5-1-2023

The Development of Preservice Teachers' Metacognitive Knowledge and Self-regulation in Online Learning

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ABSTRACT

This study investigated the development of preservice teachers' metacognitive knowledge and self-regulation in online learning using the reflective practice model. The study was conducted during the COVID-19 pandemic when learning moved completely online. The participants were preservice teachers in an early childhood program in the United Arab Emirates (UAE). A sequential mixed-method approach using quantitative and qualitative data was used. The study's results reveal that preservice teachers were able to develop their metacognitive knowledge and regulation due to their use of the reflective model. The preservice teachers set new goals for themselves to achieve and prepare for their future jobs.

Keywords: *Metacognitive knowledge, metacognitive regulations, reflective practice, online learning, self-regulation*

INTRODUCTION

There is a significant shift in the Gulf region from dependence on oil production to a knowledge-based economy. One of the main goals of the United Arab Emirates (UAE) national agenda is educational reform (UAE Vision 2021, 2009). The UAE's 2030 agenda for sustainable development features initiatives to transform education such as prioritizing students' learning, empowering learning by technology, building a quality teaching profession, and reforming curricula to focus on 21st century skills. It also promotes a STEAM-based curriculum (Science, Technology, Engineering, Art, and Mathematics) and provides different pathways to suit students' interests and meet the needs of the job market (UAE National Committee, 2017). Face-to-face, blended, and online learning supported by elearning platforms are the norm for education in the UAE. The lockdown of schools and universities that took place in March 2020 in response to the COVID-19 pandemic, when emergency remote learning was planned and implemented, forced adjustments to learning plans (Dubai Future Foundation, 2020). Modifying the schools' and universities' systems was not easy, and regulatory bodies began setting up transformative changes to develop innovative solutions for schools (Dubai Future Foundation, 2020). The Organization for Economic Cooperation and Development (OECD) Learning Compass 2030 report stated three main categories of essential skills for future education: cognitive and metacognitive, social and emotional, and practical and physical skills (OECD, 2018). Some subskills of cognitive and metacognitive skills were highlighted, such as critical thinking, creative thinking, learning-to-learn, and self-regulation. Other subskills such as empathy, self-efficacy, responsibility, and collaboration were highlighted in the social and emotional skillset. Finally, using information and communication technology efficiently, along with content creation, were skills mentioned in the practical and physical skillset (OECD, 2018).

The purpose of this study was to investigate

the impact of preservice teachers' reflection practices on developing their metacognitive knowledge and self-regulation in online learning. We used the following research question to guide this study. It includes two subquestions that were used to address the main purpose of the study:

To what extent did the preservice teachers develop their metacognitive knowledge and regulation in online learning?

RQ1: How does the reflection practice influence preservice teachers' metacognitive knowledge and regulation?

RQ2: What are the preservice teachers' perceptions about their metacognitive knowledge and regulation?

With reference to these research questions, we proposed the following hypotheses:

H_1: Preservice teachers' reflection practices impacted their metacognitive regulation and knowledge.

H_0: Preservice teachers' reflection practices did not impact their metacognitive regulation and knowledge.

LITERATURE REVIEW

Metacognitive Knowledge and Self-Regulation

Metacognitive knowledge and self-regulation are vital competencies for meaningful and successful learning in various fields including education (Veenman, 2016). Metacognition is perceived as an ambiguous concept because of the various definitions, dimensions, and perspectives discussed for its varying purposes (Flavell, 1979; Veenman, 2016). Cognitive psychology defines metacognition as how people learn and employ their necessary mental abilities to recall information, analyze, synthesize, and reason (Schraw, 2006). Metacognition is generally defined as the individual's awareness of monitoring and regulating their own cognitive processes (Hennessey, 1993). Metacognitive knowledge is also defined as what we know about our own cognitive process. It includes declarative, procedural, and conditional knowledge (Stephanou & Mpiontini, 2017). Declarative knowledge refers to the individual's knowledge about their own beliefs and perception, procedural knowledge refers to one's knowledge about procedural skills, and conditional knowledge is knowing the right time to apply various actions (Schraw, 2006). Metacognitive regulation refers to the activities that an individual engages in to facilitate learning and memory. It includes planning, monitoring, and evaluating (Stephanou & Mpiontini, 2017). Planning means to choose appropriate strategies and resources, monitoring refers to an individual's awareness of comprehension and task performance, and evaluating is the evaluation and judgment of the outcomes and thinking of future goals (Schraw, 2006).

Metacognition Awareness in Online Learning

Metacognition is the awareness of one's learning and how to use knowledge to achieve a goal (Flavell, 1979). Rapchak (2018) stated that metacognitive awareness is one of the important components for online learning. Online learning requires the ability of students to regulate their learning and to stay motivated to accomplish their tasks, which is considered metacognition awareness (Lee et al., 2013). Preservice teachers need to use the metacognitive knowledge and regulations as learners to be able to teach them to their students. As a result, students will be able to control their own learning processes in a vast range of learning contexts. Metacognitive regulation is a crucial component of learners having to handle and control their knowledge (declarative, procedural, and conditional knowledge) in learning processes (planning, monitoring, and evaluating) (Schuster et al., 2020). Students need to know how they learn, what their next step in learning will be, and how they will know when they get there. Educators need to utilize some reflective skills that enable them to assess how their instructional activities can assist their students to be self-reflective, independent, and critical thinkers (Mutch, 2012). This can then bridge the gap of one of the main problems that educators face about students' engagement regarding their cognitive, social, or behavioral engagement (Borup et al., 2020).

