

Challenges that a teacher-researcher faces during an action research – a case study

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Abstract. This paper explores the dual role of the teacher-researcher in a four-year action research project focused on problem-based learning in mathematics. It highlights the challenges faced during the phases of planning, implementation, analysis, and reflection. Drawing on insights from the author's experiences and observations based on both qualitative and quantitative data collection methods, the study identifies distinct challenges linked to the dual role, like differing design goals or subjective-objective voices. The author also proposes solutions to the identified challenges, such as collaboration with university experts and using reflective practices. Furthermore, the research underscores the beneficial impact of action research on enhancing teachers' awareness and bridging the theory-practice gap, calling for further studies in this area.

Key words and phrases: action research, teacher researchers, problem-based learning.

MSC Subject Classification: 97D99.

Introduction

A gap between research and practice is common (Broekkamp & van Hout-Wolters, 2007), and action research, where teacher and researcher roles overlap, can help address this issue, since action research challenges the assumption that knowledge is separate from and superior to practice (Krainer et al., 2014). Moreover, teacher educators who participate directly or indirectly in such cases of teachers' action research are afforded opportunities to learn in and from these experiences (Krainer et al., 2014).

The author of this article has simultaneously fulfilled the roles of teacher and researcher throughout her pursuit of PhD studies. During this period, the author designed and delivered problem-based lessons within the framework of a four-year action research project. Previous analyses examined the impacts of problem-based learning on students' motivation (Báró, 2020, 2022b), learning outcomes (Báró, 2024), and ways of thinking (Báró, 2022a, 2023).

Although the aim of the problem-based interventions was to examine the development of specific skills among students, the author was first posed with the question “However, what implications arise if we examine not only the development of the children but also investigate how this research influences the identity of the teacher-researcher?” during the defense of her PhD dissertation, and second, during a summer school program. This raised the inquiry of what can be said about the teacher as an active participant in the research context. Therefore, this study centers on the role of the teacher, aiming to identify challenges arising from the teacher-researcher dual role encountered over four years of action research and to offer possible solutions to these challenges. Thus, the research question addresses this problem: What challenges does a mathematics teacher-researcher face during an action research project that employs a problem-based approach, arising from his/her dual role?

Theoretical background

In the field of mathematics education, the roles of teacher and researcher are interconnected (Tabach, 2006). To find this connection, firstly we need to define the terms ‘teacher’ and ‘researcher’ separately.

The teacher is defined as someone who teaches or instructs (Oxford English Dictionary, n.d.), which leads to the definition of teaching. Teaching involves presenting knowledge and modelling its structure in a way that it can be accurately acquired and reproduced. The instructor is the transmitter of knowledge, while the learner is the receiver (Seel, 2011).

Researcher is defined as a person who is employed to undertake research, mainly in an academic or scientific institution (Oxford English Dictionary, n.d.).

The term ‘teacher as researcher’, teacher-researcher (T-R) as the author uses here, is usually used to indicate the involvement of teachers in educational research aiming at improving their own practice (Huillet, 2014). In Mathematics Education, research has become an important part of many teacher education programs all around the world, and several papers have presented the results of

these programs or discussed certain aspects of teacher research (Huillet et al., 2011). Most of these publications focus on teachers' practices.

The author has taken on the dual teacher-researcher (T-R) role in a four-year action research project. Action research (Koshy, 2005) is based on the curriculum where action and reflection constantly interact, so the previous studies' experiences can be the pillars of the next study. Koshy (2005) discusses the defining steps of action research in separate chapters, while here the author highlights the aspects of planning action, gathering data as implementation, and analyzing data. The T-R has designed and implemented lessons with a problem-based approach in action research, subsequently, she conducted an analysis of the collected data. Problem-based learning in mathematics can be defined as creating an environment in which students are required to analyze mathematical problem situations (problem-solving and problem-posing), critically approach their own and their peers' minds, and they must learn to explain and justify their reasoning (Kónya & Kovács, 2022; Báró, 2024).

Previous studies have also addressed the dual role of the teacher-researcher in relation to the integration of technological tools into daily mathematics instruction (Tabach, 2006), and to the implementation of challenging tasks (Russo, 2019). Tabach (2006) used her own experience to demonstrate a possible way of moving between the two roles, while keeping a reflective journal, analyzing its content, and synthesizing those reflections has positively influenced her teaching practice. Moreover, a working group called "Teachers as Researchers" was started at PME, which met annually for nine years and published a book based on contributions from its members (Zack et al., 1997), presenting different experiences of teachers' inquiry in several countries, whose aim was basically to improve practice.

Methods

Action research generally relies on a qualitative research paradigm, although it may also include quantitative elements, mainly descriptive statistics. This research aims to understand the subjective reality of the human being, of the situation, by investigating the phenomenon under natural conditions.

