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Cooperative Learning: Effect on Prospective Teachers' Metacognitive Skills Development at University Level

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Abstract: *This study was conducted while using the Quasi-Experimental design to examine the effect of Cooperative learning on prospective teachers' Metacognitive skills. The sample for this study included two sections/ groups, each comprising 40 students (40 males+40 females=80) enrolled in the fifth Semester of the B.Ed Honors program in a public university. One of the sections was declared as the Experimental, whereas the other as the Controlled group. The understudy sections were pre-tested, and then the experimental group was exposed to the intervention (cooperative learning strategy), which lasted for one Semester. Both sections were post-tested after the completion of the intervention. Metacognitive Skills Assessment Tool (MSAT) was used for pre and post-test. Based on the results, it is concluded that Cooperative Learning helps develop Metacognitive skills in prospective teachers. Therefore, it is recommended that the teachers should teach while using the Cooperative learning approach.*

Key Words: Cooperative Learning, Prospective Teachers, Metacognition, Metacognitive Skills

Introduction

Metacognition was introduced in 1979 by John H Flavell. Since then, the researchers have focused on Metacognition and Metacognitive skills. However, the researchers have studied these skills with the reference to learning. However, these are life skills instead of being specifically concerned with learning alone (Eskandari, 2020). It doesn't matter that either one intends to do any academic or non-academic task; the task needs to be done with the utilization of the acquired knowledge and decision making (Amzil, 2013). Both of these aforementioned are done as a result of metacognition. However, one's effective decision-making depends on the effective utilization of one's Metacognitive skills (Ali, 2020).

The understanding of cognition is necessary for understanding the Metacognition and Metacognitive skills. So, cognition is defined here before proceeding towards metacognition. The Latin word "cognoscere" is the root word out of which "Cognition" has come. Literally,

"Cognoscere" means "to know" (Bayne, 2019). However, it has been defined as a process by which one involves in understanding and seeking awareness (Cognifit, 2019). Cognition is a process by which one involves in the reception of information, its transformation, coding, storing, and also retrieval of stored information. Metacognition is the next step to Cognition (Worley, 2018). Cognition is concerned with one's knowledge, whereas metacognition is concerned with how one uses the knowledge (Georghiadis, 2012). In other words, it can be said that metacognition is thinking over-thinking.

The introduction of the term "Metacognition" is on John H Flavell's credit. He started his work on metacognition in the 1970s. This is what he is entitled to as the Father of Metacognitive psychology. However, Plato was the first who talked about Metacognition in "Meno." Plato discussed the inner of oneself, which evaluates oneself for the thoughts and conducts. This

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Evaluation is caused by thinking overthinking. Such thinking has been labeled as one's dialogue with oneself (Worley, 2018; Plato, 385 BCE). Similarly, Socrates has used the term "Silent Dialogue." He has described it as an activity that engages oneself in a dialogue with self. In such a way, the plural role is played by one's soul in the solitude whereby the consciousness is attained (Vallin, 2019). One becomes the questioner and answers those questions oneself. On the other hand, it is said to be the activity in which one sees own thinking above and beyond by Aristotle (Gama, 2004).

The abovementioned discussion shows that metacognition was under debate even from the age of Plato. However, as far as the proper introduction of metacognition is concerned, it was undoubtedly on Flavell's credit who initially used the term "Metamemory" for this in the 1970s. Metacognition term was used later on (Juma, 2017).

Metacognition is said to be one's awareness regarding one's thinking and learning. It has two factors; i) Metacognition Knowledge, ii) Metacognition Regulation (Adnan & Bahri, 2018). The former one consists of sub-factors, including i) Declarative knowledge, ii) Procedural Knowledge, and iii) Conditional Knowledge, whereas the latter one is comprised of six sub-factors (Azizah & Nasrudin, 2018). The first of them include planning, second Information Management, third monitoring, fourth Debugging, fifth and last Evaluation. The sub-factors of Metacognition Regulation are regarded as Metacognitive skills (De Backer, 2015).

Cubukcu (2009) investigated the difference regarding the usage of Metacognitive skills for learning based on the students' mother tongue and second language. The results depicted that the students use the aforementioned skills regardless of the language. Rather, they prefer the completion of their tasks.

Rahman (2010) took the students enrolled in the secondary classes and inspected the effect of Metacognitive skills on their achievement in academics. It has been exposed that their skills have a strong positive effect on their performance in academics.

Akturk & Sahin (2011) examined the effect of students' Metacognitive skills on their performance. The fact came to known based on

the results depicted that those students who used their skills while performing the given task have higher performance levels than those who were not using metacognitive skills during task performance.

Rahman (2011) concluded based on the study that the student's performance in academics has a significant difference based on their teachers' Metacognitive skills knowledge and usage. It has been observed that those teachers' who were aware of their skills and used them while teaching their students showed better performance than those students whose teachers were unaware of their skills.