Previous researchers have stated that the use of reflection in blended learning allows students to transfer metacognitive skills in self-regulated learning (Schuster et al., 2020). Many questions have been raised regarding the rapid use of technology, modern communication, online learning, and new forms of work. What competencies do students need for lifelong learning? What will learning and working look like after COVID-19? How can students develop their social and emotional skills? What are the new demands of the job market?

Metacognition and Reflection

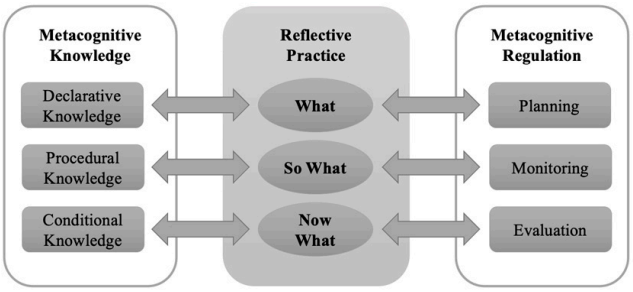
Reflection is defined as an individual thinking about their own thinking and learning practice and beginning to see it in new ways (Grimmett & Mackinnon, 1992). The discussion of reflection in learning can be traced back to John Dewey. Dewey (1933) emphasized the critical role of including reflection in instruction as it leads to a better learning process within the classroom. Schon (1983) suggested the important role of reflection in professional practice. Reflection can occur at different times of learning and according to instruction designed and planned by teachers. It could be synchronously done within teaching and learning or asynchronously at some point after learning. Schon (1987) differentiated between two types of reflection: reflection in action and reflection on action, where reflection took place during and after learning. Another term of reflection that considers future actions in light of past experience is reflection for action (McAlpine et al., 1991). On the other hand, Lawrence-Wilkes and Ashmore (2014) differentiated between four levels of reflection: reflection, reflexivity, critical reflection, and reflective practice. Reflection is to think about and interpret life experiences, beliefs, or knowledge. Reflexivity is to think objectively about one's own behavior, values, and assumptions. Critical reflection is to question and examine one's own knowledge, beliefs, and actions for change. Finally, reflective practice is a cyclical process for personal and professional growth (Lawrence-Wilkes & Ashmore, 2014). A vast number of reflective practice models have been introduced, such as Gibbs (1998), Kolb (1984), and Johns (1994). Essentially, all models are split into three distinct stages: description and reflection of what happened, analyzing and understanding the present context, and what goals will be planned to achieve in the future.

Regardless of the type of reflective practice model, educators need to find a suitable model integrated within their instructional practices to develop learners' metacognitive knowledge and regulation. A study by ElSayary (2021) stated that the preservice teachers who integrated the reflective practice model into their teaching during online learning changed their perceptions and practices. To be a reflective thinker, preservice teachers must understand how they think and learn, and document all their reflective practices (Biggs, 2003). Students develop their metacognitive knowledge and regulation by increasing their levels of reflective thinking by using online forum discussions, self-evaluating their work, writing weekly journals, and doing other reflective tasks. Kember et al. (2000) pointed out that learning with technology develops preservice teachers' learning and skills through a cyclical investigation process, where reflection and feedback are integral aspects of learning. Reflection is the link between metacognitive knowledge and metacognitive regulation. Increasing knowledge increases an individual's ability to reflect and develop regulation (McAlpine et al., 1999).

Conceptual Framework

In light of the above literature, we developed a conceptual framework to guide this study. Figure 1 illustrates the study's framework where reflective practice is used to link metacognitive knowledge and self-regulation. Rolfe et al.'s (2001) model was used to make the connection between metacognitive knowledge and regulation. The first step in the reflective practice model is to ask "What?" This helps students to plan what they want to learn and describe their perceptions and feelings of the situation. The second step is "So what?" which is to understand what knowledge, theories, and skills could help make sense of the situation and monitor their learning journey. Finally, the "Now what?" allows learners to self-evaluate their work and plan for future goals to be achieved (Rolfe et al., 2001).

Figure 1. The Conceptual Framework Used to Guide the Study Was Adapted from Rolfe et al. (2001) and Schuster et al. (2020)



METHODOLOGY

This research was designed using an explanatory sequential mixed-method approach that aimed to address the main question of the study: To what extent did preservice teachers develop their metacognitive knowledge and self-regulation in online

Table 1. The Form of the Research Pattern in the Quasi-experiment

Site	Group	Pretest	Application	Posttest	Focus Group
Campus 1	Control	O1	–	O3	
Campus 2	Experimental	O2	Reflective Model	O4	12 Preservice Teachers

learning? The study was conducted during the fall semester of 2020. The study adopted an explanatory sequential mixed-method approach, whereby the quantitative data were collected first using a quasi-experiment (pretest-posttest control group), and then qualitative data was gathered using focus group discussions. Table 1 shows the form of the research pattern of the experimental and control groups with two sections on Campus 1 for the control group and two sections on Campus 2 for the experimental group. The pretest survey is presented as O1 for the control group and O2 for the experimental group, while the posttest survey is presented as O3 for the control group and O4 for the experimental group.

