**Does the flipped classroom allow for a meaningful learning and enhance critical thinking skills?**

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**Abstract English**

The flipped classroom is an asynchronous learning method by the use of video as a learning medium. The flipped classroom is a relevant learning strategy in the digital era. The study was conducted by applying scoping review method to find out the usefulness of the flipped classrooms in improving critical thinking skills and meaningful learning opportunities. 10 articles were obtained, which were quasi, case study, experiment, and mix method. The result showed that the flipped classroom provides positive benefits in improving critical thinking skills and providing a meaningful learning experience for learners.

# INTRODUCTION

Education, which was originally in a room and done face-to-face, nowadays is done virtually. The development of technology brings transformations in education. Education is required to make changes in several processes of its activities (Kamalludeen, 2020). Applications of technology in education are the use of e-learning, the use of learning mediums like Geogebra App, AR, and many other applications, the use of assessment base computer-based tests, etc. (Guntur et al., 2019; Hernawati, 2012; Miatun & Khusna, 2020; Retnawati, Hadi, et al., 2017).

In line with the development of technology and information, millennials are obliged to have several skills to survive in global challenges. The one of main point frameworks of 21st century skills is critical thinking skills (Retnawati et al., 2018). Lai (2011) reported that with the ability to think critically, a student could analyze arguments, make claims, and provide evidence. Critical thinking skill is a crucial skill for developing problem-solving ability. Therefore, many countries have emphasized critical thinking as one of the major components in developing education in 21stcentury (Muglia et al., 2017). In spite of the fact that critical thinking skills have developed as an imperative issue, getting these abilities through the usage of pedagogies in science, technology, engineering, and mathematics has demonstrated challenges (Styers et al., 2018).

The realization of the learning process to improve critical thinking skills is intrinsically tied to educators' creativity to maximizing students' roles (Retnawati et al., 2018). The educators who have pedagogic competence can prepare learning strategies under the demands of the times and the level of learners’ necessity. However, there are multiple barriers. Kartowagiran, *et al*. (2017) states that barriers come from students, teachers, and the availability of learning facilities. Many students have low self-esteem, struggle, and motivation. On the other hand, teachers have barriers in creating good instruments, selecting appropriate techniques, formulating clear criteria, and limited learning facilities.

Learning activities to enhance critical thinking skills and provide meaningful learning can be conducted in unlimited space and time by utilizing technology. Wahyuningrum & Latifah (2020) report that during pandemics students in the remote area studying by WhatsApp. The utilization of technology in the learning process has been applied through various platforms with various methods (Wallace, 2013). One of them is the flipped classroom.

The flipped classroom is a strategy that can implement asynchronous learning by video as a learning medium. Students can access the learning videos for problem-solving practices as well as home learning (Bishop & Verleger, 2013). The Flipped classroom was developed by two Colorado teachers. They initially wanted to provide lessons for students who did not attend school. Surprisingly, the learning method increased students’ participation and learning activities (Tucker, 2012). Students used the opportunity to review learning, solve problems and collaborate. Even though Prabowo & Juandi (2020) claim that the use of technology in learning has not been able to elaborate cognitive processes, many studies have proven the benefits of flipped classrooms. Tang *et al.* (2020) found that online teaching with the flipped classroom during pandemic Covid-19 improves students’ learning attention. Nugraha *et al.* (2019) found that blended learning using the flipped classroom enhances students’ abilities in mathematics. Nevertheless, does the flipped classroom improve critical thinking skills? Does the flipped classroom allow for a meaningful learning experience? Based on that background, this study was carried out to determine the benefits of the flipped classroom learning in the 21st century, particularly in terms of improving critical thinking skills and providing a meaningful learning experience.

