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# Impact of online cooperative learning strategies on self-directed learning among pre-service teachers

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**ABSTRACT**

Self-directed learning (SDL) often drives learners to engage with what they want to learn. Thus, investigating teaching-learning strategies that drive SDL gains importance in this technology-driven era. The present study investigates the impact of online cooperative learning (OCL) strategies on SDL skills among pre-service teachers (PST). The study engaged 130 PSTs using a quasi-experimental non-equivalent control group design with a pretest and posttest. The study divided PST into a control group and an experimental group. The experimental group underwent OCL strategy, and the control group had a traditional online lecture method. The researchers measured the SDL of PST using the SDL scale. The paired sample t-test results indicated a significant enhancement in SDL skills among the experimental group compared to the control group. The findings underscore the importance of integrating cooperative learning (CL) strategies in online instruction to foster SDL ability among learners. Further studies may create user-friendly features in video-conferencing platforms that provide more opportunities to engage students with CL pedagogies.

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## 1. INTRODUCTION

The COVID-19 pandemic has changed education and pushed teachers and students to fit into online learning settings [1], [2]. This change has brought both chances for creative teaching and learning approaches and significant difficulties [3]–[5]. Self directed learning (SDL), which helps students take charge of their educational paths, is a vital ability that has evolved in this environment. Previous studies have showed that SDL is crucial for pre-service teachers (PST) since it promotes lifelong learning-a necessary element of professional development in a constantly evolving field of education [6]–[8]. Concurrently, cooperative learning (CL) strategies have evolved into an effective tool for online environments [9], [10], [8]. Online cooperative learning (OCL) fosters teamwork, critical thinking, communication, and subject knowledge building those aids students in virtual contexts [11]–[13].

Previous studies show that cooperative learning improves SDL by encouraging autonomous learning and self-regulation qualities vital for teachers continuously improving their abilities and knowledge [6], [14], [15]. However, earlier studies have not explicity addressed OCL's impact on SDL among PSTs. The objective of the present study is to find whether OCL strategy intervention improves SDL skills among PSTs. The current research addresses a critical demand in post-pandemic teacher preparation for producing self-directed, lifelong learners capable of succeeding in conventional and online learning environments.

The COVID pandemic has drastically changed the scene of education by driving teachers and students to adjust quickly to online or blended learning [16]–[18]. This sudden change exposed notable disparities in digital literacy, instructional tactics, and student participation levels [5], [19]–[21]. Programs for teacher preparation now have to contend with preparing future teachers for an uncertain terrain [7], [22], [23]. The closing of conventional institutions accentuated the need for self-directed, adaptable teachers to support significant learning opportunities in many environments [24]–[26]. It became clear during this crisis that depending too much on external monitoring has limits. One essential ability is SDL, which enables students to be proactive and accountable for their learning paths [27]–[29].

In line with the above, in teacher preparation, SDL is not just for fulfilling academic criteria but also for continuous professional development in adjusting to new technologies, materials, and pedagogical approaches [15, [30], [31]. Research describes SDL as a proactive process in which individuals evaluate their learning requirements, create goals, pinpoint resources, and own outcomes [32]. Reinforcement of SDL in teacher training is essential for developing lifelong learners capable of handling technological developments and new challenges [33]–[35]. SDL helps teachers consider their instruction methods, pursue independent professional growth, and evaluate their work [28], [36], [37]. SDL provides the basis for PSTs' reflective practice, ensuring they remain updated with technological advances and curriculum revisions [38]–[40]. Modern education requires adaptation to engage 21st-century learners, and these educators may fail without SDL [9], [41], [42].

Previous studies on teacher preparation highlight the importance of SDL [39], [43], [44]. Previous studies reveal a positive link between SDL and academic success, meaning that PSTs who participate actively in their learning usually perform well [45]–[47], [24]. Furthermore, SDL is associated with greater motivation, self-efficacy, and professional competency qualities vital for good teachers [11], [13], [44]. However, accomplishing SDL calls for help from educational institutions and sound teaching strategies [15], [43], [48]. Encouraging students to take charge of learning is not enough; they also need structured opportunities and surroundings supporting autonomy and collaboration [49]–[51] and these contexts underscore the importance of OCL.