Ozturk (2015) examined the effect of Metacognitive skills on the participants' reading skills. The scaffolding was used as an intervention by the researcher for the development of the aforementioned skills. It has been concluded that the intervention benefited the participants' skills, and they started to use these skills while reading the assigned material.

Evangeline (2016) also established that Metacognitive skills help in enhancing the students' academic performance. Suppose the students are given the training of Metacognitive skills usage during their studies and exam preparation. They show good performance in academics as compared to those who are not given such training to use their aforementioned skills.

Erdoğan (2017) took sixth-grade students for the development of Metacognitive skills. Cooperative learning has been used for the development of these skills. The results show its positive effect on the development of the concerning skills.

Numerous researches have been conducted on the phenomenon under study. However, the main reservation which is found out by the researcher is that all of the prior researchers have used the self-reported instruments to measure Metacognitive skills, which were quite inappropriate. The reason behind this is that the skills can't be measured with the self-reported scales/ instruments as there are fair chances of bias from the participant's side. On the other hand, the measurement of the skills demands and needs the performance and one's skillfulness or acquired skills are determined based on one's performance. Let it be simplified with an example that if one's driving skills are to be assessed. Will

it be appropriate and enough to ask one that either you are skillful in driving a vehicle or not? In case one responds positively that one is skilled in driving, then what? Would it be appropriate to believe in? Let's be honest; it is not enough. So, there would be the need for the performance evaluation before the declaration of the extent one possesses any skill. The same is with this case. This reservation is addressed in the current study that a proper performance-based test/ instrument has been used. So, this research study will be a significant contribution to the existing literature.

On the other hand, the researches on Metacognitive skills have focused the students' skills development, and there is a grey area regarding the teachers' skills development. Logically, it seems to be quite difficult for teachers to develop Metacognitive skills in their students when they are unaware of their Metacognitive skills. As far as it is concerned with the Pakistani context, there are a few researches related to the phenomenon under study. This was also a reason to conduct this study. So, this research is also significant concerning the phenomenon under study because it was conducted to develop the prospective teachers' Metacognitive skills. The prospective teachers are likely to be professional teachers after the completion of their study program/ pre-service education. This training was likely to develop their Metacognitive skills, which could be helpful in their task conduction. There is a potential for the application of their learned knowledge during their teaching practices.

Literature Review

The review of the related literature has been stated here in this section and stated as under:

Cognition

It is a mental process that bears great significance regarding teaching and learning. Therefore, its understanding is also significant for the educational stakeholders [\(Woolfolk, 2009\)](#). This is a process by which one understands the things and concepts. One also knows things by involving oneself in the process of cognition. This process involves sensory perception at first. Then it comes the turn for the storage of the info, followed by the transformation and the retrieval [\(Cherry, 2020\)](#).

This is the function of one's brain. One's knowledge comes as the result of the Cognitive

process. One becomes able to think, recall and evaluate the ideas or phenomena with the help of the Cognitive process [\(Ashman & Conway, 2002\)](#). It is an overall process of perceiving the stimuli, transforming the perception into meaningful information and its retrieval as well. One understands the attained information because of cognition. If anyone's cognition is not functioning appropriately, one would be difficulty regarding the thinking and understanding the phenomenon [\(Bayne, 2019\)](#).

Metacognition

In simple, it is a process of thinking over own thinking. One involves oneself in thinking over own thinking. "Metacognition" is derived from the Greek word "Meta." This means "beyond." Therefore, metacognition is thinking but not ordinary thinking. Rather it is beyond the thinking one is usually involves in. One thinks back and forth while Meta thinking [\(Ali et al., 2020\)](#). It is the process by which one thinks over own thinking, decisions, and actions. One thinks like what is thought by one. Why is it thought by one? How is it thought? How differently one could think the thought and etc. [\(Cubukcu, 2009\)](#). It is a process by which one plans the things or tasks before doing any given task. Then one manages the attained information necessary for the conduction of any task. After this, the task is monitored by the same individual. The monitoring is followed by Debugging if any error appears there during the task conduction. In the end, it is the term of the Evaluation by which the individual evaluates the task as well as its conduction and completion [\(Akturk & Sahin, 2011\)](#).

Metacognition aware of one regarding own thinking and learning. One also thinks over the learnt material and concepts. If one is involved in metacognition, one keeps on thinking over thinking no matter whatever one is just thinking or also doing any task [\(Cherry, 2020\)](#). Metacognition is said to be a process that is constructive in nature. This process compels one to think about overthinking and also correct the detected errors [\(Erdogan & Sengül, 2017\)](#).

