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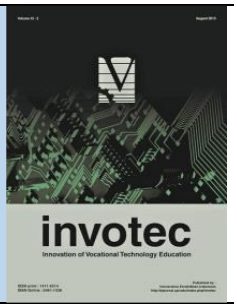

IMPLEMENTING COOPERATIVE LEARNING IN VOCATIONAL TECHNOLOGY EDUCATION TO ENHANCE PRE-SERVICE TEACHERS' DESIGN SKILLS

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ABSTRACT

This study focused was to explore the implementation of cooperative learning in vocational technology education to enhance pre-service teachers' design skills during practical tasks. This study used social interdependence theory, which provided a framework for understanding the effectiveness of cooperative learning in enhancing pre-service teachers' design skills. The research design for this study was collaborative action research. Participant observation and semi-structured interviews were used as the main data collection tools. Participants in the study included final-year pre-service teachers enrolled in the Bachelor of Education in vocational technology education programme. Inductive thematic analysis was applied to the raw data from observation notes and semi-structured interviews. The study found that the implementation of cooperative learning has enhanced preservice teachers' design skills during practical tasks. It was found that cooperative learning encourages learners' engagement and responsibility during practical tasks. The implementation of cooperative learning developed learners' critical thinking, communication, problem-solving and collaboration skills. It is recommended that preservice teachers be adequately equipped with design skills during practical tasks. A shift towards a more interactive, cooperative, and learner-centred approach is essential for equipping preservice teachers with design skills.

1. Introduction

The rapid transformation of the 21st century has significantly redefined job requirements and essential competencies (Van Laar et al., 2017). Higher education institutions (HEIs) are thus compelled to reform their teacher education programmes to address these emerging demands (Jarvis & Mok, 2019). Institutions offering vocational technology education must adequately prepare future educators with the adaptive skills necessary for navigating the evolving educational landscape (Gouws & Dicker, 2007; Darling-Hammond et al., 2017).

Advanced Asian countries have successfully integrated vocational education to respond to the demand for future-relevant skills (Banga & te Velde, 2019). South African HEIs hold a strategic position in delivering such essential competencies, although there remains a need for greater responsiveness to technological and societal shifts (Cloete et al., 2006; Postma et al., 2015). Within this context, pre-service teachers require strong design skills that support critical thinking and problem-solving abilities (Plotnikova & Strukov, 2019). Cooperative learning offers a promising

pedagogical approach to cultivate these skills effectively. This study addressed two key research questions: (1) How does cooperative learning impact pre-service teachers' design skills during practical tasks? and (2) To what extent can cooperative learning enhance those skills?

Vocational technology education was formally introduced into South Africa's national curriculum in 2005 (DBE, 2008), aiming to integrate theoretical knowledge with practical problem-solving (Sangwan & Singh, 2022). According to the Curriculum and Assessment Policy Statement (CAPS), the subject is intended to prepare learners for real-world challenges while promoting sustainability and technological awareness (DBE, 2011). Despite ongoing professional development for in-service teachers, recent studies show that training often neglects specific focus on design skills (Msimango et al., 2024). Resource constraints further limit the development of these essential competencies (Blose & Ndlovu, 2023).

Developing design skills in pre-service teachers requires exposure to collaborative, problem-based learning environments. Cooperative learning provides a structured model in which students work interdependently to achieve shared goals (Kaendler et al., 2016). Observations at a South African university revealed that teacher-centred approaches failed to support the acquisition of design skills effectively (du Toit-Brits, 2019), highlighting the need for more interactive teaching strategies.

Cooperative learning emphasizes group collaboration, shared responsibility, and collective success (Loh & Ang, 2020). Grounded in social constructivist theory, this approach promotes deeper learning through peer interaction and shared engagement (Gannar & Kilani, 2013). Numerous studies confirm its positive impact on students' design-related knowledge and skills across diverse educational settings (Fernandez-Rio et al., 2016). For example, Al-Tamimi and Attamimi (2014) found that students exposed to cooperative learning scored significantly higher in design process skills compared to those taught through traditional methods. Similarly, Altun (2017) observed that cooperative strategies led to marked academic improvement.

