

# PLANNING AND IMPLEMENTING ACTION RESEARCH IN PRE-SERVICE TEACHER EDUCATION: CHALLENGES AND SOLUTIONS

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Received 3 Feb 2026; Revised 24 Feb 2026; Accepted 20 March 2026; Published 1 April 2026

Vol: 6, Issue 2 (2026)

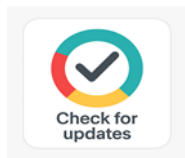
Doi: 10.5281/zenodo.18946522

## Abstract

The focus in teacher education has been said to be typically theory-based, resulting in a disengage between theory and practice. Action research can bridge this gap by allowing pre-service teachers to transform their conceptual knowledge into practical experience through actively addressing a real-world teaching or learning issue. This study aimed to explore pre-service teachers' experience when they engaged in action research, with a focus on the challenges faced and how they addressed these challenges. Data for this qualitative research was collected using interviews. The analysis of data involved coding and categorising the codes into themes. The findings revealed that the pre-service teachers faced numerous challenges such as identifying a research direction, reviewing the literature, and lacking research skills at the proposal writing stage. At the implementation stage, data collection and analysis posed challenges to them. To address these issues, they sought advice from their supervisors and mentors, discussed with their peers and looked for potential solutions on the internet. This study suggests that it is crucial to empower pre-service teachers as self-directed reflective practitioners in their action research journey so that they can continue to reflect on their experiences, actions and decisions made towards a high-quality pre-service teacher education.

### Keyword:

Action research,  
Teacher education,  
Higher education,  
Challenges,  
Solutions



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DOI [10.5281/zenodo.18946522](https://doi.org/10.5281/zenodo.18946522)

## Introduction

Typical teacher education would often adopt a transmission approach, focusing on lesson planning to help students learn a preset curriculum (Albareda-Tiana et al., 2019). Lectures are typically theoretical-based, resulting in a split between theory and practice (Kosnik & Beck, 2000). The importance of linking theory, practice and research in pre-service teacher education is widely recognised by international researchers (Flores, 2018; Marcondes et al., 2017). Research can be used to inform practice and to enhance professional development not only for in-service teachers, but also pre-service teachers. There is a positive correlation between the quality of inquiry in

research and quality of teaching among pre-service teachers (Van Katwijk et al., 2023). Thus, it is recommendable to introduce authentic experiences with research components, such as action research (AR) into teacher education so that they can make evidence-based decisions in teaching and learning (Van Katwijk et al., 2023).

AR is a means to help pre-service teachers understand and experience the complex roles of a teacher (Kosnik & Beck, 2000). AR is a valuable research opportunity for “re-nurturing myself as a learner” (Falk, 2004, p. 73) through first-hand experience to incrementally transform the conceptual knowledge of action research into personalised practical experience (Yan, 2016). AR involves a dynamic, spiral of plan, action, results and reflection (Oosthuizen, 2022). The central interrogation is the actual practice itself. If the current practice does not produce a desirable result, changes are needed. Its cyclic nature then calls for critical reflection on each cycle for further refinement (Oosthuizen, 2022).

The development of AR integration in teacher education was at a stagnant stage till early of year 2000 (Kosnik & Beck, 2000). The gaps of AR in teacher education are repeatedly pointed out in various studies. Elliot (1991) critiqued that AR is often conducted in such a way that ‘teaching’ is separated from ‘research’, creating a huge gap between teaching as a reflective practice and curriculum development. Most of the AR studies are conducted on in-service teachers involved in the process and the experiences of participating students (Bendtsen et al., 2019; Van Katwijk et al., 2023). Thus, there is a need for higher education institutes conducting pre-service teacher education programmes to monitor the impact of different approaches on pre-service teachers’ learning and outcomes to prepare them for the future career. Also, in response to the demands of the 21st century, teachers need to use professional judgement to solve problems besides collecting empirical data to support their arguments and solutions. Therefore, studies on how pre-service teachers generate their professional knowledge and solve problems in educational settings are worth further investigation.