Although Aristotle discussed metacognition in his "On the Soul" and the "Parva Naturalia" while saying it is a process by which thinks at a higher level. At this level, one's soul plays a dual role. One role is the role of a doer, whereas the other role is the role of evaluator. However, the

proper term "Metacognition" was used by Flavell in 1976. Thus, he is called the father of Metacognitive Psychology ([Veenman et al., 2013](#)).

Difference between Cognition and Metacognition

Cognition and metacognition can be confusing to an extent as both of these involve thinking. So, let's understand the difference between both of these. cognition is the process of thinking that one thinks about different things, phenomena, and processes and etc. For this purpose, the information is obtained with the help of one's sensory organs. Then this information is transformed or coded, followed by its understanding and storage [_\(Ozturk, 2015\)](#). Whereas cognition is thinking again on an already thought concept or process. In this, one thinks over own thinking (Azizah & Nasrudin, 2018). In simply, cognition is the process by which one gets engaged initially and then one proceeds towards Meta-thinking or Metacognition. This has been made more simple by [Gama \(2004\)](#) that one endeavor to complete any given task or problem in cognition. Whereas metacognition leads one to monitor, debug followed by the Evaluation. The way or strategy of the task completion is evaluated by the individual involved in metacognition.

Importance of Metacognition

A common mistake that has been made with the concept of metacognition is that it is assumed to be used and effective for learning alone. However, it's not only a study or learning skill at all. Rather it is a skill that is useful for all of the completion of the task regardless of their nature. No matter if one is a businessman, one can plan, monitor, debug and evaluate the information and the processes effectively while using Metacognition ([Ali et al., 2020](#)).

Metacognition is one's awareness of own thinking and learning. However, if one is unaware of own thinking and learning, one can't be an effective learner. On the other hand, the teachers' efforts would not be as effective as they should be. But in case one is aware of own thinking, one would be conscious and aware of own learning. As a result, he would become effective learning ([Rahman, 2011](#)). If a learner uses metacognition while learning, that learner's learning efforts would be planned. As a result, the efforts would not go to wastage.

Similarly, the information would be well managed, which would save one's time regarding the learning. On the same pattern, one would keep on monitoring own performance during task completion or learning. This will help one track own mistakes or procedural errors. This would lead one to debug the errors and remain on track to the completion of the concerning task. One's Evaluation would lead one to judge own performance or learning. All of this makes the whole process of learning an effective process ([Gama, 2004](#)).

Regardless of the nature of the task, one's task performance is improved if one uses metacognition during the task completion. If one practices metacognition while learning, one's learning would be improved. Similarly, if one uses these skills for problem-solving. One's problem solving would be more effective and improved ([Chatzipantelia et al., 2013](#)). One monitors and evaluates own performance and how one did the task? How effective was the used strategy? Or any other strategy could be more productive? Or how the task could be improved? While involved in the Metacognitive process, one's problem-solving is also improved. This is a life skill that everyone needs the problem-solving.

Education doesn't require one to just achieve a grade in academics, and that's it. Rather, the ultimate goal of education is to make an individual able to adjust to society as well as to solve the problems in one's real life. This is possible with the help of Metacognitive skills. If one uses Metacognitive skills, one would be at ease to effectively solve real-life problems ([Shen & Liu, 2011](#); [Priya, 2012](#)). While looking at the importance that Metacognition and Metacognitive skills have in one's life, the researcher intended to develop the prospective teachers' Metacognitive skills with the help of Cooperative learning.

Metacognitive Skills

Metacognitive skills include planning, Information Management followed by Monitoring, Debugging, and Evaluation ([Evangeline, 2016](#)). Metacognitive skills include one's planning of any task, managing the information regarding the task, monitoring the task, debugging the task conduction process, and evaluating as well [_\(Erdoğan & Şengül, 2017\)](#).

Methodology

This study was conducted under the Positivist paradigm while using the quantitative approach. The Quasi-Experimental design was adopted by the researcher(s) for the conduction of this research. This design was used for this study due to the restriction by the concerning university regarding the randomization of the subjects. The sample for this study was taken conveniently from a Public University based in Lahore providing teacher and science education. The sample included two sections/ groups, each comprising 40 students (40 males+40 females=80) enrolled in the fifth Semester of the B.Ed Honors program. One of the sections was declared as the Experimental, whereas the other as the Controlled group. The understudy sections were pre-tested in the beginning. Then the experimental group was exposed to the intervention, which lasted for one

Semester. It was taught with the cooperative learning strategy (Jigsaw), whereas the Controlled group was taught by the Lecture method. After the completion of the intervention, the post test was administered to both of the groups. MSAT was used by the researcher(s) for data collection. This tool was developed by [\(Ali, Siddiqui, & Tatlah, 2020\)](#) based on five Metacognitive skills. This was a valid and reliable tool bearing 0.72 Cronbach's Alpha.