The main purpose of using an explanatory sequential mixed method is to apply the quasi-experiment and collect quantitative data first to understand how the reflection practice influence preservice teachers' metacognitive regulation and knowledge. This is followed by a qualitative data collection that allows for gathering in-depth information about preservice teachers' reflection regarding their metacognitive knowledge and self-regulation. This information was collected using focus group discussions through Zoom meetings with preservice teachers in the experimental group. Creswell et al. (2013) mentioned that the research design's theoretical lens could be explicit or implicit according to the research design. In this study, the theoretical lens is implicit as the study will use a sequential mixed method.

Participants

The intended sample size was 60 preservice teachers from the two campuses in Dubai and Abu Dhabi. However, due to the criteria of selection, the number of participants was reduced. The criteria set for the participants were defined that they be (a) enrolled in their first, second, or third semester in an undergraduate early childhood education program, (b) registered in a Practicum I course (the first practical course of the early childhood education program), and (c) willing to participate in the study. The preservice teachers' practicum course was in different schools (private and governmental) with different curricula: Ministry of Education (MOE), and American, British, and International Baccalaureate (IB). In the Practicum I course, preservice teachers were required to complete six observation tasks in 12 weeks by observing grades 1-3 students online for the following: learning environment, social-emotional development, lesson implementation, language and literacy, assessment for learning, and managing a classroom. Preservice teachers spent two weeks for each task. One week was working with the instructor on understanding how to observe using YouTube videos and practicing the observation skills. The following week, they were placed in schools virtually to complete their observation tasks.

The participants were all the preservice teachers in the early childhood education program. The sample was selected purposefully from two campuses to have two sections on the Dubai campus (control group, $n_C = 23$) and two sections on the Abu Dhabi campus (experimental group, $n_E = 34$). The adequacy and equivalency between the groups were measured to ensure that there are no differences between the groups before conducting the quasi-experiment. Then, we randomly assigned the experimental group to be at the Abu Dhabi campus and the control group was assigned to the Dubai campus. The total sample (n = 57) was selected purposefully from preservice teachers who met the criteria. According to McMillan and Schumacher (2010), nonequivalent groups of pretest-posttest control group design is very dominant and useful in education as it is difficult to assign subjects randomly. The participants were 100% females 18-21 years old. The sample selected for the focus group discussion was 12 preservice teachers selected randomly from the experimental group. A fair explanation of the study's purpose and procedures was given to participants before conducting the study, and a consent form was sent for their signature. Participants had the choice of whether or not to participate in the study, and all data collected

were anonymous. According to Cohen's (1988) power table for effect size *d*, an average was estimated of [*d* =] 1.0 with alpha set at .05 and power (1 – beta) set at .80, a sample size of at least 17 participants per group was needed. In order to confirm the study's participants selection, the sampling power was measured using SPSS to be 0.827 using the sample size of 57 participants ($N_c = 23$ and $N_E = 34$) and $p < 0.5$. The power analysis is greater than 0.8, which is considered high, as per Cohen (1988).

Instruments

The preservice teachers' survey was used for conducting a quasi-experimental pretest-posttest control group that aimed to investigate the impact of the reflection model used that was set as the treatment. The dependent variables were identified as metacognitive knowledge and metacognitive regulation. The survey was adapted from the Metacognitive Awareness Inventory (MAI) by Schraw (2006) and used a five point-Likert scale: 1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, and 5 = *strongly agree*.

The first section of the survey started with demographic information to ask teachers about the courses they had registered for, the semester they were enrolled in, and their age. The second section includes 17 closed-ended metacognitive knowledge items (8 items declarative knowledge, 4 items procedural knowledge, and 5 items conditional knowledge). The third section in the survey is also closed-ended items of metacognitive regulation to form 15 items (5 items planning, 4 items comprehension monitoring, and 6 items evaluation). The survey given to the preservice teachers did not include the identification of categories for validity because providing category names might influence teachers' responses.

The survey was sent to an educational specialist for content validity. She was asked to give feedback on the appropriateness of the items selected to fulfill the study's purpose. The feedback received from the expert was to reduce the items in the survey since students are learning online and a few items were not applicable. Accordingly, the total number of the survey items was reduced to 32, and no further changes were required. The internal consistency of Cronbach's Alpha was measured for the reliability of the instrument. The survey was piloted with 30 students, and the reliability test was valued at 0.980, $\alpha > 0.9$, which is considered suitable for the study.

The focus group discussion was used to address the second question of the study: What are the preservice teachers' perceptions about their metacognitive knowledge and regulation? The focus group discussion questions were adapted from Rolfe et al. (2001) to ask students questions about their experience in the practicum course and the observation tasks they had carried out. The questions consisted of three main categories of Rolfe's practice model: What, So What, and Now What. For each category, there were four semistructured questions. In the What category, students were asked: What were you trying to achieve? What was your role in the tasks? What was the outcome of the situation? What was good/bad about the experience? Students were asked in the So What category: So, what does this tell you/teach you/imply about the situation/your attitude/practice/problem? What did you base your decisions/actions on? What could you have done differently to get a more desirable outcome? What does this experience tell you about how you work? Finally, students were asked in the Now What category: Now, what does this experience teach you? What do you need to do in the future to do better/fix a similar situation/stop being stuck? What considerations do you need about yourself/others/the situation to make sure this plan is successful? What do you need to do to ensure that you follow your plan?