As raised by Saqipi & Vogrinc (2020, p. 6) in their focus issue on the development of teacher research as a form of developing teacher pedagogical practice, it is pertinent to continue contributing toward the exploration of the following questions:

What purpose should teacher research serve? What are the minimal research skills that teachers need in order to engage in classroom research and how can teachers be best trained for this? What are good methods of motivating teachers to engage in researching their own practice? In what ways should school culture support teacher engagement in researching their practice?

In tandem with this focus, this paper intends to provide insights into the above, from the perspective of the pre-service teachers enrolled in a teacher education programme and who underwent the teacher research process in the form of an action research project. This study aimed to explore pre-service teachers’ experience in an AR at the proposal writing and implementation stages, with a focus on the challenges faced and how they addressed these challenges. This study was guided by two research questions:

1. What are the challenges faced by pre-service teachers at the proposal writing stage in an action research project, and how would they address these challenges?
2. What are the challenges faced by pre-service teachers at the implementation stage in an action research project, and how would they address these challenges?

## Literature Review

### Action Research in Pre-service Teacher Education

The ideas of teacher research and teacher as researcher (Craig, 2009), teacher inquiry (Mertler, 2021) and practitioner enquiry (Alves et al., 2024) underpin key components in the design and structure of the programme. The notion of a reflective practitioner (Schön, 1983, 1991) is also not new, putting emphasis on the importance of skills to be able to reflect on and improve teaching practice in a continuous manner as part of a teacher's professional development. One form of such reflective practice can be seen in the development of the use of action research (first coined by Kurt Lewis in 1944) or classroom action research (Yusron et al., 2023).

Having an action research component in a teacher education programme is an effective way of linking theory and practice (Kosnik & Beck, 2000). There is a lot of opportunities for pre-service teachers to become research literate as placement schools are research-rich environments. However, the integration of research components in teacher education programmes vary, from non-existent, not explicit to explicit curriculum with a research component (Flores, 2018; Montebon, 2021). There are variations in the inclusion of a research component, "from one compulsory methods course to a critical reading of research papers and use of databases for policymaking recommendations" (Niemi & Nevgi, 2014, p. 132) to "the development of a pedagogical intervention project with a research component (action research) during the practicum in a school" (Flores, 2018, p. 625).

The use of research in teacher education is highly advocated (BERA-RSA, 2014; Kosnik & Beck, 2000). BERA-RSA (2014) identified four benefits of integrating research into teacher education. First, research-based knowledge and scholarship enrich the content of teacher education. Second, research informs the design and structure of teacher education programmes. Third, teachers can develop research-based knowledge and skills through their partnerships with the research community. Finally, teachers can conduct their own research, individually and collectively, to investigate the impacts of particular interventions on their educational practice and student learning. Kosnik & Beck (2000) added that pre-service teachers became enthusiastic about their role as teacher-researchers and teacher-scholars. Studying academic research helps pre-service teachers bridge the gap between theory and practice by critically examining their classroom practice.

Many empirical studies conducted in teacher education support the BERA-RSA (2014) report. For instance, in the study by Hu et al., (2018), the pre-service teachers and their school tutors were involved in collaborative action research projects which aimed to promote reflective thinking among the pre-service teachers. Each team identified an educational issue within their placement school as well as designed and implemented the interventions to overcome these issues. By engaging in the action research project, it was found that the pre-service teachers were able to develop reflective practice abilities through classroom observations, reflective diaries and sharing sessions. This study highlighted the role of school tutors as collaborators and role models for pre-service teachers (Hu et al., 2018). Professional training for tutors is necessary to ensure that they are equipped with theoretical and practical knowledge of action research to work collaboratively with pre-service teachers. In agreement with Hu et al., (2018), other studies indicated that pre-service teachers evaluated and deeply reflected on the effectiveness of their teaching practice and (Madin & Swanto, 2019; Mok, 2016). Madina and Swanto (2019) added that inquiry approach and checklist, when integrated into action research, could guide the pre-service teachers to produce organised and focused reflections.