Beyond academic performance, cooperative learning fosters conceptual understanding and learner autonomy (Eymur & Geban, 2017). This approach also enhances motivation, engagement, and social interaction (Shi & Long, 2021). Meta-analyses by Johnson & Johnson (2016) and empirical studies Gillies (2016) further affirm its effectiveness over individualistic and competitive learning strategies. Peer feedback and discussion enable the development of higher-order thinking skills.

Despite its advantages, successful implementation of cooperative learning requires careful planning. Challenges such as unequal participation, over-reliance on high-performing peers, and lack of communication skills training can limit its effectiveness (Gillies, 2016; Alghamdy, 2019). Achieving intended outcomes requires deliberate group structuring, guided facilitation, and sufficient learning resources.

In summary, cooperative learning holds significant potential to enhance design skills among pre-service teachers in vocational technology education. However, its impact depends on strategic integration, adequate support, and well-facilitated collaboration during practical teaching tasks

2. Method

The present study is located within a qualitative research approach. A qualitative research approach allowed the researcher to understand individuals from their natural setting (Plano Clark, 2017). Tools for data collection consisted of semi-structured interviews and participant observation during the collaborative action research (CAR) process. Observing preservice teachers during the CAR allowed the researcher to gather first-hand data, contrary to reporting other people's interpretations.

2.1 Theoritical Framework

The current study was guided by social interdependence theory. According to social interdependence theory, when individuals interact with others and experience social

interdependence, it affects their outcomes and can result in positive outcomes through cooperative interactions (Baloche & Brody, 2017). This theory provided a theoretical foundation for the implementation of cooperative learning.

Social interdependence theory defines two types of interdependence, positive and negative. Positive interdependence refers to a situation in which individuals believe they can achieve their goals when other members in a group accomplish their goals (Balliet et al., 2017). Positive interdependence is fostered by positive goal interdependence, positive resource interdependence, and positive role interdependence (Baloche & Brody, 2017; Balliet et al., 2017). On the other hand, negative interdependence is when individuals view that they will accomplish their goals when others do not achieve their goals; this leads to individualistic behaviour (Baloche & Brody, 2017). The social interdependence theory suggests that a cooperative learning process can encourage positive interdependence by creating a condition where group members believe they will be successful when other members in the group also reach their levels of success (Johnson & Johnson., 2018). This is achieved by sharing resources and coordinating the efforts of group members. This is one approach to learning that is based on the principles of positive interdependence and has been shown to lead to several positive outcomes for learners, including increased academic achievement, improved interpersonal relations, and enhanced social and cognitive skill acquisition. Cooperative learning may work for teacher education to enable pre-service teachers to appreciate design skills.

2.2 Research Design

Collaborative action research was used as a research design to implement cooperative learning in the vocational technology education programme. Collaborative action research was suitable as a design to support pre-service teachers by exposing them to collaborative knowledge and experience (Kennedy-Clark et al., 2018). The four steps of action research proposed by Pardede (2019) were followed in the study.

2.2.1 Planning Phase

In the planning phase, a lesson plan and practical tasks were used to implement cooperative learning.

2.2.2 Action Phase

The researcher took action by using the lesson plan and a practical task to implement cooperative learning during the practical task session.

2.2.3 Observation Phase

The observation phase consisted of participant observation, where the researcher acted as a participant and observed pre-service teachers during practical tasks.

2.2.4 Reflection Phase

Reflection was done on data gathered from semi-structured interviews and observation. Figure 1 below shows a visual diagram of action research.

