, J., ... & Burgos, D. (2021). A systematic review of systematic reviews on blended learning: Trends, gaps and future directions. *Psychology Research and Behavior Management*, 1525-1541.
7. Ayob, H. H., Daleure, G., Solovieva, N., Minhas, W., & White, T. (2023). The effectiveness of using blended learning teaching and learning strategy to develop students' performance at higher education. *Journal of Applied Research in Higher Education*, *15*(3), 650-662.
8. Bean, J. C., & Melzer, D. (2021). *Engaging ideas: The professor's guide to integrating writing, critical thinking, and active learning in the classroom*. John Wiley & Sons.
9. Betihavas, V., Bridgman, H., Kornhaber, R., & Cross, M. (2016). The evidence for 'flipping out': A systematic review of the flipped classroom in nursing education. *Nurse education today*, *38*, 15-21.
10. Bornkamm, K., Koch, C., Dietterle, J., Steiert, M., Fleig, A., Weiller, C., & Brich, J. (2021). Teaching the neurologic examination: a prospective controlled study to compare a blended learning approach with face-to-face instruction. *Neurology*, *97*(20), e2032-e2038.
11. Bouilheres, F., Le, L. T. V. H., McDonald, S., Nkhoma, C., & Jandug-Montera, L. (2020). Defining student learning experience through blended learning. *Education and Information Technologies*, *25*, 3049-3069.
12. Bursa, S., & KOSE, T. C. (2020). The Effect of Flipped Classroom Practices on Students 'academic Achievement and Responsibility Levels In Social Studies Course. *Turkish Online Journal of Distance Education*, *21*(4), 143-159.
13. Chen, F., Lui, A. M., & Martinelli, S. M. (2017). A systematic review of the effectiveness of flipped classrooms in medical education. *Medical education*, *51*(6), 585-597.
14. Chen, K. S., Monrouxe, L., Lu, Y. H., Jenq, C. C., Chang, Y. J., Chang, Y. C., & Chai, P. Y. C. (2018). Academic outcomes of flipped classroom learning: a meta-analysis. *Medical education*, *52*(9), 910-924.
15. Cheng, L., Ritzhaupt, A. D., & Antonenko, P. (2019). Effects of the flipped classroom instructional strategy on students' learning outcomes: A meta-analysis. *Educational Technology Research and Development*, *67*, 793-824.
16. Chowdhury, F. (2020). Blended learning: how to flip the classroom at HEIs in Bangladesh? *Journal of Research in Innovative Teaching & Learning*, *13*(2), 228-242.

ISSN (ONLINE):2710-0308 www.irjmss.com ISSN (PRINT):2710-0316
DOI: **10.5281/zenodo.10725219**

17. Da Silva, L. (2023). *Flipping the classroom to enhance student engagement in first-year statistics education* (Doctoral dissertation, University of the Free State).
18. Davies, R. S., Dean, D. L., & Ball, N. (2013). Flipping the classroom and instructional technology integration in a college-level information systems spreadsheet course. *Educational Technology Research and Development*, *61*, 563-580.
19. Davis, M. A., Curtis, M. B., & Tschetter, J. D. (2003). Evaluating cognitive training outcomes: Validity and utility of structural knowledge assessment. *Journal of Business and Psychology*, *18*, 191-206.
20. DeSantis, J., Van cuRen, R., Putsch, J., & MetzgeR, J. (2015). Do students learn more from a flip? An exploration of the efficacy of flipped and traditional lessons. *Journal of Interactive Learning Research*, *26*(1), 39-63.
21. Diwanji, P., Hinkelmann, K., & Witschel, H. F. (2018, March). Enhance Classroom Preparation for Flipped Classroom using AI and Analytics. In *ICEIS (1)* (pp. 477-483).
22. Ford, A. C., Guyatt, G. H., Talley, N. J., & Moayyedi, P. (2010). Errors in the conduct of systematic reviews of pharmacological interventions for irritable bowel syndrome. *Official journal of the American College of Gastroenterology| ACG*, *105*(2), 280-288.
23. Fulton, K. (2012). Upside down and inside out: Flip your classroom to improve student learning. *Learning & Leading with Technology*, *39*(8), 12-17.
24. Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *The internet and higher education*, *7*(2), 95-105.
25. Gillette, C., Rudolph, M., Kimble, C., Rockich-Winston, N., Smith, L., & Broedel-Zaugg, K. (2018). A meta-analysis of outcomes comparing flipped classroom and lecture. *American journal of pharmaceutical education*, *82*(5), 6898.
26. Goksu, D. Y., & Duran, V. (2020). Flipped classroom model in the context of distant training. *Research highlights in Education and Science*.
27. Gopalan, C., Daughrity, S., & Hackmann, E. (2022). The past, the present, and the future of flipped teaching. *Advances in physiology education*, *46*(2), 331-334.
28. Gundlach, E., Richards, K. A. R., Nelson, D., & Levesque-Bristol, C. (2015). A comparison of student attitudes, statistical reasoning, performance, and perceptions for web-augmented traditional, fully online, and flipped sections of a statistical literacy class. *Journal of Statistics Education*, *23*(1).
29. Gurevitch, J., Koricheva, J., Nakagawa, S., & Stewart, G. (2018). Meta-analysis and the science of research synthesis. *Nature*, *555*(7695), 175-182.
30. Hagen, E. J., & Fratta, D. (2014). Hybrid Learning in Geological Engineering: Why, How, and to What End? Preliminary Results. In *Geo-Congress 2014: Geo-characterization and Modeling for Sustainability* (pp. 3920-3929).
31. Hew, K. F., & Lo, C. K. (2018). Flipped classroom improves student learning in health professions education: a meta-analysis. *BMC medical education*, *18*, 1-12.
32. Hu, R., Gao, H., Ye, Y., Ni, Z., Jiang, N., & Jiang, X. (2018). Effectiveness of flipped classrooms in Chinese baccalaureate nursing education: A meta-analysis of randomized controlled trials. *International Journal of nursing studies*, *79*, 94-103.
33. Hussain, S., Ahmad, M. S., & Hussain, S. (2022). Relationship of Teacher-Student Interaction, Learning Commitment and Student Learning Comfort at Secondary Level. *International Research Journal of Education and Innovation*, *3*(2), 156-169.
34. Kang, S., & Shin, I. S. (2016). The effect of flipped learning in Korea: Meta-analysis.
35. Karagöl, İ., & Emrullah, E. S. E. N. (2019). The effect of flipped learning approach on academic achievement: A meta-analysis study. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, *34*(3), 708-727.
36. Kennedy, E., Beaudrie, B., Ernst, D. C., & St. Laurent, R. (2015). Inverted pedagogy in second semester calculus. *Primus*, *25*(9-10), 892-906.
37. Klein, S. P., Kuh, G., Chun, M., Hamilton, L., & Shavelson, R. (2005). An approach to measuring

