

# *Peer Tutoring in K-12 Education*

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**Abstract:** This paper uses different learning theories, including constructivism, cognitivism and sociocultural learning theories, to analyze the use of peer tutoring in K-12 Education. Different learning theories reveal problems with peer tutoring. Then the paper gives out three potential improvements that would help peer tutoring be more effective in K-12 Education. The improvements studied are using peer tutoring in a flipped classroom, combining peer tutoring and peer instruction, and assigning the student mentor to be a Homework Helper. A case study in an 11th Grade physics class would show how the improvements are practicable.

**Keywords:** peer tutoring, flipped classroom, peer instruction

## 1. Introduction

### 1.1. Background and Significance

The concept of peer tutoring has a long history. Since the beginning of the education system, people have often used this teaching method to enrich the classroom, and it can even be traced back to the ancient Greeks [1]. A simple definition of peer tutoring is the 'use of teaching and learning strategies in which students learn with and from each other without the immediate intervention of a teacher [2]. In peer tutoring, the role of the tutors and tutees is fixed [3]. This article will analyze the "Cross-level peer tutoring involving one institution where unequal status is built on the existing difference." variation of peer tutoring in the K-12 school system [4]. Goldschmid and Goldschmid described an example of this variation of peer tutoring where students selected from the class are given a status advantage over the rest of their classmates and are required to teach the rest of the class [5]. The student mentors are often tasked to give lectures, lead discussions, answer questions, etc.

For nearly half a century, scholars have examined, researched, and enhanced peer tutoring from many perspectives and using various evaluation methods. Vygotsky recognized the value of peer learning and peer tutoring and argued that the range of skills developed through peer collaboration or adult guidance is more extensive than any skills obtained alone [6]. As a result, peer tutoring has been widely accepted and utilized in higher education throughout many nations. In the K-12 system, however, applications and studies on peer tutoring are relatively uncommon.

## 1.2. Research Thinking and Method

Peer tutoring aims to benefit both the tutors and tutees. It has been shown to help students improve social skills, gain self-confidence, increase positive social interactions with peers, develop cognitive skills, and increase academic engagement. Nevertheless, some shortcomings may be revealed when peer tutoring is analyzed through the lenses of different learning theories. Cognitive theories and sociocultural theories underlie peer tutoring. Cognitivism hypothesizes that people orchestrate their learning using metacognition, the awareness of one's cognitive process, and the ability to regulate one's behaviour to achieve objectives [7]. While students attempt to teach their peers, they are required to organize the knowledge learned to teach it to other classmates. During this process, meta-cognition occurs and promotes learning. Socioculturalism also supports peer tutoring. Sociocultural shows that human learning is a social process and our cognitive function is formed based on our interaction with those who are "more skilled" [8]. Learning occurs when the tutors and tutees interact. Although many educators recognize the theories above, cognitivism and sociocultural perspectives do not form the whole picture. When looking at peer tutoring through different lenses, the effectiveness remains uncertain.

Educators must be aware of the learning theories supporting the teaching method when deciding whether or not to use peer tutoring in practice. In addition, they should contemplate whether the method is effective and whether it suits the situation of most students in the K-12 system. Important information will be presented in this paper. In it, I would describe how peer tutoring follows cognitivist theories and socioculturalist theories of learning. Next, I will apply different learning theories to the practice that would expose different pros and cons. In particular, I will focus on the constructive perspective in analyzing peer tutoring.