Research in Malaysia revealed that the pre-service teachers gained a better understanding of student learning through action research (Lew & Munira Mohsin, 2014; Lilia Halim, Nor Aishah Buang & T. Subahan Meerah, 2010). The pre-service teachers in Lilia Halim et al., (2010)'s study showed an improvement in subject matter knowledge, pedagogical content knowledge and research skills after conducting an action research. Lew and Munira Mohsin (2014) elaborated that the pre-service teachers understood the learning theories underpinning the interventions and considered many factors such as learning styles, interests, emotional states and competencies when they designed the intervention activities. Similar finding was reported by Esau (2013) who found the South African pre-service teachers in his study paid more attention to learners' needs, challenges in real school environments and ways to improve teaching after they engaged in participatory action research.

### **Challenges in Conducting Action Research among Pre-service Teachers**

Most of the studies focused on investigating the challenges faced by in-service teachers (Abelardo et al., 2019; Nagibova, 2019; Shanmugam & Lee, 2017; Tindowen et al., 2019; Ulla et al., 2017), with less focus on pre-service teachers. Among the challenges faced by in-service teachers are skills, time, motivation, support by the school administration, resources and teacher's perceptions. Whereas, the pre-service teachers lacked research knowledge and skills (Abelardo et al., 2019; Shanmugam & Lee, 2017; Ulla et al., 2017; Ulvik & Riese, 2016). For instance, they had difficulties in identifying the research problems, reviewing literature, designing appropriate methods, collecting and analysing data as well as publishing their findings (Tindowen et al., 2019). In the Malaysian context, one of the reasons has been attributed to the lack of prior and early exposure to AR (Mohd Zaki Mohd Amin et al., 2019).

In-service teachers have a large volume of work at hand and thus, they hardly have time to conduct an AR (Abelardo et al., 2019; Shanmugam & Lee, 2017; Ulla et al., 2017). The study by Ulvik and Riese (2016) also found that time constraint was one of the pre-service teachers' main concerns. These participants were occupied with their master's studies at the same time (Ulvik & Riese, 2016). As a result, AR was not prioritised. The teachers perceived that there was no support and recognition from the school administrators in conducting research (Abelardo et al., 2019; Shanmugam & Lee, 2017). Teachers did not get any reward or promotion despite their efforts in research (Shanmugam & Lee, 2017; Ulla et al., 2017). This led to low motivation in using AR to improve student learning (Abelardo et al., 2019).

Teachers had negative perceptions on action research, thinking that research is secondary compared to teaching. They were also not comfortable with changing their role from an instructor to a researcher. Besides, lack of infrastructure in schools, mainly availability of internet and resources, also hindered the planning and implementation of AR. Shanmugam and Lee (2017) and Ulla et al., (2017) added that shortage of training did not help to upskill the teachers.

AR which involved a cyclic process of identifying problems, data gathering, making conclusions and reflecting on the results was demanding for pre-service teachers. For instance, the study by Capobianco and Ríordáin (2015) showed that pre-service teachers who specialised in science and mathematics faced a lot of uncertainties when they embarked upon their first action research experiences. They had doubts about the validity, unpredictability, research requirements and perceived values of the research. In terms of validity, they were concerned if the data collection methods allowed them to collect valid empirical data to support their arguments. Lack of experience in interpreting data and not getting 'expected' results also led to uncertainties. Since

the results of the action research were context bounded, they were also uncertain about the significance of their research.

## Methodology

The study was conducted at a private university located in an urban area in Selangor, Malaysia. The Education department offered a three-year bachelor's degree in Education programme to train pre-service teachers. In this programme, all pre-service teachers need to undergo a teaching practicum twice (two separate semesters), generally once in their Year 2 and another in their Year 3 (final year). A research-oriented approach was adopted for the teaching practicum of this programme, specifically the second teaching practicum scheduled in the third year of study. The pre-service teachers were required to enrol in two action research courses. In the first course, pre-service teachers were required to write a proposal for the action research. The second course required them to implement the action research at their placement school.

At the placement school during the implementation stage, each pre-service teacher had a mentor who would provide focused guidance to them. In addition, one supervisor from the university would guide the pre-service teachers in dealing with issues related to the action research, such as adjusting the original proposal, discussing solutions to overcome challenges and providing advice on writing the report.