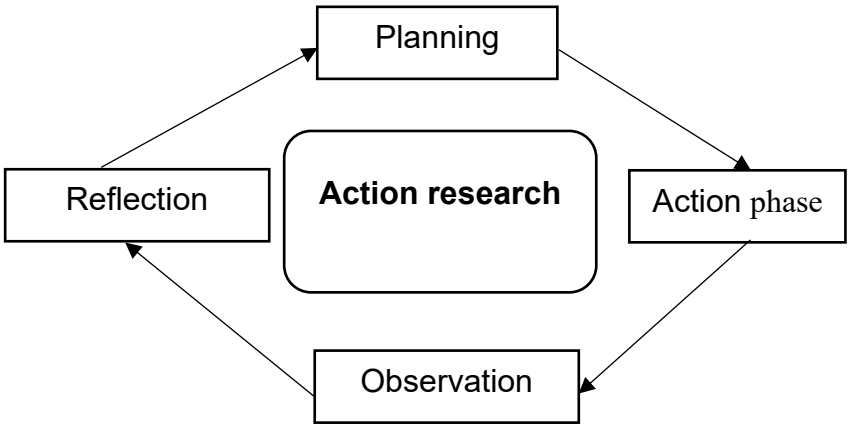

Figure 1. Visual diagram of action research

2.3 Participants

This research study was based in a rural university in the province of Limpopo province where the researcher is based. The participants for this study were final-year pre-service teachers enrolled on the Bachelor of Education in vocational technology education programme. The study included pre-service teachers in their final year of study (N = 42) due to their accessibility to the researcher.

2.4 Data Analysis

The current study used inductive thematic qualitative data analysis to analyse data, as proposed by Clarke & Braun (2017), inductive thematic analysis was applied to data from non-observation notes and semi-structured interviews. The data were analysed in the following manner:

Step 1: Familiarisation

As a researcher in the first step is to get familiar with the data collected from interview transcripts and observational notes. It was important to get a detailed overview of all the data before analysing individual items. The researcher listened carefully to the interview audio recordings, taking initial notes, and read through the texts to become acquainted with the data. Transcribed audio recordings were reviewed by the researcher several times to ensure that have been accurately captured what the participants expressed in the audio recordings.

Step 2: Coding

Coding involves highlighting sections of text from the transcribed audio of interviews and assigning shorthand labels or 'codes' to describe their content. At this stage, the researcher highlighted the codes in the data derived from the interview transcripts. The codes that emerged from the interview transcripts were then categorised.

Step 3: Generating Themes

The codes that were created were checked, and patterns among them were identified. Themes were developed from several codes and consolidated into single themes.

Step 4: Reviewing Themes

The themes that were created were checked for accurate representation of the data, and the themes were compared to the data set to ensure consistency.

Step 5: Defining And Naming Themes

In this stage, the researcher named and defined the themes. The themes were formulated to accurately capture the essence of what the data entailed.

Step 6: Writing Up

The analysis of the data was written to convey the meaning of what was expressed by the participants.

2.5 Trustworthiness of the Study

The researcher ensured that the trustworthiness aspects were addressed. This study addressed the following aspects:

2.5.1 Trustworthiness Aspects

In this study, the researcher ensured that the data collection process was transparent and detailed descriptions of the research context were provided to participants (Ahmed, 2024). The data collected were accurately described by the researcher. The interview transcripts were given to participants for verification purposes. To ensure transferability, a clear description of the research context was provided to the research participants, allowing other researchers to assess the applicability of the study's findings to their settings (Carminati, 2018). Dependability was ensured in this study as the researcher followed all the steps of action research. The researcher documented and justified all decisions made throughout the research process. For this study, confirmability was established by sending the transcribed data from the observations and interviews back to the participants (Moser & Korstjens, 2017). The study maintained a systematic and transparent audit trail that documented all steps taken during the classroom action research process.

2.6 Ethical Considerations

Ethical considerations were addressed before the commencement by following all the guidelines for a research study. Research participants were informed about what classroom action research entails and were assured that their identities would not be revealed. To protect their privacy, pseudonyms were used. This study ensured that participants were informed of of all the ethical considerations that applies to research studies.

3. Result and Discussion

3.1 Result

The following section provides study findings obtained from semi-structured interviews and non-participant observation. The findings are organised in the following themes that emerged: 3.1.1 the effect of cooperative learning on improving design skills, 3.1.2 the impact of cooperative learning on interaction and collaboration among pre-service teachers during practical tasks, and 3.1.3 challenges encountered during the implementation of cooperative learning in practical tasks.