Qualitative research usually uses multiple sources of data, a process known as triangulation (Jalongo & Saracho, 2016). We employed triangulation methods to ensure the reliability and credibility of our research findings. This included the

triangulation of researchers in some instances and the triangulation of methods and data in others.

The action research reported here involves one mathematics teacher-researcher (the author) from Romania, who taught 5th- to 8th-grade students (171 students), and two university experts in mathematics education. The T-R planned problem-based lessons with professional guidance, delivered and analyzed them, repeating this process across multiple cycles during the four-year intervention.

All conducted problem-based lessons were recorded on video, and corresponding transcripts were created for analysis purposes. Students' work, pictures of the blackboard, and students' evaluation cards, questionnaires and interviews with the students were also available for analysis. These data were primarily collected to detect students' development, but at the same time, they assisted the teacher-researcher in writing the second reflection. The two rounds of reflections were structured in the following manner:

After every problem-based lesson, the reflections of the T-R were recorded. This process occurred consistently as follows: immediately after the conclusion of the problem-based lesson, the teacher recorded their thoughts and impressions regarding the session using an audio recorder. It is crucial for the teacher to do this directly after the lesson, as immediate reflections capture transient impressions that may change upon reviewing the video later. This audio message was subsequently transcribed, making it suitable for analysis.

The identified challenges during the action research

The author here divides her T-R dual role into three phases considering the three distinct phases of action research (Figure 1): designing the intervention (as teacher and researcher), delivering the lessons (as a teacher), and then analyzing the collected data (as a researcher).

The following subsections outline the challenges of this dual role and propose possible solutions.

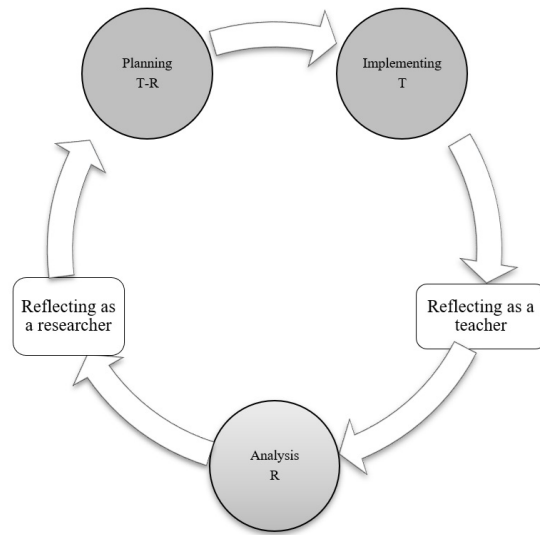


Figure 1. Phases of action research

Planning and designing

In the design of the problem-based lessons, the author based the approach on the relevant literature (see previous problem-based learning in mathematics) and the following criteria:

- (1) during the lesson, students should analyze mathematical problem situations through problem-solving or problem-posing;
- (2) students should apply heuristic strategies when analyzing problem situations;
- (3) the lessons should include cooperative or collaborative tasks;
- (4) the activities should develop students' verbal and written communication skills, encouraging independent opinion formation and reasoning;
- (5) the activities should require and stimulate critical thinking;
- (6) the activities should support discovery-based learning.

In this phase, the T-R must function as a designer: the teacher chooses curriculum materials to adopt and change to suit instructional goals, while the researcher might design the research tools, or adapt existing tools (Tabach, 2006). Balancing these differing design goals poses a challenge. The T-R received support from two university experts in mathematics education, who also served as her

PhD supervisors. The T-R reflected: “The ongoing consultation was invaluable, providing me with ideas for lesson planning and insights into potential pitfalls. . .” (the T-R’s reflection from 2021).

Implementing

As McClain (2002) states, the teacher is an active participant in the lessons circulating among the students whose ways of reasoning would support the emergence of the aforementioned goals. In doing so, the teacher takes a “snapshot” of the students’ activity and attempts to determine how they were proceeding with their analysis, as the teacher makes decisions about how to organize the whole class discussion. During this monitoring and decision-making period, T-R role conflicts emerged in problem-solving and problem-posing activities during problem-based lessons.

Problem-solving

For instance, in problem-solving pair work, the researcher categorized students based on their understanding and sorted their reasoning ability into three categories: who can and wants to, who wants to but cannot, and those who do not want to reason (Bárá, 2022a). At the same time, the teacher sought to support all students, wanting everyone to understand and be able to explain. The challenge lies in the researcher’s role as an observer, which limits interference, while the teacher wants to assist.