## 2. Theoretical Framework

### 2.1. Learning Theory 1#: Cognitivism

Peer tutoring requires the student mentors to unknown the self-study knowledge and teach it to other students. This practice is based on how cognitivism understands people's learning process. To be more specific, students' attempts to self-study and teach demand a process of metacognition. Cognitive monitoring occurs through actions and interactions among four classes of phenomena: metacognitive knowledge, metacognitive experience, goals and actions [7]. This practice provides an objective that encourages students to go through cognitive experience actively since it is tough to accomplish the goal of giving a fluent lecture without organising one's thoughts. Besides, the whole process of teaching one's knowledge to others is recalling what was already known, which is a type of metacognitive experience. Therefore, teachers could force students to go through the cognitive experience. Thus, develop more understanding of cognitive phenomena, which young children lack [9]. According to cognitivist theories of learning, students' development in metacognition is beneficial for controlling memory, problem-solving, and completing tasks. However, as mentioned above, children lack metacognition abilities, so it would be a great challenge for them as they prepare to be a peer tutors. Studies suggest that children have less complex and organized metacognition [10]. This may also negatively affect the quality of the student mentor's teaching and, thus, the tutees' learning efficiency. It seems that cognitivist theories of how people learn support peer tutoring, yet even from the same perspective, this educative practice still is flawed and may cause negative results.

## 2.2. Learning Theory 2#: Constructivism

Seeing through different lenses of learning theories, the utility of peer tutoring is also suspected. For instance, from the constructivist perspective, peer tutoring may cause misconceptions about knowledge. Constructivism believes that "Learning does not understand the "true" nature of things... but rather a personal and social construction of meaning out of the bewildering array of sensations which have no order or structure besides the explanations (and I stress the plural) which we fabricate for them." [11]. In other words, they believe that learning is how learners deal with new information and integrate it with their realities. Student mentors tend to obtain new information through books or the Internet when peer tutoring is adopted in the classroom. The knowledge provided by these resources is likely inconsistent with the facts, resulting in misconceptions. At the same time, tutees receive the information output from the student tutor. This process is very likely to produce other information and understanding deviation. This is because there is no direct involvement of teachers in the whole process of peer tutoring, so there is not a relatively reliable source of information and immediate correction of wrong interpretations. Thus, in the light of constructivist learning theories, peer tutoring has some hidden problems.

## 3. Research Question

Peer tutoring is a popular teaching method throughout the world. It aims to support students to gain self-confidence, enhance cognitive processing and be more engaged in class. However, there are limitations to this method in the K-12 system. Different weaknesses are revealed when examined from different perspectives. For example, cognitivism shows students' difficulty in self-studying and teaching, and constructivism exposes the lack of static bodies of knowledge. Based on the problems discovered, a question appears: What is known about instructional strategies teachers can use to make peer tutoring more effective in the K-12 system? The following sections would be answering this question.

## 4. Findings Section

In the following chapters, I will give three ways to improve peer tutoring according to the above-mentioned shortcomings. To analyze the effectiveness of these methods, I will take an educational experience I had as a case study and combine it with past studies on these methods. The three improvement suggestions are: to use peer tutoring in a flipped classroom, combine peer tutoring and peer instruction, and assign the student mentor as a Homework Helper. My explanation for them is as follows:

### 4.1. Improvement 1: Using Peer Tutoring in a Flipped Classroom

Flipped learning is a paradigm that reverses the position of the teacher and student by having students learn through video or other materials before class. It has been put into practice in more and more classrooms and areas around the world. Among school administrators, 28% believe that flipped learning has significantly impacted the teaching reform in their region. In addition, most middle schools (38%) and high schools (40%) are applying flipped learning and have achieved "positive results"[12].

The flipped classroom is based on the reversal of traditional teaching methods. Students carry out some of the learning processes in the classroom at home. Teachers will provide video materials of lectures and other learning materials that are convenient for self-study for students to watch before class. The teacher is only responsible for answering questions in class and guiding the discussion. Supporters of flipped classrooms cited many advantages of the flipped classroom model:

it allows students to learn at their own pace, encourages students to participate in classroom materials actively, frees up actual classroom time for more effective, more creative and more active learning activities, teachers have more opportunities to interact with students and evaluate students' learning, and students are responsible for their learning [13-14].

Zante, Bjoern developed a 15-minute peer-led interactive "physiology education" session to introduce a total of 44 residents to critical care physiology using the flipped classroom model [15]. Using a nine-item electronic survey with open questions and a five-point Likert scale, they analyzed the concept of feasibility, motivation, and emotional learning of critical care physiology. The research concluded that peer-led flipped classroom teaching sessions were feasible and generally appeared useful for teaching critical care physiology to ICU residents.

