Developing the university course Mathematics for all– an action research

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SCHOOL OF EDUCATION

The course Mathematics for all

- Aims to introduce theories of mathematics education and teaching methods for heterogeneous groups of learners
- Explains difficulties that students encounter in mathematics , their impact on learning and the methods for diagnosing them
- The course is built on ideas of inclusive education and universal design for learning
- The course is an elective course for many study lines
- It is taught every other year and the number of participants is around 25

Learning outcomes

At the end of course students are able to:

- discuss selected research on how students learn mathematics
- analyze the understanding of mathematics in their learner group and organize their teaching accordingly
- describe diverse manifestations of difficulties in mathematics and their cause
- organize and use varied strategies in teaching diverse group of students mathematics
- use assessment for learning in working with students

The theoretical foundation of the course

Teaching diverse groups of learners builds on a pedagogy that intertwines knowledge of teaching, learning and children's development and involves a moral and social commitment to all learners (Hafdís Guðjónsdóttir og Edda Óskarsdóttir, 2016).

- All children can learn mathematics
- Mindset (Carol Dweck)
- CGI: Cognitively Guided Instruction
- Creativity
- Activity/project-based learning
- Formative assessment
- Difficulties in learning mathematics

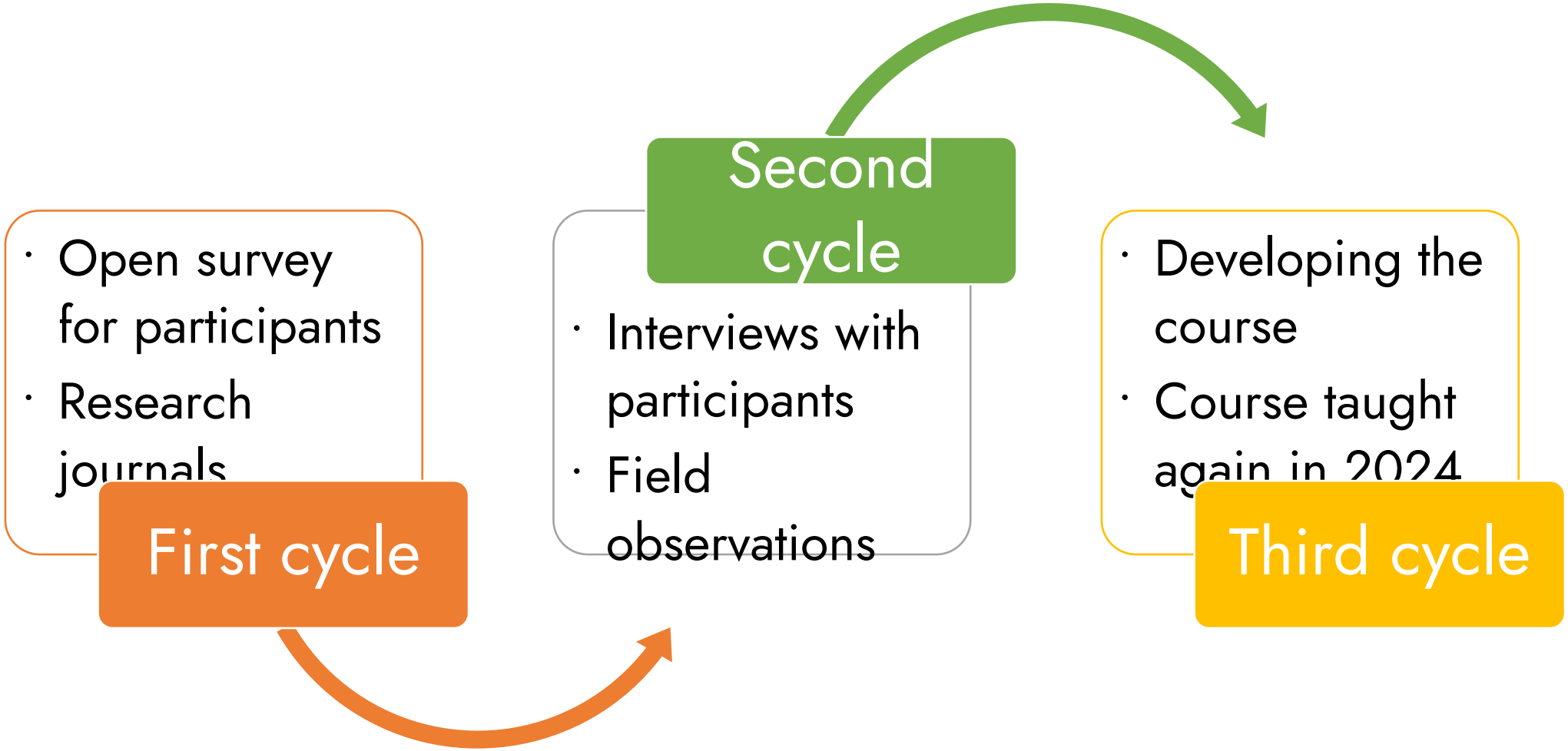
Purpose – aim and research question

This action research focuses on developing a graduate level course on mathematics for all

The aim of this research is to gain an insight into how the course has influenced participants as professionals in teaching mathematics.