Procedure

This study was designed using an explanatory sequential mixed-method design, in which quantitative data were collected first, then the qualitative data were collected throughout the semester. We used a quantitative approach to address Research Question 1 (How does the reflection practice influence preservice teachers' metacognitive knowledge and regulation?) by employing a quasi-experiment (pretest-posttest control group design) conducted with preservice teachers. We used a qualitative approach to address Research Question 2 (What are the preservice teachers' perceptions about their metacognitive knowledge and regulation?) by utilizing a focus group discussion conducted with selected students from the experimental group.

Participants received the consent forms at the beginning of the semester, and a full explanation of the study's purpose was shared with them.

Participants received a web-survey link as a pretest in the first two weeks of the semester. The experimental group practiced Rolfe's reflection model and the web survey link as a posttest was sent to both groups. The descriptive and inferential statistics were used to present each group's mean and standard deviation and to analyze the effect on preservice teachers' metacognitive knowledge and regulation. Handal et al.'s (2013) questionnaire score range (presented in Table 2) was used as a reference to explain and describe the mean score range of the descriptive statistics in the survey results used in this study.

Table 2. Handal et al.'s (2013) Questionnaire Score Range of the Means

Score Range	Description
$1.0 \leq x < 1.5$	Very low
$1.5 \leq x < 2.0$	Low
$2.0 \leq x < 2.5$	Moderately low
$2.5 \leq x < 3.0$	Slightly below average
3.0	Average
$3.0 < x \leq 3.5$	Slightly above average
$3.5 < x \leq 4.0$	Moderately high
$4.0 < x \leq 4.5$	High
$4.5 < x \leq 5.0$	Very high

The qualitative data were collected using the focus group discussions conducted at the end of the semester, after the posttest, to investigate the preservice teachers' perceptions about their metacognitive knowledge and regulation. There were two focus group discussions with six preservice teachers in each group selected from the experimental group. The discussions were conducted through Zoom for 30–50 minutes each with an average of 40 minutes. The results were analyzed using the phenomenological approach to narrow the lens and understand preservice teachers' perceptions. The open-ended questions used were based on Rolfe's reflection model that includes: What?, So what?, and Now what?

RESULTS

Equivalence and Adequacy of the Two Groups

In order to begin the analysis, the descriptive statistics of pretest-posttest experimental and control groups were calculated and are presented in Appendix A where Table 3 presents the analysis of metacognitive knowledge and Table 4 presents the analysis of metacognitive regulation. In metacognitive knowledge, there are three categories of measure: declarative, procedural, and conditional knowledge. For the declarative knowledge, the results show that the mean of the pretest control group ($M = 3.25$, $SD = 1.22$) was slightly higher than the mean of the pretest experimental group ($M = 3.16$, $SD = 0.620$). In procedural knowledge, the mean of the pretest control group ($M = 3.17$, $SD = 1.16$) was slightly lower than the mean of the pretest experimental group ($M = 3.21$, $SD = 1.17$). In conditional knowledge, the mean of the pretest control group ($M = 3.00$, $SD = 1.39$) was slightly lower than the mean of the pretest experimental group ($M = 3.24$, $SD = 1.25$). According to Handal et al. (2013), the means range in metacognitive knowledge is between average and slightly above average.

For metacognitive regulation, Table 4 in Appendix A shows that there are three categories of measures: planning, monitoring, and evaluation. For the planning, the results show that the mean of the pretest control group ($M = 3.31$, $SD = 1.27$) was slightly lower than the mean of the pretest experimental group ($M = 3.45$, $SD = 1.16$). In monitoring, the mean of the pretest control group ($M = 3.19$, $SD = 1.25$) was slightly lower than the mean of the pretest experimental group ($M = 3.25$, $SD = 1.12$). In evaluation, the mean of the pretest control group ($M = 3.02$, $SD = 1.03$) was slightly lower than the mean of the pretest experimental group ($M = 3.27$, $SD = 1.28$). According to Handal et al. (2013), the means range in metacognitive regulation is also between average and slightly above average.

The equivalency and adequacy between the control and experimental groups were measured by conducting a one-way analysis of variance before running the quasi-experiment. Regarding metacognitive knowledge, the results showed no significant difference between the pretest of the experimental and control groups, as follows: declarative knowledge ($p = 0.97$), procedural knowledge ($p = 0.99$), and conditional knowledge ($p = 0.83$). For metacognitive regulation, results also showed no significant difference between the

pretest of experimental and control groups, as follows: planning ($p = 0.96$), monitoring ($p = 0.99$), and evaluation ($p = 0.82$).

Influence on Preservice Teachers' Metacognitive Regulation and Knowledge

Following the descriptive statistics analysis and the equivalency and adequacy test, the two groups' mean was compared using the univariate analysis of variance. The results of the pretest-posttest control and experimental groups showed significant differences in metacognitive knowledge and regulation.