ISSN (ONLINE):2710-0308 www.irjmss.com ISSN (PRINT):2710-0316
DOI: **10.5281/zenodo.10725219**

cognitive outcomes across higher education institutions. *Research in Higher Education*, *46*, 251-276.
38. Kumar, A., Krishnamurthi, R., Bhatia, S., Kaushik, K., Ahuja, N. J., Nayyar, A., & Masud, M. (2021). Blended learning tools and practices: A comprehensive analysis. *Ieee Access*, *9*, 85151-85197.
39. Låg, T., & Sæle, R. G. (2019). Does the flipped classroom improve student learning and satisfaction? A systematic review and meta-analysis. *AERA open*, *5*(3), 2332858419870489.
40. Lee, Y., & Martin, K. I. (2020). The flipped classroom in ESL teacher education: An example from CALL. *Education and Information Technologies*, *25*, 2605-2633.
41. Li, R., Lund, A., & Nordsteien, A. (2023). The link between flipped and active learning: A scoping review. *Teaching in Higher Education*, *28*(8), 1993-2027.
42. Liu, Y. Q., Li, Y. F., Lei, M. J., Liu, P. X., Theobald, J., Meng, L. N., ... & Jin, C. D. (2018). Effectiveness of the flipped classroom on the development of self-directed learning in nursing education: a meta-analysis. *Frontiers of Nursing*, *5*(4), 317-329.
43. Lo, C. K., & Hew, K. F. (2019). The impact of flipped classrooms on student achievement in engineering education: A meta-analysis of 10 years of research. *Journal of Engineering Education*, *108*(4), 523-546.
44. Lo, C. K., Hew, K. F., & Chen, G. (2017). Toward a set of design principles for mathematics flipped classrooms: A synthesis of research in mathematics education. *Educational Research Review*, *22*, 50-73.
45. McClelland, C. J. (2013, June). Flipping a Large-enrollment Fluid Mechanics Course–Is it Effective?. In *2013 ASEE Annual Conference & Exposition* (pp. 23-607).
46. McLaughlin, J. E., Roth, M. T., Glatt, D. M., Gharkholonarehe, N., Davidson, C. A., Griffin, L. M., ... & Mumper, R. J. (2014). The flipped classroom: a course redesign to foster learning and engagement in a health professions school. *Academic medicine*, *89*(2), 236-243.
47. Moorhouse, B. L., & Wong, K. M. (2022). Blending asynchronous and synchronous digital technologies and instructional approaches to facilitate remote learning. *Journal of Computers in Education*, *9*(1), 51-70.
48. Orhan, A. (2019). The effect of flipped learning on students' academic achievement: A meta-analysis study. *Cukurova University Faculty of Education Journal*, *48*(1), 368-396.
49. Palmer, K. (2015). Flipping a calculus class: One instructor's experience. *Primus*, *25*(9-10), 886-891.
50. Park, J. H., Eisenhut, M., van der Vliet, H. J., & Shin, J. I. (2017). Statistical controversies in clinical research: overlap and errors in the meta-analyses of microRNA genetic association studies in cancers. *Annals of Oncology*, *28*(6), 1169-1182.
51. Phillipson, S. N., & Lam, B. H. (2011). *Learning and teaching in the Chinese classroom: Responding to individual needs* (Vol. 1). Hong Kong University Press.
52. Pigott, T. D., & Polanin, J. R. (2020). Methodological guidance paper: High-quality meta-analysis in a systematic review. *Review of Educational Research*, *90*(1), 24-46.
53. Rao, G., Lopez-Jimenez, F., Boyd, J., D'Amico, F., Durant, N. H., Hlatky, M. A., ... & Wessel, J. (2017). Methodological standards for meta-analyses and qualitative systematic reviews of cardiac prevention and treatment studies: a scientific statement from the American Heart Association. *Circulation*, *136*(10), e172-e194.
54. Rehman, U., & Lakhan, M. A. S. A. (2021). A review on state of the art in flipped classroom technology a blended e-learning. *Int. J*, *9*.
55. Rothstein, H. R., Sutton, A. J., & Borenstein, M. (2005). Publication bias in meta-analysis. *Publication bias in meta-analysis: Prevention, assessment and adjustments*, 1-7.
56. Sahin, A., Cavlazoglu, B., & Zeytuncu, Y. E. (2015). Flipping a college calculus course: A case study. *Journal of Educational Technology & Society*, *18*(3), 142-152.
57. Seery, M. K. (2015). Flipped learning in higher education chemistry: emerging trends and potential