Problem-posing

In problem-posing, the researcher focuses on the contexts of the posed problems (Bárá, 2022b), while the teacher addresses students’ difficulties with prior topics and decides to return to certain previous topics in future lessons. This situation also highlights the tension between being an objective observer and an active participant. In this phase, the teacher’s role is dominant, as s/he organizes the classroom, responds to students’ needs, manages attention, and addresses various issues (Tabach, 2006). That means, in this phase the T-R primarily acts as a teacher, collaborating with the students, prioritizing the development and motivation of students. Teachers need to be prepared for difficult situations where the best and quickest decisions are essential. The author argues that the T-R is present in the classroom primarily as a teacher in terms of prompt reaction, but the videos and reflections are necessary and recommended for analysis as a researcher.

Analyzing

This phase is dominated by the researcher's presence, with a focus on objective analysis of the data. In the analysis part, particular care should be taken to ensure that the results and answers found in the reflection do not influence the teacher in future lessons. This is more of a risk if the analysis includes the students' opinions. In this case, it is recommended that the students' names be withheld or the answers collected anonymously. If the opinions are gathered online and student identification is necessary for comparison purposes, another researcher can anonymize the students' names before the teacher-researcher conducts the analysis.

The reliability of the results is strengthened by using the triangulation method during the analysis of action research, which involves incorporating multiple perspectives by including more experts to analyze and by collecting multiple data sources, as, in our case, students' work, answers, videotapes, interviews, and reflections.

Reflecting

Reflection can be about the scope and sequence of the mathematics curriculum, educational objectives, and lesson planning and preparation. It may involve considerations of student understanding and retention of skills and concepts, the use of manipulative materials or methods. In this case, the T-R reflected separately as a teacher right after the PBL lessons and as a researcher after the analysis. This section will present the challenges of teacher-researcher reflection, focusing not on the content of the reflections themselves, but rather on the subjective-objective insights that arise from the dual role.

The teacher's reflections primarily focused on the flow of the lesson, student mathematical understanding, motivation, and engagement, including subjective elements. The subjectivity can be discovered in the teacher's statements when describing emotions: "I feel good because there was enthusiasm", "to be honest, I felt this lesson was a disaster" or "...this student's remark struck a chord with me". In contrast, the researcher's reflections proved to be entirely objective, as illustrated by the statements: "In Class 8B, students tended to solve problems symbolically and algebraically, whereas this was not the case in Class 8A, which was not expected given the previous class performance" or "students from Class A posed more questions than the students from the other class".

These salient examples do not imply that the teacher is characterized solely by emotional expressions and the researcher by objective insights. Rather, the combination of both types of reflection was essential for integrating all experiences into the planning phase as progressing to the next cycle of action research. Nevertheless, the author agrees with Thompson (1992), who also put reflective activity at the heart of the process of change in teacher beliefs.

Results

Highlighting the key phases of action research – planning, implementation, analysis and reflection, we identified the challenges faced by the teacher-researcher participating in a four-year action research project, which stemmed from the various roles involved. This is briefly summarized in the Table 1, which also includes potential options in the last column that may provide support in addressing these challenges.

Phase	Dominant role	Challenge	Solution
Planning and designing	T-R	differing design goals	support from university experts
Implementing	T	tension between being an objective observer and an active participant	reflections and analyzing the recorded videos
Analyzing	R	being fully objective	anonymous answers and method of triangulation
Reflecting	T-R	subjective and objective voices	voice recordings, combination

Table 1. The challenges faced by the teacher-researcher

Since these insights are drawn from an observation of a case study involving a teacher who specifically worked on the curriculum, it is possible that other teachers may encounter different challenges in similar situations. This represents one limitation of the research, while also highlighting the need for similar studies to be conducted. The author has already taken initial steps in this direction by inviting eight mathematics teachers from Transylvania to conduct problem-based lessons, to gather their experiences. A teacher-researcher collaborating on this study also shared his/her thoughts: “The two roles are both exciting and

mutually beneficial, but the fact that the goals are (usually) not the same can cause serious dilemmas. This dilemma, in turn, can also help the professional progress of both roles.”

Conclusion

The research question can, therefore, be addressed through the observations presented in the four different phases: planning, implementation, analysis, and reflection. In these steps, the teacher-researcher confronted the following challenges: differing design goals and tension between being an objective observer and an active participant, which influenced the subjective and objective manifestations. After identifying these challenges, the author explored the potential solutions that served or could have served as assistance during the action research process. Considering support from experts, consistent reflections, and triangulation, which can assist in confronting the challenges, the author advocates for the application of action research among teacher-researchers. The author argues that action research benefits both teachers and researchers: it enhances teachers’ awareness and reflection while helping researchers remain connected to practice, thereby reducing the theory-practice gap.

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