In my recent learning experience, my physics teacher chose me to be the peer tutor of our Grade 11 H-level physics class since I learned part of the knowledge we needed to deal with in class in advance. At first, the teacher invited me to give lectures in class, but this encountered some problems. When my classmates asked me about some knowledge I had not prepared for, or my explanation of certain concepts was unclear, they quickly misunderstood the content. This is consistent with the shortcoming of peer tutoring found from the perspective of constructivism. As a result, we tried to adopt the flipped classroom model. The teacher provided video materials suitable for pre-class learning. At this time, in the classroom, the peer tutor was only responsible for further explaining the materials and answering questions about the video content that the tutees did not understand.

Flipped classroom solves some of the problems described earlier. With the help of flipped classrooms, peer tutoring is provided as a more reliable source of information and reduces the proportion of misconceptions. However, flipped classroom requires students to be willing to study independently and actively participate in discussions and ask questions to learn knowledge through interaction with classmates.

## 4.2. Improvement 2: Combine Peer Tutoring and Peer Instruction

Peer instruction requires students to answer several conceptual questions in small groups and teach other groups about the answer they think is correct when other groups have trouble finding the "correct answer" [16]. This teaching method was first developed in a Physics class and aims to exploit student interaction during lectures and focus students' attention on underlying concepts. The process seven individual steps:

Each <i>Concept</i> Test has the following general format:		
1.	Question posed	1 minute
2.	Students given time to think	1 minute
3.	Students record individual answers (optional)	
4.	Students convince their neighbors (peer instruction)	1–2 minutes
5.	Students record revised answers (optional)	
6.	Feedback to teacher: Tally of answers	
7.	Explanation of correct answer	2+ minutes

Figure 1: Steps of peer tutoring [16].

This forces the students to think about the concepts and develop arguments [17]. After the students studied through a peer instruction process, they completed a Concept Test. The results show a notable increase in average scores after implementing peer instruction.

We also tried this learning method in physics class to learn new concepts. The number of students participating in group discussions and group discussions increased significantly. This model gives tutees more opportunities to express their ideas. Combining peer tutoring and peer instruction is the addition of mutual teaching under a separate peer tutor system. It further increases the participation of all students and their interest in physics learning. This can also arouse students' interest other than the existing peer tutor to teach in the class.

#### 4.3. Improvement 3: Assign the Student Mentor to be a Homework Helper

Student mentors are asked to correct homework for their classmates. In correcting homework, teachers must analyze the source of error in students' homework [18]. And so are the students playing the role of a teacher. When tutors find out the existing errors for tutees and annotate them, they will have a deeper understanding of the solution to the problem, and the knowledge learned will be consolidated. Also, because the questions have correct answers, in the process of finding out the causes of errors and correcting them, both the tutors and tutees can further evaluate their learning situation and confirm whether there are misunderstood knowledge points and content. Once again, this is a solution to avoiding the possible consequences of obtaining wrong knowledge

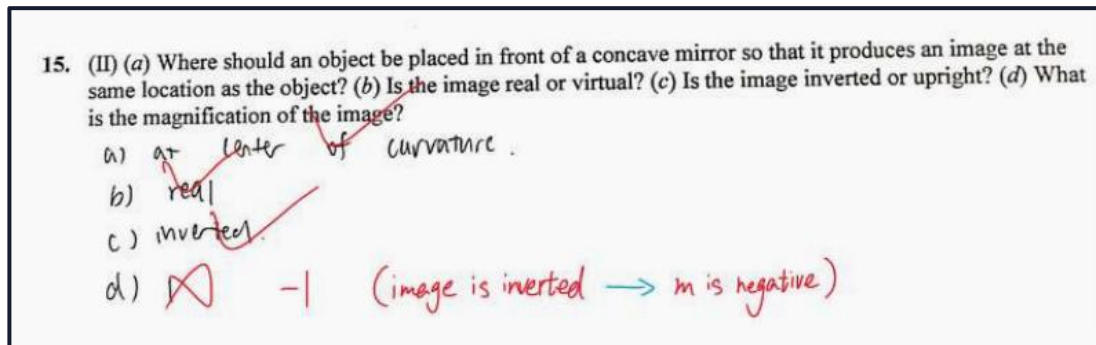


Figure 2: Student mentors are asked to correct homework for their classmates.

construction.