METACOGNITIVE KNOWLEDGE

The metacognitive knowledge includes three types: declarative, procedural, and conditional knowledge. The results are represented in Appendix B where tables 5, 6, and 7 present the declarative knowledge, procedural knowledge, and conditional knowledge, respectively. As shown in Table 5, declarative knowledge revealed significant differences ($F (1, 110) = 20.639$, $p < 0.001$, $\eta p2 = 0.360$). As shown in Table 6, procedural knowledge revealed significant differences ($F (1, 110) = 15.246$, $p < 0.001$, $\eta p2 = 0.294$). As shown in Table 7, conditional knowledge revealed significant differences ($F (1, 110) = 15.983$, $p < 0.001$, $\eta p2 = 0.304$). All types of knowledge shown in the metacognitive knowledge were significant, but the declarative knowledge was shown to have the highest percentage at 36%, while conditional knowledge was 30.4% and procedural knowledge was 29.4%. This means that most preservice teachers' agreements ranged from highest to lowest in declarative, conditional, and procedural knowledge.

METACOGNITIVE REGULATION

The metacognitive regulation includes three types: planning, monitoring, and evaluation. The results are represented in Appendix C where Tables 8, 9, and 10 present the planning, monitoring, and evaluation, respectively. As shown in Table 8, planning revealed significant differences ($F (1, 110) = 9.485$, $p < 0.001$, $\eta p2 = 0.206$). As shown in Table 9, monitoring revealed significant differences ($F (1, 110) = 13.114$, $p < 0.001$, $\eta p2 = 0.263$). As shown in Table 10, evaluation revealed significant differences ($F (1, 110) = 12.858$, $p < 0.001$, $\eta p2 = 0.261$). All types of knowledge shown in the metacognitive regulation were significant. However, monitoring and evaluation were shown to have the highest percentage of 26.3% and 26.1%, respectively, while planning was 20.6%. This means that most preservice teachers' agreements ranged from highest to lowest in monitoring, evaluation, and planning. According to Cohen's (1988) guidelines, these differences had a large effect size $\eta_p^2 > 0.14$ and showed a high power level. As a result, the null hypothesis was rejected, and we determined that the slight difference found between the means of the pretest control and pretest experimental group did not affect the results.

In addition, we conducted one-way analysis of variance to compare between the pretest and posttest experimental and control groups. The results showed a significant difference between the pretest and posttest of the experimental group ($p < 0.001$) and a significant difference between the posttest experimental and control groups where $p < 0.001$ regarding metacognitive knowledge (declarative, procedural, and conditional knowledge) and metacognitive regulation (planning, monitoring, and evaluation).

Focus Group Discussion

Due to the situation of being unable to meet in person during lockdown, we met with preservice teachers virtually using Zoom conference. Their responses were categorized based on the three stages of the reflective practice model, as it sets the connection between the metacognitive knowledge and regulation. Preservice teachers shared their thoughts about their experiences in the Practicum I course.

In the What category, students were asked: What were you trying to achieve? What was your role in the tasks? What was the outcome of the situation? What was good/bad about the experience?

Preservice teachers agreed that the observation tasks in their Practicum I course were challenging in the beginning. However, they got used to it, especially as the mentor teachers guided them. They were having fears of not being able to observe grades 1–3 online classes. Below are some preservice teachers' responses:

PT1: "I aimed to understand the observation items and describe what I saw to understand the learning environment. The outcome was not that bad because I got most of the answer, just two of the learning environment indicators that I did not get it."

PT2: "I still have some questions in mind and questions on my paper that need an answer. To get a more desirable outcome, I asked for some help from the class teacher, and she answered all my questions. This experience tells me about the way I work, that it does not depend on what I have only in front of me, I have to go and ask for help because I may miss some information."

PT3: "I aimed to observe children virtually. I was worried about understanding the indicators and got an answer for the items. Some of them were not clear for me, so I discussed them with the teacher. The good thing is that I have the opportunity to speak to the teacher. The bad thing is the difficulty I faced, in the beginning to observe young students online, but then it was easy after considering some items that cannot be observed online. Also, maybe because it was my first time to do the observation."

PT4: "My aim was to observe the learning environment. It was beneficial, I learned a lot of things, but I wish I could ask more questions to know even more information. Mentors sometimes are overwhelmed in teaching online, so I didn't ask many questions."

PT5: "My aim is to observe students in grades 1-3 online and use the observation checklist. In the beginning, it was very overwhelming as we have to focus on the items and try to address each point. The problem is that some items on the observation tasks did not apply to online learning while other items should be included such as students' engagement."

Students were asked in the So What category: So, what does this tell you/teach you/imply about the situation/your attitude/practice/problem? What did you base your decisions/actions on? What could you have done differently to get a more desirable outcome? What does this experience tell you about how you work?

Preservice teachers agreed that this experience changed their perspectives on observing classes and the difference between objectivity and subjectivity in observations. They gained new skills and learned different methods of teaching grades 1–3 students online. Some of them recognized that it is essential to reflect and learn from their own mistakes. Some of the exciting responses are listed below:

PT1: "My actions and decisions were based on the answers I received for the questions I asked. For example, if the answer I got was useful, I can use it in the future, but I can learn from my mistakes if it is not. I could have asked more questions to increase my knowledge and to clear my confusion. It is important to learn from my mistakes as I will never forget what I have learned."