3.1.1 The Impact Of Cooperative Learning On Enhancing Design Skills

From the interviews conducted, the findings discovered that pre-service teachers are not regularly exposed to active learning approaches such as cooperative learning. The findings discovered that pre-service teachers were reluctant to work in small groups as part of cooperative learning. The sentiments below were made by the participants:

''At first, I was a bit hesitant about cooperative learning as I am used to working on my own. But as we formed groups during practical tasks, I found cooperative learning to be helpful because we got different viewpoints from our group members. I can say that my design skills have improved a lot.''

Another participant raised the following view in support of what was mentioned above:

''I was not comfortable working in small groups. I am an introvert. But as we were engaged with our practical tasks in groups, I began to appreciate the implementation of cooperative learning as it allows us to get support and various ideas from our group members.''

The implementation of cooperative learning has been shown to enhance pre-service teachers' design skills when they are engaged in practical tasks. The pre-service teachers declared that their design skills have improved significantly since they began cooperating during practical tasks. The following declarations support this:

"Yes, our group's design skills have improved a lot since we began cooperating during practical tasks.'' Another point raised was the following:

''By being involved in cooperative learning, my group members helped me to improve design skills during practical tasks." Similar sentiment indicated that group members helped each other during practical tasks:

"I was able to contribute to the design sketches for our practical tasks. I am satisfied with the implementation of cooperative learning as it allowed us to help one another during practical tasks. Cooperative learning has improved my design skills."

3.1.2 The Impact of Cooperative Learning on Interaction and Collaboration Among Pre-Service Teachers During Practical Tasks

In this section, the focus was to determine how the implementation of cooperative learning has assisted pre-service teachers in interacting with each other during practical tasks. The findings revealed that pre-service teachers assisted each other through group discussions. In the execution of practical tasks, it emerged that pre-service teachers were equally allocating tasks to each member in their groups. The following views were expressed by pre-service teachers: *''During our practical tasks, we assisted each other with the design of sketches, and we managed to allocate tasks equally to each member of the group.''* Group leaders were performing critical roles during the execution of practical tasks. The declaration below shows the roles that were played by group leaders:

‘‘Our group leader provided directions during group discussions. By cooperating, the group leader assigned tasks to each group member during practical tasks.’’ Another sentiment shared by pre-service teachers was the following: ‘‘*All our group members participated in discussions by sharing ideas, and we helped each other during practical tasks*.’’ Similar views were shared as follows:

‘‘*Cooperative learning has enabled us to share ideas during our discussion.’’* The importance of group collaboration was raised in the following description:

‘‘As a group, we managed to work together to design our sketches for the practical task that is assigned to us.’’

3.1.3 Challenges Encountered In The Implementation Of Cooperative Learning During Practical Tasks

During the implementation of cooperative learning, findings showed that pre-service teachers experienced several challenges. The following issues were raised by pre-service teachers**:**

‘‘*Yes, I have encountered challenges during the implementation of cooperative* learning*.’’* About the challenges experienced during the implementation of cooperative learning, it is reported that group decisions were presented as one of the challenges. The assertion below is an extract from pre-service teachers:

‘‘Group decisions took longer, and some members in our group tend to lose focus while we were busy with designing sketches for our practical task.’’ Similar sentiments were shared by another pre-service teacher who indicated that they encountered challenges and managed to resolve them.

‘‘Challenges were present, but we managed to resolve them. Working together as a team can be difficult at times, as we tend to disagree on certain aspects of practical tasks.’’

On the other hand, another view that was mentioned by pre-service teachers was that they managed to work in their group without challenges. The following is an extract from the group.

‘‘Our group managed to work together without any challenges.’’ The implementation of cooperative learning was helpful for our group. It allowed us to improve our design skills.

Findings from the observation indicated that pre-service teachers were actively involved in group discussion. During the group discussion, effective communication and collaboration took place. In leading group discussions, group leaders were seen allocating responsibilities among the group members. The group leaders were taking an active role in leading and monitoring the progress of the group.

The implementation of cooperative learning was seen as being effective in enhancing their design skills. This was apparent as the groups were seen sharing and discussing ideas during the practical tasks. As they were engaged in practical tasks, it was observed that they showed commitment and demonstrated responsibility when they were working in their groups. The pre-service teachers showed improvement in design skills as they were able to design sketches for their practical task allocated to them. While the groups were working, they displayed confidence and ability in design skills during their practicals. This was shown when pre-service teachers managed to finalise their chosen design sketches for their practical tasks.