# RESEARCH METHOD

The study was conducted by the use of Arksey and O'Malleys’ framework of scoping review. The framework consists of 5 stages (*identifying research questions, identifying relevant studies, conducting selections using several criteria, charting the data, and in the latter stage making conclusions and reporting the results of research*) (Arksey & O’Malley, 2005). Data collection of this study focused on the usefulness of flipped classrooms to improve critical thinking skills and meaningful learning opportunities. The following are criteria in this research method:

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| **TABLE 1.** Inclusion and exclusion criteria  |
| **Criteria** | **Inclusion** | **Exclusion** |
| Time period | The last 10 years(2011-2021) | Studies outside these dates or time period |
| Study focus | Education | Research other that the realm of education is not used |
| Research method | Quasi – experiment, Mix metode, Case study, experiment. | Qualitative, R n D, Development, Survey. |
| Sample | Students | Not students |

## **RESULTS AND DISCUSSIONS**

Based on the study and reviewed various literature using the search engine Google scholar obtained a total of 120.000 articles related to the flipped classroom. The article was filtered using inclusion criteria “**TABLE 1**”. According to the result of filtration, there were 10 articles obtained by the following “**TABLE 2”** and **“TABLE 3**”.

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| **TABLE 2.** Studies included into scoping review |
| **Title** | **Subject** | **Method** | **Instrument** | **Dependent variable** | **Result** | **Suggestions** |
| Developing information literacy and critical thinking skills through domain knowledge learning in digital classrooms: An experience of practicing flipped classroom strategy (Kong, 2014) | 107 students | Experiment | pre- and post-tests | literacy competency and critical thinking skills | Students had a statistically significant growth in information literacy competency and critical thinking skills in trial teaching, which was designed by flipped classrooms. | The professional design of a flipped classroom can integrate elements of critical thinking into the domain of the knowledge learning process. |
| An experience of a three-year study on the development of critical thinking skills in flipped secondary classrooms with pedagogical and technological support. (Kong, 2015) | 124 students | Experiment | Test and interview | Critical thinking skill | The flipped classroom strategy increased participation in the self-paced preparation process prior to class as well as skill development after class. Students could create answers to critical thinking questions. | The future work on developing critical thinking skills could infuse critical thinking skills development into the process of domain knowledge learning; deploy appropriate pedagogy and use appropriate technology to facilitate this learning process |
| Flipped classrooms and student learning: not just surface gains(McLean et al., 2016) | 54 students | Mix method | Test | Independent learning skills, meaningful and active learning, | Students reported deep and active learning in the flipped environment. Meaningful learning involves an approach whereby the learner’s intention is to extract meaning, look for patterns, and monitor one’s own understanding of the material. | Improve access to technology may allow even more opportunity for students to engage in off-task activities, this is an important potential benefit to flipped classroom implementation. |
| The flipped classroom stimulates greater learning and is a modern 21st century approach to teaching today’s undergraduates (Mortensen & Nicholson, 2015) | 130 students | experiment | Test | Critical thinking, and positive opinions of the course | The flipped classroom proved to be a positive learning experience for students | While flipping any course takes careful planning and considerable time, the benefits to the students more than justify these efforts |
| A self-regulated flipped classroom approach to improving students’ learning performance in a mathematics course (C. L. Lai & Hwang, 2016) | 44 Students | Experiment | pre-test, post-test, and the questionnaires | learning performance in a mathematics course | Students who learned with the self-regulated flipped classroom approach showed higher performance in goal setting. | Students’ learning performances in flipped classrooms might not be as good as expected without self-regulated support. |

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| **TABLE 3.** Studies included into scoping review |
| **Title** | **Subject**  | **Method** | **Instrument** | **Dependent Variable** | **Result** | **Suggestions** |
| The flipped classroom allows for more class time devoted to critical thinking(DeRuisseau, 2016)  | 80 students  | Case study | Test | High order thinking skills | a flipped classroom approach allowed for more time devoted to active learning and a transition of assessment questions to include additional higher-order thinking activities. | For high-content science courses, hopefully more opportunities will open for faculty to try this pedagogy in their own hands to see for themselves how this format can be transformative for all involved. |
| Application of a MOOC in a general physics flipped classroom(Jao, 2017) | 51 students  | experiment | Test | learning outcomes, ability in self-learning and communication skills | applying a MOOC in a TBL-based general physics flipped classroom is helpful to enhance students’ learning outcomes and develop students’ ability in self-learning and communication skills in a team work context. | this teaching strategy can be extended and applied to other topics or subjects |
| Comparing the effects of traditional lecture and flipped classroom on nursing students' critical thinking disposition: A quasi-experimental study (Dehghanzadeh & Jafaraghaee, 2018) | 85 students | quasi-experimental | pretest-posttest | Critical thinking | This study shows the positive effects of flipped classroom on nursing students' critical thinking disposition. | Teachers can enhance the effectiveness of FC by providing electronic contents to students before the course onset.  |
| A flipped classroom method based on a small private online course in physiology (X. M. Zhang et al., 2019) | 600 students | experiment | Questionnaire and Test | learning efficiency and a deeper understanding of the knowledge | The study indicated that the SPOC flipped classroom was effective in enhancing the examination scores of students, reflecting an improved learning efficiency and a deeper understanding of the knowledge. | There was an additional enhancementassociated with SPOC video preview in the flipped classroom group. |
| Applying the MOOC-based Flipped Classroom Education to the Accounting Information System (H. Zhang, 2020)  | 51 students | experiment | Test | learning motivation, independent learning and cooperative learning ability. | MOOC-based flipped classroom teaching mode has obvious advantages over traditional teaching. It can stimulate students’ learning motivation, and cultivating their independent learning and cooperative learning ability. | To maximize the advantages of the flipped classroom teaching should prepare learning resources, organize class activities and inspire students’ critical thinking andindependent thinking abilities.  |