PT2: "I based my decision and action first on the video that we saw together in class. I wrote notes as much as I could. Then we discussed the video with my instructor, which also helped me get notes to apply it in the online observation. This experience tells me that there are small details while teaching [that] maybe the teacher won't focus on and may affect students' learning. So that every teacher has to put a plan before meeting students and make sure each student is participating."

PT3: "I based my decisions on the video that I saw and what the instructor discussed with me. It shows me the learning environment and what is offered for the children, and if I did not find the answer to my question on the video, I need to ask more questions. This experience allowed me to think more about the children and the learning environment and observe classes using critical analysis of what I see and hear from teachers and students. I started even to compare between teaching online and teaching face-to-face."

PT4: "I observed the online classes, took notes, and identified the needs for each student. This experience taught me how to be objective in observing classes. Also, it gave me a clear image about what a learning environment for children looks like."

PT5: "There is no doubt that online learning is affecting everyone (teachers and students). I learned the difference between teaching online and teaching face-to-face. Young students need to be in the face-to-face learning environment to make sure that they are cognitively, socially, emotionally, and physically developing. However, there are many ideas can be used in online teaching to help and support students and parents, such as: creating a home learning pack, reading interactive stories, calling students by name and asking them, build a good rapport with students, etc."

Finally, preservice teachers were asked the following in the Now What category: Now, what does this experience teach you? What do you need to do in the future to do better/fix a similar situation/

stop being stuck? What considerations do you need about yourself/others/the situation to make sure this plan is successful? What do you need to do to ensure that you follow your plan?

Preservice teachers expressed their satisfaction with the learning experiences they had experienced. They all agreed about the challenges they faced in observing grades 1–3 students online, but they learned better with persistence in accomplishing the tasks. All of them had plans, and they set goals for themselves to achieve. Some of the exciting responses were listed below:

PT1: "In the future, I think that I need to be specific and brainstorm for the information that I have and write only a keyword so that I remember it. To ensure that I follow my plan, I need to finish all my work on time and practice on each task to understand it better."

PT2: "It taught me to be responsible and be more attentive. I am encouraged to work hard and put more effort into achieving my goals. I will plan my work ahead of time with achievable goals and try to follow my plans. I might make some adjustments in the plan but will insist on achieving my goals."

PT3: "This experience taught me not to depend on one source of information, and try to validate the information I received. In the future, I will reflect every day on my teaching practices and will write notes about everything and seek answers for my questions. I have to make sure that I am following my plans and set new goals whenever I achieve the old ones."

PT4: "This experience taught me to focus on everything about students' learning and their needs. Also, the interaction between the teachers, children, and their work is very important in teaching. In the future, I think that I need to be more specific and brainstorm for the information that I have and write only a keyword so that I remember it. To ensure that I follow my plan, I need to finish all my work on time and do more observations to help me."

PT5: "This experience taught me to consider the unexpected situations that might occur and make sure that I develop the skills that I might need later. For example, I have to consider developing my digital competencies and create new ways of interacting with young students. I need to go beyond the expected learning outcomes to support the new generation."

DISCUSSION

The discussion section is derived from the qualitative and quantitative data where both types of data complement each other in discussing and addressing the study's questions.

INFLUENCE ON PRESERVICE TEACHERS' METACOGNITIVE REGULATION AND KNOWLEDGE

The reflective practice model of Rolfe et al. (2001) was used as a conceptual framework that guided this study. It included three stages of What, So What, and Now What. In each stage, students were able to link the components of metacognitive knowledge and metacognitive regulation. The results show a significant difference between the control and experimental groups due to the use of reflective practices that form as a link between metacognitive knowledge and metacognitive regulation. The results agree with Schuster et al. (2020), who emphasized the role of reflection in a blended learning environment and how it transfers the metacognitive knowledge in self-regulated learning. The preservice teachers were able to use their declarative knowledge (own knowledge and beliefs) in questioning themselves about what they need to plan for and what appropriate strategies to use. Also, they used their procedural knowledge (own knowledge about their skills) in questioning themselves about how they will perform in specific tasks and what needs to change. Finally, they used their conditional knowledge (knowing the right time to apply various actions) to self-evaluate themselves and think of new goals to achieve. This was also emphasized by Mutch (2012), who highlighted what students need to know, how they learn, what will be their next step, and how they will know that they have got there.

Preservice teachers observed grades 1–3 students online and completed six observation tasks in twelve weeks. They reflected with their instructors every other week on each observation task. During the focus group discussions, they emphasized the importance of reflecting and practicing with their instructors on these tasks. This is the reflection *in* action that was highlighted by Schon (1987). In addition, they reflected on the overall experience after they finished the six observation tasks. They highlighted some challenges and benefits of their experiences. This kind of reflection

was also highlighted by Schon (1987), which is called reflection *on* action. Furthermore, preservice teachers started to realize that they needed to plan for the new demands of the emergence of remote teaching and to consider many skills that need to be developed for their future jobs. This is a reflection *for* action that was emphasized by McAlpine et al. (1991), which is to consider future actions in the light of past experience.