The participants were four graduates of the programme. All of them had taken and passed the AR course. Informed written consent was obtained from each participant and all participant data have been anonymised. The demographic data of the interviewees is shown in Table 1.

**Table 1.** Participants

<b>Participant</b>	<b>Gender</b>	<b>Status</b>	<b>Placement School</b>
<b>ST1</b>	Male	International	An international school outside Malaysia
<b>ST2</b>	Male	Local	An international school in Malaysia
<b>ST3</b>	Female	International	An international school in Malaysia
<b>ST4</b>	Female	Local	An international school in Malaysia

This study was guided by a qualitative research design. Data was collected using interviews with the four participants. The interview questions focused on the challenges the students faced and how they addressed them at the proposal writing and implementation stages of the action research project. Each interview took about one hour and was video-recorded.

Thematic analysis was used to analyse the data collected from the interviews which were recorded. Thematic analysis is a “research method used to identify and interpret patterns or themes in a data set; it often leads to new insights and understanding” (Naeem et al., 2023, p. 2). The thematic analysis in this study comprised four general steps, as adapted from Naeem’s et al. (2023) study and shown in Figure 1.

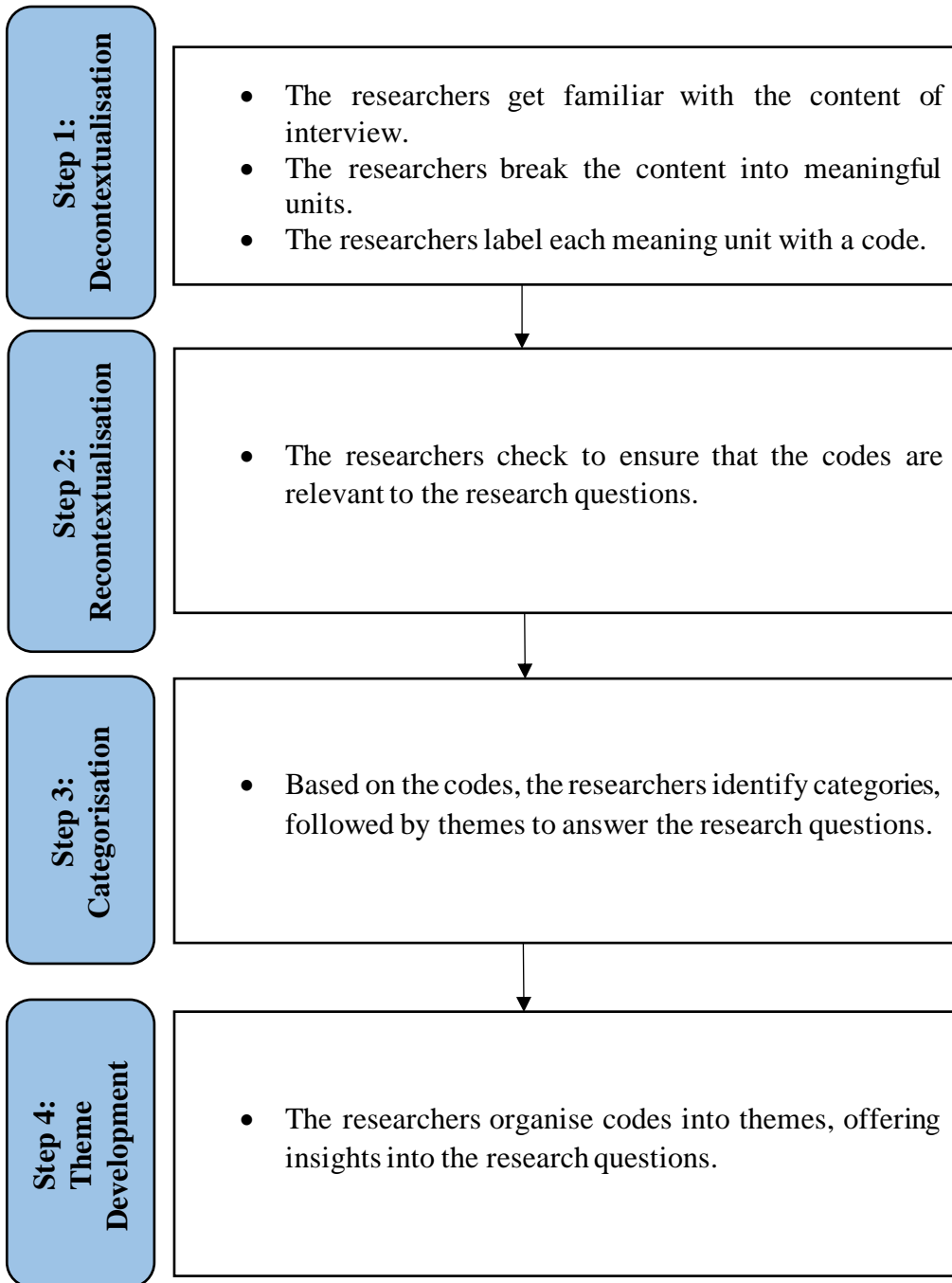


Fig. 1 Steps in thematic analysis (adapted from Naeem's et al., 2023)

A few strategies were used to strengthen the trustworthiness of this study. First, all qualitative data were coded by two coders, the first and the second authors. The two coders chose one response and coded the data separately. Then, the codes were reviewed and revised based on the consensus of the two coders. Once agreement was reached on the coding schemes, all responses were coded. Next, the coders discussed their coding results and explained their coding decisions until a consensus was reached. Across the entire process, approximately 10% of changes were made. The second strategy involved data documentation which allowed for an audit trail.

## Findings

### Proposal Writing Stage

The proposal writing stage was where the pre-service teachers proposed a research topic and

outlined a plan of action to be implemented in the following semester. Five themes emerged from the data: (1) identification of research topic, (2) literature review, (3) research knowledge and skills (4) writing process, and (5) consultation.