The research question is: How has the course Mathematics for all influenced the professionalism and teaching practices of former course participants?

Action research – data and cycles

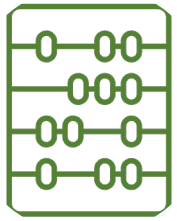


Participants and ethics

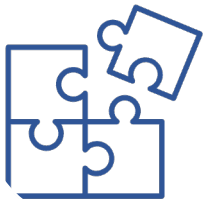
- Students (25) in our course in Fall 2022 were offered to participate in the research
- 11 participated in the open survey
  - 6 comprehensive class teachers
  - 1 mathematics comprehensive teacher
  - 1 special education comprehensive teacher
  - 2 secondary mathematics teachers
  - 1 play school teacher
- Two teachers have been interviewed
  - Sif fifth grade teacher in a school in a small town
  - Embla third grade teacher in a school near Reykjavík
- Informed consent was sought and pseudonyms used

Findings from the end of course survey

The course material and projects improved their understanding of their own mathematics learning and that of others.



The course influenced their professionality and teaching practice



The diverse group in class was a strength and course participants with different background felt that their needs were met

Findings from second cycle

Sif is a 5th grade teacher. Her class has 45 students and two teachers, the third teacher comes in for mathematics so they have grouped the class by ability in mathematics.

- I would like to work more with problem solving with my students – that is what I was most excited about after the course
- The problem is that the teachers in the 5th grade team do not have the same understanding of how to work with problem solving in class.
- I would have liked to learn more about how to create word problems for my students based on the CGI structure

Findings from the second cycle

Embla is a teacher in 3rd grade. Her class is very diverse and a lot of time in the fall has been focused on classroom management

- My teaching is more conventional that I had hope for when the term began... I want to emphasise classroom discussions in mathematics but I haven't been able to get that going
- I try to be patient when they are working on tasks and support them in finding the answers – not giving it to them
- I do rotating stations with different projects and I think it is such quality time. Then I usually have one station that I follow and the other ones are sustainable where they can help themselves. I find that these are the best lessons
- I would like to have a practicum within the course so that we can practice what we are studying – especially for those that are not teaching

Influence on participant understanding

I have learnt a lot in the course - I have discovered that I have a fixed mindset in mathematics – I have now conciously tried to change to a growth mindset. (Preschool teacher)

I will be able to use a lot. For example about drilling and place emphasis on quality than quantity of practice. (upper-secondary teacher)

One thing I remember was [..] about the equal sign and that it means you have to do the same on both sides but not just to move the numbers and change the other signs =>it is not the same thing. This was an"Ah-HA!!" moment for me (upper-secondary teacher)

Understanding own professionalim and teaching practice

This course has increased my self confidence in teaching math, I have more tools than before and more knowledge and ways to work with students. I want to use more diverse teaching methods, work from the goals but not just the books. I finish the course full of good intentions! (Comprehensive school teacher)

I have learnt incredibly many things, both on all kinds of tasks and creativity that I can use in my teaching. I have read lots of interesting research on mathematics. (Comprehensive school teacher).

I'm interested in finding ways to connect mathematics to other subjects and look forward to doing that. I would like to do more outdoor teaching and use the nature as part of learning mathematics. (Special needs teacher in a comprehensive school)

The diverisity of participants

I learned that number sense is the foundation for mathematical learning for children. The goal was to add accesible shapes, numbers and games in my class. I made a store game where the products prices is marked and the children pay with money, a fun game where children learn by experimenting and playing (play school teacher)

I have been introduced to diverse teaching methods that I can use as a teacher, also for other subjects. I realize better which challenges students face and what ways there are to work through those challenges (secondary student teacher)

What I have used the most is problem solving and having students explain their solutions. I have also gained tools to assess where students are at based on their solutions to problems. (comprehensive school teacher)

Discussions and next steps

- We have learned that our teaching in class is a role model for participants as they got to try methods on their own skin
- There is call for emphasis on outdoor math education, more emphasis on critical thinking and discussion techniques
- Question if a practical unit can be incorporated into the course or perhaps a follow up course
- We see that we could use formative assessment more effectively in our course assignments and lessons
- We could include more on supporting students with different language background

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