ISSN (ONLINE):2710-0308 www.irjmss.com ISSN (PRINT):2710-0316
DOI: **10.5281/zenodo.10725219**

directions. *Chemistry Education Research and Practice*, *16*(4), 758-768.
58. Seery, M. K. (2015). Flipped learning in higher education chemistry: emerging trends and potential directions. *Chemistry Education Research and Practice*, *16*(4), 758-768.
59. Shapson, S. M., Wright, E. N., Eason, G., & Fitzgerald, J. (1980). An experimental study of the effects of class size. *American Educational Research Journal*, *17*(2), 141-152.
60. Shi, Y., Ma, Y., MacLeod, J., & Yang, H. H. (2020). College students' cognitive learning outcomes in flipped classroom instruction: a meta-analysis of the empirical literature. *Journal of Computers in Education*, *7*, 79-103.
61. Shi, Y., Ma, Y., MacLeod, J., & Yang, H. H. (2020). College students' cognitive learning outcomes in flipped classroom instruction: a meta-analysis of the empirical literature. *Journal of Computers in Education*, *7*, 79-103.
62. Shurygin, V., Ryskaliyeva, R., Dolzhich, E., Dmitrichenkova, S., & Ilyin, A. (2022). Transformation of teacher training in a rapidly evolving digital environment. *Education and Information Technologies*, 1-20.
63. Siontis, K. C., Hernandez-Boussard, T., & Ioannidis, J. P. (2013). Overlapping meta-analyses on the same topic: survey of published studies. *Bmj*, *347*.
64. Sit, H. H. W. (2013). Characteristics of Chinese students' learning styles. *International proceedings of economics development and research*, *62*, 36.
65. Slavin, R., & Smith, D. (2009). The relationship between sample sizes and effect sizes in systematic reviews in education. *Educational evaluation and policy analysis*, *31*(4), 500-506.
66. Tan, C., Yue, W. G., & Fu, Y. (2017). Effectiveness of flipped classrooms in nursing education: Systematic review and meta-analysis. *Chinese Nursing Research*, *4*(4), 192-200.
67. Tune, J. D., Sturek, M., & Basile, D. P. (2013). Flipped classroom model improves graduate student performance in cardiovascular, respiratory, and renal physiology. *Advances in physiology education*, *37*(4), 316-320.
68. Unal, A., Unal, Z., & Bodur, Y. (2021). Using Flipped Classroom in Middle Schools: Teachers' Perceptions. *Journal of Research in Education*, *30*(2), 90-112.
69. Van Alten, D. C., Phielix, C., Janssen, J., & Kester, L. (2019). Effects of flipping the classroom on learning outcomes and satisfaction: A meta-analysis. *Educational Research Review*, *28*, 100281.
70. van Wely, M. (2014). The good, the bad and the ugly: meta-analyses. *Human reproduction*, *29*(8), 1622-1626.
71. Xu, P., Chen, Y., Nie, W., Wang, Y., Song, T., Li, H., ... & Zhao, L. (2019). The effectiveness of a flipped classroom on the development of Chinese nursing students' skill competence: A systematic review and meta-analysis. *Nurse education today*, *80*, 67-77.
72. Yong, D., Levy, R., & Lape, N. (2015). Why no difference? A controlled flipped classroom study for an introductory differential equations course. *Primus*, *25*(9-10), 907-921.
73. Zhang, S. (2018). A systematic review and meta-analysis on flipped learning in science education. *HKU Theses Online (HKUTO)*.
74. Zhu, G., Thompson, C., Suarez, M., & Peng, Z. (2019, April). A meta-analysis on the effect of flipped instruction on K-12 students' academic achievement. In *American Educational Research Association Annual Meeting. Toronto, Canada, April* (pp. 5-9).