OCL is the group activities in digital settings that support social interaction and shared learning objectives [44], [45], [47]. Under OCL, students collaborate to address challenges and consider their progress through dialogues [39], [52], [53]. This collaborative approach develops critical thinking, communication, and teamwork [11], [40], [8]. Focusing on learner autonomy and accountability, OCL closely aligns with SDL principles [11], [52], [54]. Through OCL, PSTs actively engage in their learning, making decisions about task management and peer interactions. This disciplined yet adaptable environment promotes self-regulation a necessary skill for SDL [54], [55], [33]. OCL's spontaneous social interactions help students debate one another's views and offer feedback, therefore deepening their content engagement and research support OCL's effectiveness in fostering SDL [54], [46], [10], [56].

Research indicates students can establish objectives and manage their conduct by implementing structured online cooperative projects. Moreover, students in conventional contexts were less prepared for SDL than those in OCL [30], [4]. Previous research in cooperative leanring shows that, students transform from passive recipients to active participants, which is crucial for developing SDL. This transition fosters accountability and ownership [38], [57], [58]. The flexibility of OCL further enables learners to regulate their participation, thereby fostering independence and time management skills [22], [52], [59]. Pre-service teacher education is shifting towards online and blended learning more and more. As programs for teacher training change, developing SDL takes the front stage. Strong SDL PSTs are more suited to negotiate the complexity of current teaching, including including new technologies and fulfilling varied student needs [12], [14], [35].

Examining OCL's impact on SDL addresses a gap in the literature. While previous research investigated the benefits of CL in numerous contexts, but few have examined how CL in online contexts affects PSTs' SDL post-pandemic. The present research contributes to the body of knowledge on SDL and OCL by demonstrating how OCL could enhance SDL, an essential skill for prospective teachers' lifelong learning and professional development. The thorough literature study underlines the need to develop SDL among post-pandemic PSTs. It emphasizes OCL's great potential as a formidable teaching tool that supports SDL through collaboration and critical thinking, leading teacher education initiatives to combine OCL strategies properly.

This study's theoretical framework integrates adult learning theories [32], Vygotsky's social learning theory [60] and [61] social cognitive theory to explore how online andragogy emphasizes learner autonomy. Vygotsky [60] highlights that social interaction, peer group discussion, and scaffolding during OCL enhance SDL among PSTs. Vygotsky's [60] zone of proximal development (ZPD) envisioned CL environments like OCL to enable learners to reach deep comprehension through scaffolding and peer learning opportunities. Bandura's theory emphasizes observational learning and self-efficacy's part. PSTs develop self-regulation abilities in OCL by seeing and copying successful peer tactics, building their

confidence. These theoretical lenses show that OCL creates an environment fit for SDL, therefore arming following teachers with the tools they need for professional growth and lifelong learning.

## 2. METHOD

The present study utilized a quasi-experimental non-equivalent control group design [62] with a pretest and posttest. The study's population involved the PSTs in India's Bachelor of Education (B.Ed.) programs from 2021 to 2023. The study sample consisted of 130 PSTs. Using convenient sampling, the researchers selected intact groups from two B.Ed. Colleges as the experimental (N=65) and control groups (N=65). The experimental group engaged in OCL strategy intervention, while the control group participated in the traditional online lecture method. The researchers measured the SDL skills using a self-directed learning (SDL) skills scale for pre-service science teachers developed by Acar *et al*. [63]. The scale consisted of two factors: 'self-efficacy' (10 items; $\alpha$=0.74) and 'awareness' (11 items; $\alpha$=0.84). The scale used a rating process developed by Likert with a score between 5 and 1. Respondents chose one of the propositions of 'totally agree', 'agree', 'undecided', 'disagree', and 'strongly disagree'.

The researchers developed OCL strategy intervention modules for the present study. Researchers selected the content of the modules from the educational psychology course of the B.Ed. programme. The researchers validated the OCL strategy intervention modules with 5 subject experts and computed an inter-rater agreement (IRA) value of 0.80 and a scale-content validity index (S-CVI) value of 0.95, indicating strong agreement and integrity [64], [65], of the modules among assessors in key areas (objectives, content, format, language, presentation, and utility). The modules were piloted among 20 PSTs and reliability of the SDL scale was established with Cronbach's $\alpha$=0.85. The researchers approached the colleges and obtained permission to conduct the study from the college administration and also collected informed consent from the study participants.