Based on the description related to the flipped classroom learning model, it is known that the flipped classroom is a technology-based learning model that can provide a positive learning experience for learners, enhance students' learning outcomes, communication skills, and develop students' ability in self-learning (Jao, 2017; Mortensen & Nicholson, 2015). The flipped classroom can invigorate learning motivation, developing independent learning and cooperative learning ability (H. Zhang, 2020). In addition, flipped classrooms can increase student involvement in the learning process (Kong, 2014). Students get ready for the learning process, they can be way better to reply questions that require critical thinking ability (Kong, 2015; Mortensen & Nicholson, 2015).

DeRuisseau (2016) found that the flipped classroom allows for more time devoted to critical thinking to improve learning activities and a high level of thinking abilities. (2018) found the same result. The flipped classroom is also known to provide positive effects on students' critical thinking. Many studies on flipped classrooms provide information that flipped classrooms can improvemeaningful and active learning*.* Meaningful learning involves an approach whereby the learner intends to extract meaning, look for patterns, and monitor one's understanding of the material. Using the flipped classroom can improve learning efficiency and a deeper insight of the knowledge (McLean et al., 2016; X. M. Zhang et al., 2019).

The flipped classrooms arranged by professional development activities could afford support teachers in designing appropriate learning and teaching tasks that well-integrate elements of the flipped classroom and critical thinking into the domain knowledge learning process (Kong, 2014). The flipped classroom takes careful planning and considerable time, giving the benefits to the students more than justify these efforts (Mortensen & Nicholson, 2015). Using technology may allow even more opportunities for students to engage in off-task activities. This circumstance is a potential benefit to flipped classroom implementation (McLean et al., 2016). To maximize the preferences of the flipped classroom within mathematics learning, instructors ought to learn, create, sort relevant learning resources, and organize lesson exercises to enhance students' critical thinking. Students should actively learn to improve initiative learning and self-managing ability (H. Zhang, 2020).

Studies of the effectiveness of the flipped classroom on mathematics learning achievement and motivation showed that students using the flipped classroom performing better than the traditional method (Krishnan & Priya, 2021; Nugraha et al., 2019; Unakorn & Klongkratoke, 2015; Zheng et al., 2020). Another study was conducted by Wei *et al*. (2020) with 88 sixth grade students in a secondary school in mainland China to evaluate the effectiveness of the flipped classroom. The result showed that the flipped classroom approach significantly improved students’ mathematical learning. Therefore, Jao (2017) suggested applying this strategy to other topics or subjects.

# CONCLUSION

The study was conducted to see the influence of flipped classrooms specifically in improving high-level thinking processes and meaningful learning. Education levels studied ranging from elementary school to college. Criteria of research methods are experiments, mixed methods, quasi-experiments, and longitudinal research. The research reported that there was a positive influence on flipped classrooms on learning achievement. These positive influences include improving critical thinking skills, developing students' abilities in self-learning, and improving meaningful and active learning.

The flipped classrooms should be designed as best as possible to motivate students to learn and improve critical thinking. Although the flipped classroom is one of the effective methods of online learning, to continuously improve the effectiveness and quality of the learning process, research in learning activities using technology must be expanded to enhance students' ability and give opportunity for meaningful learning.