3.2 Discussion

The present study has found that the implementation of cooperative learning in vocational technology education presents numerous benefits. From the findings, it has been shown that the implementation of cooperative learning has offered a positive effect on pre-service teachers' design skills. In comparison to traditional learning learning approaches, cooperative learning has effectively enhanced pre-service teachers' design skills. Implementation of cooperative learning during a practical task has shown that it can enable pre-service teachers to interact and collaborate effectively. This was evident as the pre-service teachers managed to share ideas in their formulation of design sketches. These findings align with the study of Eymur and Geban (2017), who indicated that cooperative learning enhances students' design skills as well as understanding of complex

concepts. Also, Altun (2017) maintains that cooperative learning has a positive effect on learners' achievement as it can improve their understanding.

Pre-service teachers were found to be hesitant to work in small groups, as they are used to working in a traditional way where they work alone on their practical task. However, with the implementation of cooperative learning, they applauded cooperative learning as it allowed them to work in small groups to complete their practical task effectively. Preservice teachers were motivated during the implementation of cooperative learning due to the benefits that are associated with cooperative learning (Kopparla & Goldsby, 2019). The implementation of cooperative learning has been shown to support pre-service teachers in engaging and assisting each other during practical tasks. The findings above are in line with the study of Gillies (2016), who indicated that students who take part in cooperative learning show academic achievement as well as refinement in critical thinking skills. Furthermore, the study revealed that cooperative learning promotes interaction and collaboration among pre-service teachers. Through cooperative learning, pre-service teachers were able to effectively communicate and engage with each other during group discussions. The implementation of cooperative learning has enabled pre-service teachers to acquire communication, teamwork, and collaboration skills. These skills were acquired as pre-service teachers were working, participating in group discussions and sharing ideas for their practical task. Self-directed learning was fostered as the group leader assigned tasks to all the members in the group. According to Loh & Ang (2020), learning to work in groups where each member of a team makes contributions so that the group can be able to achieve academic success. This study further showed that the implementation of cooperative learning has enabled pre-service teachers to actively participate in group discussion. However, several challenges were encountered during the group discussion. It has been discovered that group decisions took longer to be made during discussion. Also, findings indicated that the implementation of cooperative learning can be problematic at times, as the groups tend to struggle to work together as a team. These findings correspond to Alghamdy (2019), as the author reported that cooperative learning has several challenges, such as learners not being able to work together due to different viewpoints.

4. Conclusion

The purpose of this study was to explore the implementation of cooperative learning in enhancing pre-service teachers' design skills during practical tasks. It has been shown that cooperative learning has an impact on pre-service teachers' design skills during practical tasks. The implementation of cooperative learning during a practical task can enhance the preservice teachers' design skills. Cooperative learning enables preservice teachers to collaborate effectively in their small groups. Preservice teachers' engagement and responsibility increased during the practical task due to the effectiveness of cooperative learning. The implementation of cooperative learning in a practical task promotes interaction and collaboration among preservice teachers, and it enables preservice teachers to acquire critical thinking and problem-solving skills, enhancing communication and collaboration skills. Although cooperative learning presents several benefits, findings from the study point out that the implementation of cooperative learning has some challenges. Group decision-making took longer during the implementation of cooperative learning. These results demonstrate that implementing cooperative learning during a practical task can enhance pre-service teachers' design skills.

Cooperative learning should be regularly enforced rather than traditional methods during practical tasks in different modules that are offered in undergraduate vocational technology education programmes. An interactive, cooperative, and learner-centred approach is essential for equipping preservice teachers with design skills. Pre-service teachers enrolled for the Bachelor of Education in vocational technology education should be trained and equipped with essential skills such as design skills, critical thinking, problem solving and communication skills. Educators in

vocational education programs should ensure that they regularly use teaching learning approaches such as cooperative learning.

Conflicts of Interest

The authors declare no conflict of interest regarding the publication of the paper.

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