The researchers administered the SDL scale on control group and experimental group as a pretest at the beginning of the intervention, and as a posttest after the intervention. The scale was administered in a controlled environment to ensure the validity and reliability of the measurements. After finalizing the timetable for the intervention phase, the researchers conducted an orientation for the experimental group about OCL strategy intervention. They trained the PSTs in the experimental group on Zoom, break-out rooms, email, Google Classroom, writing reflective journals in digital form, filling assessment sheets, online evaluations, and resource searching before the intervention. The OCL intervention lasted six weeks, during which the experimental group completed OCL sessions with various online tasks, discussions, and projects in virtual environments, and completed reflective journals. The control group participated in the traditional online lecture method, emphasizing lecture-based content delivery and individual tasks. After the intervention, both groups retook the SDL skills scale to measure changes in SDL skills as posttest.

## 3. RESULTS AND DISCUSSION

The normality of the data from both groups in their pretests and posttests were assessed using the Shapiro-Wilk to test. Following normality confirmation, paired sample t-test compared scores of SDL between pre and posttests of control group and experimental group, identifying any statistically significant differences post-intervention. Data analysis was conducted using Jamovi (version 2.3.16). Table 1 shows that the *p*-values of all the variables in the test are greater than 0.05. So, statistically the sample distribution is approximately normal.

Table 1. Normality test of SDL skill

| | | Shapiro-Wilk *p* | | |
|---|---|---|---|---|
| Tests | Groups | Mean | *df* | sig |
| Pretest | SDL control | 84.0 | 3.30 | 0.183 |
| | SDL experimental | 84.1 | 3.49 | 0.060 |
| Posttest | SDL control | 83.8 | 2.56 | 0.153 |
| | SDL experimental | 90.7 | 3.00 | 0.075 |

From Table 2, the paired sample *t-tests* of the control group show that $t(64.0)=0.982$, $p=0.330$. The obtained *p*-value is more significant than 0.05. The results suggest no significant difference in the control group's mean pretest ($M$=84.0, $SD$=3.30) and posttest scores ($M$=83.8, $SD$=3.00) of SDL skills. Similarly, the paired sample *t-tests* of the experimental group show that $t(64.0)=-22.0$, $p=0.001$. The obtained *p*-value is less than 0.05. The results suggest a significant difference in the experimental group's mean pretest ($M$=84.1,

*SD*=3.49) and posttest (*M*=90.7, *SD*=2.56) scores of SDL skills. From the results, it is clear that the experimental group, which had the OCL strategy intervention, significantly improved their SDL skills compared to the control group, which had a traditional online lecture method of teaching.

Table 2. Paired sample t-tests between pre and post test of SDL among control group and experimental group

| Groups | | Mean | Std. deviation | Paired differences: Std. error difference | 95% confidence interval of the difference: Lower | Upper | *t* | *df* | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| Control group | Pretest | 84.0 | 3.30 | 0.204 | -0.207 | 0.607 | 0.982 | 64.0 | 0.330 |
| | Posttest | 83.8 | 3.00 | | | | | | |
| Experimental group | Pretest | 84.1 | 3.49 | 0.302 | -7.23 | -6.03 | -22.0 | 64.0 | .001 |
| | Posttest | 90.7 | 2.56 | | | | | | |

This study investigates the impact of OCL strategy intervention on SDL skills among PSTs. The present study's findings revealed that OCL strategy intervention significantly fosters SDL skills among PSTs. These findings align with the previous studies in CL [54], [58], [6]. The findings of the current study underline the need to include OCL within teacher education programs as well as the efficiency of the OCL strategy intervention on SDL capabilities of PSTs. This integration might equip the PSTs to be reflective and self-directed [14], [38], [4]. One of the benefits of OCL is that it may meet various learning requirements. Learners in an OCL environment can engage in activities that fit their particular learning style while helping the group achieve goals. PSTs significantly benefit from this adaptability since they will come across pupils with different learning styles in their classrooms.