Three participants faced difficulties in identifying the research topic. A few factors, including an oversight of potential research topics during their first teaching practicum, different research interests and diverse classroom settings, led to this challenge. ST1 explained that he did not pay much attention to the problems faced by the learners during his practicum, “the first practicum was like an ‘observation practicum’. There was no emphasis on paying attention to what kind of classroom problems the student faced”. Since he did not make note of the problem, he had forgotten the issues by the time he needed to choose a research topic. ST2 had observed many problems but none of these problems was his research interest. ST3 was very much influenced by her mentor, who was a Mathematics teacher and thus, she selected a Math-related research topic. However, she was uncertain if it was her topic of interest and spent a lot of time figuring it out.

Since the school where the participants did their first teaching practicum was different from the one they implemented the action research, ST2 added, “I did my [practicum] at a refugee school so the school setting is different ... I am not sure the problem is valid when I do my action research in a typical school”.

Discussions with third parties and searching for information online helped the participants identify their research topic. The participants talked to their supervisor, classmates and lecturers about their research ideas. ST3 added that she talked to the mentor from her first placement school, “He guided me to find my research questions by asking questions such as ‘what did you find challenging in your first practicum and what are the key takeaways.’”. ST2 shared his research idea with his sister who had no background in the field of education, saying that, “...a random talk with someone who has no idea what's going on can be helpful. If they can see what you are going to do, that means that when I bring it back to my context, it should be even easier to see the sense.” The participants acknowledged the roles played by their supervisors. During the consultation sessions, the supervisor “zoomed in to” the research topic they have chosen and asked questions to stimulate thinking. Besides, the participants searched for potential topics online. For example, after ST1 had identified a potential topic, he searched for teaching resources for his intervention to ensure that it was feasible. In addition, the course lecturer allocated a session for the participants to present the design of their action research. During this session, the lecturer and their classmates asked questions and critiqued their proposal. This helped them to reflect on the proposal they had written and to refine it. Another strategy used by ST3 was to refer to the notes she made during her first practicum. By practising this, she discovered more details about challenges young children encountered in Mathematics and what her mentor did to overcome these challenges.