Data Analysis

Descriptive Statistics, including Skewness and Kurtosis were applied to data for checking the normality. On the other hand, the Inferential Statistic (Mixed ANOVA) was applied to the data for investigating the significant effect of the intervention on the students' Metacognitive skills development. The detail is given below.

Table 1. Descriptive Statistics of Metacognitive Skills

	M	SD	Skewness	Kurtosis
Planning	5.77	2.01	.16	-1.70
Information Management	7.77	3.01	.17	-1.57
Monitoring	5.73	2.08	.21	-1.42
Debugging	1.90	.96	.20	-1.92
Evaluation	5.63	2.17	.26	-1.43
Total Metacognitive Skills	26.82	9.54	.11	-1.76

Note. N = 80

The Mean, Standard Deviation, and Skewness followed by the Kurtosis of Metacognitive skills have been presented in Table 1. The data were

normally distributed as the values of Skewness, and Kurtosis for Metacognitive skills were within ± 2 , which is acceptable.

Table 2. Descriptive Statistics

	M	SD
Pre-Test Scores of Experimental Group	19.05	3.39
Pre-Test Scores of Controlled Group	18.12	2.60
Total	18.58	3.04
Post-Test Scores of Experimental Group	35.77	3.89
Post-Test Scores of Controlled Group	17.87	2.20
Total	26.82	9.54

Note. N = 80

Table 2 shows that the Pre-test Mean scores (M= 19.05) with SD= 3.39 attained by the Experimental Group participants are not statistically higher than the Pre-test Mean scores (M= 18.12) with SD= 2.60 attained by the Controlled Group participants.

However, the Post-test Mean scores (M= 35.77) with SD= 3.89 attained by the Experimental Group participants are higher than the Post-test Mean scores (M= 17.87) with SD= 2.20 attained by the Controlled Group participants.

Table 3. Within Subject Effects

	Mean Square	df	F	Sig	Partial Eta Squared
Measure (Pre & Post-test Scores)	2714.25	78	349.51	.000	.81
Measure * Groups (Experimental & Controlled)	2881.50		371.04	.000	.82

Note. N = 80

Based on the results from Table 3, it is revealed that the Mean Square for Measure (Pre & Post-test) is 2714.25, F= 349.51 and p= .000 with Effect Size = .81. Similarly, Mean Square for Measure * Groups is 2881.50, F= 371.04 and p= .000 with Effect Size = .82.

It is concluded based on the results that there is a significant effect of the treatment within the subjects regarding Metacognitive skills development as $p < .05$ for both the Measure as well as Measure * Groups.

Table 4. Between Subject Effects

	Mean Square	df	F	Sig	Partial Eta Squared
Intercept	82491.80	78	7214.31	.000	.98
Groups (Experimental & Controlled)	3543.80		309.92	.000	.79

Note. N = 80

The results from Table 4 show that the Mean square for intercept is 82491.80, F= 7214.31 and p= .000 with Effect Size = .98. Similarly, Mean Square for Groups (Experimental & Controlled) is 3543.80, F= 309.92 and p= .000 with Effect Size = .79.

It is concluded based on the results that there is a significant effect of the treatment between the subjects regarding Metacognitive skills development as $p < .05$.

The results of the current study support the findings of ([Akturk & Sahin, 2011](#); [Ali, Siddiqui, & Tatlah, 2020](#); [Chatzipanteli \(2013\)](#); [Erdoğan & Sengül \(2017\)](#); [Gama, 2004](#); [Ozturk, 2015](#); [Siddiqui \(2016\)](#); [Vallin \(2019\)](#) and [Veenman \(2013\)](#) who concluded that the students' Metacognitives skills can be enhanced while using Metacognitive skills developmental strategies like Cooperative Learning.

Conclusion and Discussion

This study examined the effect of Cooperative Learning on prospective teachers' Metacognitive skills development. The results from ANOVA (between-subject factor) depicted that no statistically significant difference was found between the pre-test mean scores of both groups (Experimental & Controlled), whereas the Experimental group scored higher than the Controlled group in the post-test. Similarly, it has been revealed based on the ANOVA (within-subject factor) results that the post-test mean scores of Experimental group participants were higher than their pre-test scores. However, no significant difference was found between the pre-test and post-test mean scores of the Controlled group. So, it is concluded that Cooperative Learning helps develop Metacognitive skills in students.

Recommendations & Implications

Based on the results, it is recommended that the students should be taught by their teachers with the Cooperative learning approach so that their Metacognitive skills could be developed and improved. Furthermore, the head of institutions should direct the teachers for using the Cooperative learning approach as it develops the students' Metacognitive skills.

Future Directions

As the instrument "MSAT" developed and used for the measurement of the Metacognitive skills have been developed newly, it is recommended that the further researchers may conduct their research(es) to retest it and improve it further if needed.

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