Moreover, PSTs collaborate, think critically, and problem-solve through OCL. OCL may prepare PSTs for continuous professional development and lifelong learning [46], [56], [26]. At the same time, earlier research shows that lifelong learning will be required in the post-pandemic future by motivating involvement, cooperation, accomplishing shared goals, and flexibility to alter pedagogy and technology [3], [17], [10], [18]. Effective teaching in many different educational environments depends on PSTs participating in real-world tasks requiring cooperation, critical thinking, and problem-solving all of which OCL lets them accomplish. Thus, including CL in online and in-person instruction gives PSTs the chance to grow in these areas early in their professions.

OCL promotes active participation in the materials and classroom. These help to strengthen the SDL abilities of the PSTs. SDL skills enable PSTs to take ownership of their learning by finding resources and staying informed about current educational trends. Moreover, it empowers PSTs to be accountable for their learning and ongoing skill development. OCL allows PSTs to augment their digital competencies [52], [10], [19]. Structured OCL strategies enhance SDL skills. It equips teachers to understand the SDL process, enabling them to take greater responsibility for their learning [45], [10], [42]. According to the study, organized OCL activities may work as a scaffolding for SDL skill development. Teacher training programs can create activities that help PSTs traverse the process of self-regulation, goal-setting, and independent learning rather than expecting them to become self-directed learners independently.

OCL addresses learning requirements by enabling PSTs to participate in activities that align with their personal preferences while contributing to collective objectives [54], [47]. The findings underscore the importance of integrating CL strategies in online teaching and learning to foster SDL ability among learners. The study emphasizes how much SDL helps to foster ongoing professional growth. Teachers must be able to autonomously find new learning opportunities, practice professional development, and apply creative teaching approaches in a fast-changing educational scene. Maintaining a sound professional competency and overcoming new challenges depend on the self-reflection, critical thinking, and teamwork abilities acquired in OCL. By including OCL in their courses and pushing PSTs to take responsibility for their learning and keep honing their abilities long after they have finished their official education, teacher education programs can help to create a culture of continuous professional development. More chances to involve students with CL pedagogies mean that further research could produce user-friendly elements in video-conferencing systems.

The results of this study highlight the significant consequences for pre-service teacher education in a post-pandemic setting depending more and more on online and blended learning. This study shows that OCL strategy intervention greatly enhances SDL skills in PSTs, therefore supporting the inclusion of OCL within teacher preparation courses. This integration promotes CL and helps prospective teachers to develop personally as reflective practitioners skilled in continuous professional development. OCL encourages digital competencies and collaborative skills required for modern educational standards, and it improves practical projects that foster critical thinking and problem-solving, which are essential for effective instruction. So, incorporating structured OCL strategies in online learning can support SDL nurturing among PSTs by taking

individual responsibility for their learning and satisfying students' individual needs. These, in turn, foster their continuous professional improvement.

## 4. CONCLUSION

The findings of the present study reveal that the OCL Strategy intervention significantly enhances the SDL skills of PSTs compared to traditional instructional methods. OCL strategies support SDL by equipping teachers with essential digital tools, fostering collaborative skills, and promoting reflective practices crucial for success in traditional and online learning environments. OCL approaches equip future teachers to effectively negotiate the demands of modern education and contribute significantly to the teaching profession by supporting autonomy and teamwork. The study underlines how important it is to include CL approaches in online learning to help PSTs to be able to SDL. As education increasingly adopts blended and online learning paradigms, incorporating OCL into teacher education programs is vital for developing flexible, lifelong learners. In light of these findings, future research could focus on creating user-friendly features within video-conferencing platforms to provide more robust opportunities for engaging students with CL pedagogies. Such developments in education would maximize the interactive and collaborative possibilities of OCL approaches, improving educational results and attending to the changing needs of teacher preparation in various learning settings.

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

## CONFLICT OF INTEREST STATEMENT

There is no conflict of interest between the authors.

## INFORMED CONSENT

Researchers have obtained informed consent from all individuals involved in the study.

## ETHICAL APPROVAL

The researchers obtained an institutional review board (IRB) certificate of ethical approval from Christ University for the present study

## DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author, [NC], upon reasonable request.

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