# REFERENCES

Arksey, H., & O’Malley, L. (2005). Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology: Theory and Practice*, *8*(1), 19–32. https://doi.org/10.1080/1364557032000119616

Bishop, J. L., & Verleger, M. A. (2013). The flipped classroom: A survey of the research. *ASEE Annual Conference and Exposition, Conference Proceedings*, *January 2013*. https://doi.org/10.18260/1-2--22585

Dehghanzadeh, S., & Jafaraghaee, F. (2018). Comparing the effects of traditional lecture and flipped classroom on nursing students’ critical thinking disposition: A quasi-experimental study. *Nurse Education Today*, *71*(March), 151–156. https://doi.org/10.1016/j.nedt.2018.09.027

DeRuisseau, L. R. (2016). The flipped classroom allows for more class time devoted to critical thinking. *Advances in Physiology Education*, *40*(4), 522–528. https://doi.org/10.1152/ADVAN.00033.2016

Guntur, M. I. S., Setyaningrum, W., Retnawati, H., Marsigit, M., Saragih, N. A., & Noordin, M. K. bin. (2019). Developing augmented reality in mathematics learning: The challenges and strategies. *Jurnal Riset Pendidikan Matematika*, *6*(2). https://doi.org/10.21831/jrpm.v6i2.28454

Hernawati, K. (2012). Desain Elearning Adaptif Berbasis Cognitive Style Untuk Pembelajaran Matematika Sma Kelas XII IPA. *Phytagoras*, *7*(1), 14.

Jao, J. C. (2017). Application of a MOOC in a general physics flipped classroom. *World Transactions on Engineering and Technology Education*, *15*(1), 28–33.

Kamalludeen, R. . (2020). Transitioning To The New Normal In Education. *The Star*.

Kong, S. C. (2014). Developing information literacy and critical thinking skills through domain knowledge learning in digital classrooms: An experience of practicing flipped classroom strategy. *Computers and Education*, *78*, 160–173. https://doi.org/10.1016/j.compedu.2014.05.009

Kong, S. C. (2015). An experience of a three-year study on the development of critical thinking skills in flipped secondary classrooms with pedagogical and technological support. *Computers and Education*, *89*, 16–31. https://doi.org/10.1016/j.compedu.2015.08.017

Krishnan, N. R., & Priya, J. (2021). *Effectiveness of Flipped Classroom in Mathematics*. *October 2016*. https://doi.org/10.5281/zenodo.192292

Lai, C. L., & Hwang, G. J. (2016). A self-regulated flipped classroom approach to improving students’ learning performance in a mathematics course. *Computers and Education*, *100*, 126–140. https://doi.org/10.1016/j.compedu.2016.05.006

Lai, E. R. (2011). Critical Thinking : A Literature Review Research Report. In *Pearson* (Issue June). http://www.pearsonassessments.com/research. %0A

McLean, S., Attardi, S. M., Faden, L., & Goldszmidt, M. (2016). Flipped classrooms and student learning: Not just surface gains. *Advances in Physiology Education*, *40*(1), 47–55. https://doi.org/10.1152/advan.00098.2015

Miatun, A., & Khusna, H. (2020). Pengaruh geogebra online berbasis scaffolding dan tingkat self regulate learning terhadap kemampuan berpikir kritis. *Pythagoras: Jurnal Pendidikan Matematika*, *15*(2). https://doi.org/10.21831/pg.v15i2.34499

Mortensen, C. J., & Nicholson, A. M. (2015). The flipped classroom stimulates greater learning and is a modern 21st century approach to teaching today’s undergraduates. *Journal of Animal Science*, *93*(7), 3722–3731. https://doi.org/10.2527/jas.2015-9087

Muglia, S., Saiz, C., & Rivas, S. F. (2017). Creative and critical thinking : Independent or overlapping components ? Creative and critical thinking : Independent or overlapping components ? *Thinking Skills and Creativity*, *27*(June 2018), 114–122. https://doi.org/10.1016/j.tsc.2017.12.003

Nugraha, D. G. A. P., Astawa, I. W. P., & Ardana, I. M. (2019). Pengaruh model pembelajaran blended learning terhadap pemahaman konsep dan kelancaran prosedur matematis. *Jurnal Riset Pendidikan Matematika*, *6*(1). https://doi.org/10.21831/jrpm.v6i1.20074

Prabowo, A., & Juandi, D. (2020). Analisis situasi didaktis dalam pembelajaran matematika berbantuan ICT pada siswa SMP. *Pythagoras: Jurnal Pendidikan Matematika*, *15*(1). https://doi.org/10.21831/pg.v15i1.32573

Retnawati, H. (2016). The Challenges of Junior High School Mathematic Teachers in Implementing the Problem-Based Learning for Improving the Higher-Order Thinking Skills. *The Online Journal of Counseling and Education*, *5*(3).