It is significant and important to highlight that the preservice teachers passed through the four levels of reflection (reflection, reflexivity, critical reflection, and reflective practice) identified by Lawrence-Wilkes and Ashmore (2014). They thought about and interpreted their knowledge and beliefs to plan for their tasks, which is defined as reflection. They thought objectively about their own behavior and skills in monitoring their work, which is defined as reflexivity. They also questioned and examined their own knowledge, beliefs, and actions when they self-evaluated their work, which is considered critical reflection. Finally, they set new goals to achieve and be prepared for their future jobs and to consider a new set of goals whenever they reached the old ones; this is identified as reflective practice (Lawrence-Wilkes & Ashmore, 2014).

Preservice Teachers' Perceptions about Their Metacognitive Knowledge and Regulation

Preservice teachers changed their perceptions about their metacognitive knowledge and regulation after using the reflective practice in observing young children online. This is in agreement with ElSayary's (2021) study, which stated that using the reflective practice model in teaching preservice teachers using online learning changed their perceptions and practices. Preservice teachers did not observe classes face-to-face due to the pandemic situation of COVID-19 and all classes were shifted online. This experience was challenging and beneficial at the same time. According to Kember et al. (2000), learning with technology develops students' knowledge and skills through a cyclical investigation process.

In the focus group discussions, preservice teachers highlighted that some of the observation tasks' items were not applicable to be addressed in the online classes, and that some items should be added. Although adjustments to learning plans took place in the response to the emergent necessity of remote teaching due to the quarantine of COVID-19 (Dubai Future Foundation, 2020), other things need to be revised carefully and considered in students' work, such as adjusting the observation items that can be used and addressed in online learning. Furthermore, one of the aspects they highlighted in teaching young children online is to focus on social and emotional development and find ways to address them in online classes. The OECD Learning Compass 2030 report emphasized developing cognitive and metacognitive, social and emotional, and practical and physical skills (OECD, 2018).

Preservice teachers highlighted the importance of considering the unexpected critical situations and of being prepared to support young students, either online or face-to-face. They highlighted the importance of developing their digital competencies to communicate, teach, and work remotely with young students using different applications to create innovative learning environments that engage students cognitively, socially, and behaviorally in learning. Broup et al. (2020) highlighted the importance of considering three main aspects of students' engagement in online learning: cognitive, social-emotional, and behavioral engagements.

CONCLUSION AND RECOMMENDATION

The study investigated the impact of preservice teachers' reflective practice on developing their metacognitive knowledge and self-regulation in online learning. Preservice teachers' reflection practices have a positive significant impact on developing their metacognitive knowledge and self-regulation in online learning. It is essential to develop learners' metacognitive knowledge and self-regulation because education after COVID-19 will not return to be the same as before. The use of metacognitive knowledge (declarative, procedural, and conditional) and metacognitive regulation (planning, monitoring, and evaluating) lead learners to acquire self-regulation and lifelong learning. This was also confirmed by Stephanou & Mpiontini (2017), who emphasized that metacognitive knowledge and regulation in a self-regulator learning style have positive effect on developing self-regulated learning skills and enhancing students' performances. The research questions were fully addressed and confirmed the main purpose of the study. The use of Rolfe et al.'s (2001) model

helped preservice teachers connect their metacognitive knowledge (declarative, procedural, and conditional) to their metacognitive regulation (planning, monitoring, and evaluating), which need to be used in a cyclical process. They were able to develop their knowledge and regulation and reach the highest reflection level (reflective practice). Preservice teachers faced challenges in the beginning; however, the quarantine's uncomfortable situation led them to find alternative solutions to overcome these challenges. Using the reflective model led them to come up with suggestions for online learning that need to be considered. It is vital to adjust the observation tasks items to suit the online learning. The development of preservice teachers' digital competencies is essential in the wake of COVID-19. Enhancing young students' engagement and developing their social, emotional, and physical development are also essential. Teachers need to build a good rapport with young students and think of innovative solutions to enhance the online learning environment. Preservice teachers set new goals for themselves to achieve to prepare them for their future jobs. They learned how to use the reflective model in their daily routine and not just during learning.

TEACHING AND LEARNING RECOMMENDATIONS

Recommendations for the best teaching strategies and learning online should be considered and planned in teacher education programs. Also, developing preservice teachers' digital competencies should be part of their educational program, and the provision of proper professional development for in-service teachers should be considered. Stakeholders need to study the challenges and barriers that preservice and in-service teachers faced during the months of the pandemic and consider changes to meet the new demands of remote teaching and learning.

FUTURE RESEARCH CONSIDERATION

Future research should be conducted to investigate the impact of students' cognitive, social-emotional, and behavioral engagements in online settings. Another area of research is using the community of inquiry model to enhance teachers' cognitive, social, teaching, and learning presence in online classes. Research should be conducted to investigate the development of preservice and in-service teachers' digital competencies and their impact on young students' learning.

This study's limitations are the implication that the lockdown forced everyone to communicate virtually, and sometimes internet interruption caused some frustration for preservice teachers. Another limitation is the low number of participants due to the low number of students registered in the fall semester. In order to overcome these challenges, communication with students took place where more efficient applications (such as Zoom) were used instead of previous ones. This motivated students to communicate easily with instructors and peers.