Reviewing literature was a challenge to ST4. For her, academic research was hard to comprehend and demanded a lot of “energy” from the readers. She found it hard to understand the data analysis which involved statistics. To overcome this challenge, she skipped the complicated data analysis section and read the result findings and conclusion sections. From here, she looked for a connection between the existing literature with her research. If the article was related to her study, she would skim through the data analysis again. ST1 elaborated that the literature map introduced by the course lecturer helped him organise large amounts of information he encountered in the research article.

All the participants explained that writing a research proposal was challenging as they lacked exposure to action research. They had no clue what action research was and how to write a research proposal. Even though a template was provided to them, ST2 explained, “We don’t know how much autonomy we have. Can we modify the template? How much can we modify?” ST3 shared the same thought as the template was different from the research article. This contributed to the next

challenge on “how to start writing”. ST4 explained that the guidelines outlined the sections for each chapter. Yet, she barely had an idea what to include in each section. To solve these two challenges, the participants searched for sample action research reports online. They read intensively to gain an understanding of the necessary elements of an action research. This was aided by the detailed explanations given by the course lecturer on the nature of the action research and all the key components in an action research proposal. The lecture notes were systematically organised on Google Classroom for students to refer. ST4 explained that when she had no idea how to proceed, she referred to the notes.

Another challenge faced was related to the consultation session with the supervisor. Besides the 14-week lectures, each student was required to meet their supervisor at least four times in a semester. The aim was to provide personalised support to pre-service teachers so that they could complete the proposal on time. ST1 recognised the importance of individual consultation sessions, yet the sessions might give unnecessary pressure to students. He explained, “Students might have not prepared. We took more time to write some chapters.” To save time, the participants determined the sequence in writing, starting from the less time-consuming chapters (i.e., Chapter 1, Chapter 3 and Chapter 2).

All the participants agreed that their supervisors played an important role in the proposal writing stage. The supervisors could provide personalised and customised guidance to the participants based on their research area. The supervisors were reachable via Whatsapp and emails to provide prompt responses to clarify any doubts the participants had. ST2 elaborated that suggestions provided by the supervisor were helpful, “My supervisor checked the draft of my work, identified the mistakes and recommended changes to improve my work”.

### **Implementation Stage**

The implementation stage was where the participants conducted their action research project and completed a report based on the implementation. At this stage, several themes related to challenges faced emerged: (1) topic of research, (2) school-mentor, (3) data collection, and (4) data analysis-interpretation and report writing. Throughout the semester, the pre-service teachers had to demonstrate a high level of flexibility and adaptability as they anticipated various uncertainties and made corresponding changes.

Due to the nature of the course, it had been a preparation required of the participants from the proposal writing stage, where they planned the action research for implementation in the upcoming semester. One of the main challenges faced by the participants revolved around the suitability and feasibility of their topic of research. As explained by ST2, the area chosen when writing the proposal was found to be a non-issue during the implementation stage. Another participant (ST1) also faced a similar challenge where the area chosen was planned for physical classes, but the implementation environment was online due to the pandemic at that time. As a result, the participants had to be flexible and adaptable in, for example, working on a new research problem, re-planning and modifying their action research in order to suit the current context of implementation.

Another challenge faced by the participants was related to their school and mentor, where the action research project was conducted. Particularly at the beginning of the project, ST4 shared how she was struggling with the confusion faced by her and also her mentor. The confusion revolved around what the project was about, as well as its scope and expectations. This unfamiliarity clouding the initial stage heightened the difficulty for a smoother start to the project. Throughout the implementation, the participants had also come across challenges due to the school policy at that time, for example, the lack of physical classes and insufficient time and sessions to conduct the intervention planned because there were other areas needed to be focused on. To overcome these

challenges, efforts made were such as regularly discussing with the mentor, accommodating online learning as per the school policy, and modifying the intervention (e.g., to an online intervention, shorter sessions, a different plan).