Retnawati, H., Djidu, H., Kartianom, Apino, E., & Anazifa, R. D. (2018). Teachers’ knowledge about higher-order thinking skills and its learning strategy. *Problems of Education in the 21st Century*, *76*(2). https://doi.org/10.33225/pec/18.76.215

Retnawati, H., Hadi, S., Nugraha, A. C., Arlinwibowo, J., Sulistyaningsih, E., Djidu, H., Apino, E., & Iryanti, H. D. (2017). Implementing the computer-based national examination in Indonesian schools: The challenges and strategies. *Problems of Education in the 21st Century*, *75*(6). https://doi.org/10.33225/pec/17.75.612

Retnawati, H., Kartowagiran, B., Arlinwibowo, J., & Sulistyaningsih, E. (2017). Why are the mathematics national examination items difficult and what is teachers’ strategy to overcome it? *International Journal of Instruction*, *10*(3). https://doi.org/10.12973/iji.2017.10317a

Retnawati, H., Munadi, S., Arlinwibowo, J., Wulandari, N. F., & Sulistyaningsih, E. (2017). Teachers’ difficulties in implementing thematic teaching and learning in elementary schools. *New Educational Review*, *48*(2). https://doi.org/10.15804/tner.2017.48.2.16

Styers, M. L., Zandt, P. A. Van, & Hayden, K. L. (2018). *Active Learning in Flipped Life Science Courses Promotes Development of Critical Thinking Skills*. 1–13. https://doi.org/10.1187/cbe.16-11-0332

Tang, T., Abuhmaid, A. M., Olaimat, M., Oudat, D. M., Aldhaeebi, M., & Bamanger, E. (2020). Efficiency of flipped classroom with online-based teaching under COVID-19. *Interactive Learning Environments*, *0*(0), 1–12. https://doi.org/10.1080/10494820.2020.1817761

Tucker, B. (2012). The Flipped Classroom. *Education Next*, *Vol.12 No.*, 82–83. http://educationnext.org/the-flipped-classroom/

Unakorn, P., & Klongkratoke, U. (2015). *Effectiveness of Flipped Classroom to Mathematics Learning of Grade 11 Students*. *2010*, 118–122.

Wahyuningrum, A.S&Latifah, T. (2020). Investigating mathematical conversation in remote learning of mathematics during the covid-19 pandemic. *Jurnal Riset Pendidikan Matematika*, *7*(2).

Wallace, A. (2013). Social Learning Platforms and the Flipped Classroom. *International Journal of Information and Education Technology*, *4*, 198–200. https://doi.org/10.1109/ICeLeTE.2013.6644373

Wei, X., Cheng, I.-L., Chen, N.-S., Yang, X., Liu, Y., Dong, Y., Zhai, X., & Kinshuk. (2020). Effect of the flipped classroom on the mathematics performance of middle school students. *Educational Technology Research and Development*, *68*(3), 1461–1484. https://doi.org/10.1007/s11423-020-09752-x

Zhang, H. (2020). Applying the MOOC-based Flipped Classroom Education to the Accounting Information System. *Journal of Computers*, *31*(3), 242–255. https://doi.org/10.3966/199115992020063103019

Zhang, X. M., Yu, J. Y., Yang, Y., Feng, C. P., Lyu, J., & Xu, S. L. (2019). A flipped classroom method based on a small private online course in physiology. *Advances in Physiology Education*, *43*(3), 345–349. https://doi.org/10.1152/advan.00143.2018

Zheng, L., Bhagat, K. K., Zhen, Y., & Zhang, X. (2020). The effectiveness of the flipped classroom on students’ learning achievement and learning motivation: A meta-analysis. *Educational Technology and Society*, *23*(1), 1–15.