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APPENDIX A:

DESCRIPTIVE STATISTICS OF METACOGNITIVE KNOWLEDGE AND REGULATION

Table 3. Descriptive Statistics that Show the Mean and Standard Deviation in Preservice Teachers' Metacognitive Knowledge for the Pretest and Posttest

Descriptives							
		N	Mean	Std. Deviation	Std. Error Lower Bound	95% Confidence Interval for Mean	
						Upper Bound	
Declarative Knowledge	Pretest Experimental	34	3.16	.620	.106	2.94	3.37
	Posttest Experimental	34	4.57	.236	.040	4.49	4.65
	Pretest Control	23	3.25	1.229	.256	2.71	3.78
	Posttest Control	23	3.52	1.112	.232	3.04	4.00
Procedural Knowledge	Pretest Experimental	34	3.21	1.179	.202	2.80	3.62
	Posttest Experimental	34	4.55	.330	.056	4.43	4.66
	Pretest Control	23	3.17	1.168	.243	2.66	3.67
	Posttest Control	23	3.06	1.213	.253	2.54	3.59
Conditional Knowledge	Pretest Experimental	34	3.24	1.254	.215	2.80	3.67
	Posttest Experimental	34	4.60	.392	.067	4.46	4.74
	Pretest Control	23	3.00	1.030	.214	2.55	3.44
	Posttest Control	23	3.06	1.391	.290	2.45	3.66

Table 4. Descriptive Statistics that Show the Mean and Standard Deviation in Preservice Teachers' Metacognitive Regulation for the Pretest and Posttest

Descriptives							
		N	Mean	Std. Deviation	Std. Error Lower Bound	95% Confidence Interval for Mean	
						Upper Bound	
Planning Regulation	Pretest Experimental	34	3.45	1.160	.199	3.05	3.86
	Posttest Experimental	34	4.54	.359	.061	4.42	4.67
	Pretest Control	23	3.31	1.273	.265	2.76	3.86
	Posttest Control	23	3.25	1.487	.310	2.60	3.89
Monitoring Regulation	Pretest Experimental	34	3.25	1.129	.193	2.85	3.64
	Posttest Experimental	34	4.62	.338	.058	4.50	4.74
	Pretest Control	23	3.19	1.258	.262	2.65	3.74
	Posttest Control	23	3.34	1.411	.294	2.73	3.95
Evaluation Regulation	Pretest Experimental	33	3.27	1.286	.223	2.82	3.73
	Posttest Experimental	34	4.58	.310	.053	4.47	4.69
	Pretest Control	23	3.02	1.037	.216	2.58	3.47
	Posttest Control	23	3.44	1.434	.299	2.82	4.06

APPENDIX B: EFFECT OF TREATMENT OF METACOGNITIVE KNOWLEDGE

Table 5. The Effect of Treatment for Declarative Knowledge

Tests of Between-Subjects Effects						
Dependent Variable: Declarative						
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	41.026[a]	3	13.675	20.639	.000	.360
Intercept	1454.126	1	1454.126	2194.559	.000	.952
Groups	41.026	3	13.675	20.639	.000	.360
Error	72.887	110	.663			
Total	1661.281	114				
Corrected Total	113.913	113				

Table 6. The Effect of Treatment for Procedural Knowledge

Tests of Between-Subjects Effects						
Dependent Variable: Procedural						
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	46.546[a]	3	15.515	15.246	.000	.294
Intercept	1345.228	1	1345.228	1321.850	.000	.923
Groups	46.546	3	15.515	15.246	.000	.294
Error	111.945	110	1.018			
Total	1615.125	114				
Corrected Total	158.491	113				

Table 7. The Effect of Treatment for Conditional Knowledge

Tests of Between-Subjects Effects						
Dependent Variable: Conditional						
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	53.589[a]	3	17.863	15.983	.000	.304
Intercept	1326.865	1	1326.865	1187.246	.000	.915
Groups	53.589	3	17.863	15.983	.000	.304
Error	122.936	110	1.118			
Total	1623.880	114				
Corrected Total	176.525	113				

APPENDIX C: EFFECT OF TREATMENT OF METACOGNITIVE REGULATION

Table 8. The Effect of Treatment for Planning

Tests of Between-Subjects Effects						
Dependent Variable: Planning						
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	34.412[a]	3	11.471	9.485	.000	.206
Intercept	1456.420	1	1456.42	1204.281	.000	.916
Groups	34.412	3	11.471	9.485	.000	.206
Error	133.031	110	1.209			
Total	1738.480	114				
Corrected Total	167.443	113				

Table 9. The Effect of Treatment for Monitoring

Tests of Between-Subjects Effects						
Dependent Variable: Monitoring						
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	44.569[a]	3	14.856	13.114	.000	.263
Intercept	1426.070	1	1426.070	1258.786	.000	.920
Groups	44.569	3	14.856	13.114	.000	.263
Error	124.618	110	1.133			
Total	1703.688	114				
Corrected Total	169.187	113				

Table 10. The Effect of Treatment for Evaluation

Tests of Between-Subjects Effects						
Dependent Variable: Evaluation						
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	44.294[a]	3	14.765	12.858	.000	.261
Intercept	1402.852	1	1402.852	1221.664	.000	.918
Groups	44.294	3	14.765	12.858	.000	.261
Error	125.166	109	1.148			
Total	1680.139	113				
Corrected Total	169.460	112				