As part of the flexibility and adaptability required of the participants, data collection was also a component where they encountered challenges. Low and inconsistent learners' participation was one major challenge experienced. It was challenging to have the learners engaged, not only during the activities but also when they were required to complete certain tasks. At times, the participants would have low submission rates by their learners and also different levels of incompleteness when their learners did submit the required tasks for the intervention. This would normally lead to more time to submit/resubmit (if possible) and potentially less rigorous data collection. Further examples were when the learners could not really answer the interview questions, did not provide any comments in the peer assessment, as well as when the participants discovered they did not have enough time to complete all parts or repeat any parts of the data collection (when needed). To add to the participants' difficulty, all at the same time they were planning for and conducting other non-intervention classes. Therefore, the participants had to continuously navigate the process with their respective mentors. In this light, ST4 lamented her "guilt" and feeling like a "burden" to her mentor whenever she felt the need to make changes or redo certain sessions. Importantly, there were also times where the participants found it hard to be certain if their learners actually followed the intervention steps/strategies to have arrived at the outcomes obtained. For example, ST1 expressed that he was not sure if his learners used the virtual manipulatives to solve the multiple-step mathematical problems given to them. Moreover, as it was done in the online learning environment, not all students would turn up during the intervention sessions and even when they did, not all would want to join in the activity or stay focused and cooperative, as similarly highlighted by ST2, ST3 and ST4. And this is aside from all the internet connection issues plaguing the intervention sessions and technical issues (e.g., when doing and recording interviews). Attempts made included giving the learners more time to complete what was required, requesting written responses when unsure about the completion and quality of verbal responses, and using other free time such as during extra-curricular activities.

With the data collected, it was also a challenge to analyse and interpret the data, particularly for ST4. According to her, it was the process of "trying to understand ... what's happening ... what did I get from the data" that presented more difficulty. In writing up the final report, it was also challenging in terms of how to display the different types of data, how to relate to other studies, and what the contribution of the project was. Furthermore, for their action research project, the participants, as part of their final report, were also required to complete a reflection on their own action research project. A challenge faced in this aspect was the uncertainty of what was considered significant enough to be included in the reflection. With the reflection completed close to the end of the project, ST4, for example, would eventually find it difficult to seek further support as it was already close to the submission deadline.

## Discussion

Planning and implementing an AR project encourages pre-service teachers to be reflective in their practice to address a teaching or learning issue. This experience can prepare them for future teaching as they gain insights on how to plan, implement and evaluate interventions to address issues in real-world classroom settings. The study aimed to explore pre-service teachers' experience in an AR at the proposal writing and implementation stages, with a focus on the challenges faced and how they addressed these challenges. For most student-teachers, the AR process started with numerous challenges, but in the end the majority experienced positive outcomes (Ulvik & Riese, 2016). Consistent with the findings from the previous studies (Abelardo et al., 2019; Mohd Zaki Mohd Amin et al., 2019; Ulla et al., 2017; Ulvik & Riese, 2016), one of the most challenging issues

encountered by the pre-service teachers was their inadequate research knowledge and skills to ensure that their AR was planned and conducted following a research model. This limitation impacted their progress at both proposal writing and implementation stage. For example, at the proposal writing stage, they found it hard to identify the research gaps and were unclear with the research requirements. When they were at the implementation stage, they encountered issues related to data collection and analysis.

Teacher education provides opportunities where pre-service teachers can collaborate with in-service teachers to co-design and co-implement evidence-based study for capacity building in the teaching profession (Van Katwijk et al., 2023). Similar to the existing studies (Bendsten et al., 2023; Hu et al., 2018), the findings revealed that mentors at the placement school played an important role in guiding and supporting the pre-service teachers, especially at the implementation stage. Pre-service teachers need scaffolds to ensure that their AR can be planned and implemented smoothly, as well as to ensure high quality of the end product (Ulvik & Riese, 2016). However, in-service teachers may not necessarily have sufficient research skills or experience in conducting AR, therefore, they may be less able to provide constructive feedback and guidance to pre-service teachers during the implementation of AR. Support from the school, including emotional and research, and training of school mentors are crucial so that they would be able to support pre-service teachers effectively when they engage in research-oriented intervention in the classrooms (Hu et al., 2018; Nagibova, 2019).