As a student tutor, even if there is only a simple number in the students' answers, I will try my best to analyze the reasons for the errors and explain them. Finally, the tutees think that this way helps them better master their knowledge.

## 5. Conclusion

Peer tutoring is a widely used learning model. However, from the perspective of constructivism, it is easy to cause students to misunderstand knowledge. Therefore, in this article, I propose three different improvement strategies and conduct experiments in the physics class of Grade 11. The flipped classroom is a solution to K-12 students' lack of cognition abilities and lack of static bodies of knowledge in the classroom; peer instruction provides opportunities for tutees to engage more in the class; homework correction is an effective way to correct misconceptions. I hope there will be more attempts and Research on peer tutoring in the K-12 system in the future.

## References

- [1] Topping, K. (2005). *Trends in peer learning*. *Educational Psychology*, 25, 631-645.
- [2] Boud, D., Cohen, R., & Sampson, J. (1999). *Peer learning and assessment*. *Assessment & evaluation in higher education*, 24(4), 413-426.
- [3] Topping, K. J. (1996). *The Effectiveness of Peer Tutoring in Further and Higher Education: A Typology and Review of the Literature*. *Higher Education*, 32, 321-345.

- [4] Falchikov N. *Involving Students in Assessment. Psychology Learning & Teaching.* 2004;3(2):102-108.
- [5] Barbara Goldschmid, M. Goldschmid (1976). *Peer teaching in higher education: A review. Education. Higher Education.*,5: 9-33.
- [6] Vygotsky, L. S. (1962). *Thought and Language.* Cambridge
- [7] Flavell, J. H. (1979). *Metacognition and cognitive monitoring: A new area of cognitive-developmental inquiry. American Psychologist,* 34, 906-911.
- [8] Vygotsky, L. S. (1978). *Mind in society.* Cambridge: Harvard University Press.
- [9] Brown, A. L. (1978). *Knowing When, Where, and How to Remember: A Problem of Metacognition.* In R. Glaser (Eds.), *Advances in instructional psychology (Vol. 1)* (pp.77-165).
- [10] Bjorklund JA, Thuresson K, De Wit CA.(2009). *Perfluoroalkyl compounds (PFCs) in indoor dust: concentrations, human exposure estimates, and sources. Environ Sci Technol.* 2009,1;43(7):2276-81.
- [11] Hein, G. E. (1991). *Constructivist Learning Theory. Paper presented at the CECA (International Committee of Museum Educators) Conference, Jerusalem Israel, 15-22*
- [12] *Speak up 2014 National Research Project Findings: Flipped learning continues to trend for third year. Project Tomorrow | Speak Up. (n.d.). Retrieved August 4, 2022, from [https://tomorrow.org/speakup/2015\\_FlippedLearningReport.html](https://tomorrow.org/speakup/2015_FlippedLearningReport.html)*
- [13] Gilboy, M. B., Heinerichs, S., & Pazzaglia, G. (2015). *Enhancing Student Engagement Using the Flipped Classroom. Journal of Nutrition Education and Behavior,* 47, 109-114.
- [14] 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 Educ Today.* 38: 15-21.
- [15] Zante, Bjoern; Schefold, Joerg C. (2020). *Simulation training for emergency skills: effects on ICU fellows' performance and supervision levels. BMC medical education,* 20(1), p. 498.
- [16] Crouch, C., & Mazur, E. (2001). *Peer Instruction: Ten Years of Experience and Results. American Journal of Physics,* 69, 970-977.
- [17] Eric Mazur. (2013). *Peer Instruction: A User's Manual.*
- [18] Ball DL. (1990). *The mathematical understandings that prospective teachers bring to teacher education. Elementary School Journal ;*90:449-466.