This study revealed a phenomenon which should not be overlooked. The pre-service teachers tended to seek advice from their supervisors and mentors whenever they encountered a challenge in AR. From the interviews, it was evident that the pre-service teachers were unclear of their role as a researcher, including the autonomy they had in their own research. Empowering student identity as a self-directed reflective practitioner and researcher is crucial. There is a positive relationship between pre-service teachers' perceptions, teacher research and quality of teaching (Van Katwijk et al., 2023). AR encourages them to reflect on their experiences, actions and decisions made to address teaching and learning issues. This can result in the formation of professional identity which shapes the perceptions of their roles in the field of education, not only as educators but innovators who continue to improve the quality of teaching practice.

## Conclusion

This study has practical implications for the professional development of pre-service teachers and the design of pre-service teacher education programmes. It provides insights into the challenges faced by pre-service teachers and the solutions taken by them from the proposal stage till the implementation stage in the AR research. These insights likely are relevant for teacher education programmes with similar settings.

The findings revealed that at the proposal writing stage, one of the biggest challenges faced by the pre-service teachers was identifying their research direction. Thus, course instructors could plan some activities which can trigger students' minds to look into classroom issues from different perspectives. Besides, course instructors could make arrangements for creating the theory-practice dynamics, such as collaborative action research projects with supervisors, and learning communities with different parties in placement schools to better respond to pre-service teachers' problems, questions and interests. For pre-service teachers who are going to implement their AR in the coming semesters, this study provides empirical evidence for the possible challenges they may face and the helpful solutions. This would help them manage expectations and better prepare for AR or engage in other research-based courses.

There were a few limitations in this study. First, all participants were pre-service teachers from one university who followed the same programme. The sample size was relatively small. Therefore, the findings cannot be generalised to other contexts. Even though it was found that the challenges and the ways to address these challenges shared by the participants were similar, implying that the data has reached a state of saturation, increasing sample size can provide more evidence to support the key findings. The second limitation was the data collection method, which only involved interviews. In the continuous development of AR-based courses, there is a need for further exploration into the different constraints discussed above and how they can be mitigated. More sources for data triangulation are needed to create an in-depth picture of the design and implementation of AR. In the future, researchers may use survey questionnaires to collect data from more pre-service teachers. Both close- and open-ended questions could be included in the questionnaire to gain an understanding of the challenges and solutions. This could be followed by in-depth interviews with selected pre-service teachers to deeply understand their experiences.

This study also highlights the need for establishing an overarching school culture which encourages practitioners as researchers (Craig, 2009) or teacher inquiry (Alves et al., 2024; Mertler; Shanmugam & Lee, 2017). Such research culture will better equip teacher educators with the essential knowledge and research skills for smooth collaboration among them and pre-service teachers, when they play the role as a mentor for their mentees. Teacher educators' modelling and scaffolding are helpful for creating high quality reflective teaching practice among pre-service teachers (Hu et al., 2018). Collaborative action research which involves teacher educators and their mentees is beneficial in creating spaces where they can share experiences and findings, obtain feedback, receive encouragement and support, as well as utilise research-based evidence for innovative teaching practice (Ginsberg, 2022).

This evidence-based approach would enable teachers to make informed decisions on their teaching practice (Saqipi & Vogrinc, 2020), which can potentially enhance the learning of their learners. Being a reflective practitioner provides the opportunity for pre-service teachers to hone their analytical, critical and innovative thinking skills. They will be better equipped with the knowledge and skills to navigate the complexities of classrooms and address their learners' learning difficulties and gaps.

### **Co-Author Contribution**

Authors 1 and 2 conceptualised the research, prepared the literature review and research methodology, carried out the field work, analysed and interpreted the data and completed the write-up of the article.

### **Conflicts of Interest**

The authors declare no conflicts of interest regarding the publication of this paper.

### **Acknowledgement**

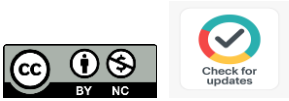
The authors would like to thank all the individuals who participated in this study, for their invaluable contributions and willingness to share their experiences.

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**Data Availability Statement:** All relevant data are within the manuscript and its [Supporting Information](#) files.