

Teacher's Mindset and Mathematical Competencies Development: An Appraisal of Intervention Actions for Curriculum Change Adoption

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Abstract

Teacher's mindset effects on curriculum implementation. A competency-based curriculum focuses on developing competencies in learners rather than transferring knowledge from teacher. There is concern why changed competence-based mathematics curriculum is not implementing well in school. This study, thus, explores the teachers' mindset and their classroom practices for mathematical competencies development in students. This is an action research based on a qualitative study was planned to intervene some tools expecting to bring changes in teachers' mindset and influence on classroom practice while implementing the curriculum. The major intervention tools were: a learning outcome log, theme-wise result of learning, and a portfolio. Data were collected using the daily logbook for observation and interview data were kept in written notes. Intervention prior and post changes activities was analyzed based on the seven steps of the Concern Adoption Model (CBAM) as a theoretical base. The results of the study showed the changes in teachers' mindset and classroom teaching and assessment practices after the intervention justifies the application of concern adoption model for the implementation of the new curriculum as desired.

Keywords: *Learning competencies, learning outcomes, teacher's mindset.*

Introduction

Many nations have started the journey of changing content-based curricula into competency-based curricula (Mkonongwa, 2018) focusing the changes on teaching-learning and assessment techniques. The national education policy of Nepal envisages the different competencies within learners through curriculum reform at the school level (MoEST, 2019). It is expected that the competency-based curriculum produces competent educated civic to the national needs and competitive in the globalized market. Furthermore, the School Sector Development Plan (SSDP, 2016-2023) has focused on skill development and making students 'ready for the world of work' making breakthrough in the teaching trends of too textbook focused, lecture-oriented to fostering creative thinking and enabling in core skills (Bourn & Pasha, 2020, p. 16). However, the general practices observed shows that the pedagogical focus is still on knowledge transfer from book to students rather than competencies development. This is not only the case in Nepal, but the same situation is found in other developing countries as well. Mkonongwa (2018) found in Tanzania, teachers are still assuming textbooks as curriculum, and following the same traditional types of teaching-learning activities along with assessment when the curriculum focus has turned into competencies development rather than knowledge deliberation. In this context, this study tries to explore teachers' mindset regarding the implementation of new integrated and competency-based curriculum in the classroom, before and after implementation of a few interventions action to improve curriculum delivery.

Theoretical Understanding

The Concern Based Adoption Model (CBAM) (Hall, et al, 1974) is taken as a theoretical reference for the study. This theory explains about facilitating change through facilitators/leaders in course of change adoption in school education particularly k-12. Facilitators/leaders make some intervention for desired change in school setting. In the present context of Nepal, there is a shift in curriculum from discipline-based to competency-based curriculum; integrated competence-based curriculum at basic school level from grade 1-3. The present concerns of the adoption of changes in curriculum is implementation of intents of

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the curriculum in classroom practice for change. The CBAM framework includes three dimensions to measure the changes; (1) Survey of Concerns (SoC) (2) Level of Use (LoU) and (3) Innovation Configuration (IC) (Khoboli & O'toole, 2012; Nawastheen, 2021). The first dimension SoC deals with the individual readiness for understanding and adopting the desired change of the curriculum in teachers regarding introduced new changes (Nawastheen, 2021). CBAM developers have developed seven stages in SoC. Hall and Hord (2011) emphasized to use of these seven stages of SoC for the changes as a process where teachers begin with stage 0 and move to other stages guided by their willingness and experiences. Seven stages according to Hall and Hord (2011) are given in Table 1.

Table 1. Description of stages of concern (SoC).

Stages	Category	Reflection on Teachers
0	Unconcerned	Teachers have little knowledge about curriculum reforms. It indicates teachers are not ready to be involved in the curriculum reform process.
1	Informational	Teachers possess knowledge about the curriculum reforms and show their willingness to learn about it.
2	Personal	Teachers start to think about the impact of curriculum reforms at a personal level and their limitations related to the reforms.
3	Management	Teachers focus on processes and tasks of using the reforms. They concentrate on solving problems and difficulties related to the reforms.
4	Consequence	Teachers start to focus on how the reforms will affect their students.
5	Collaboration	Teachers begin to share ideas and observe what their peers are doing with the reforms.
6	Refocusing	Teachers concentrate on more strategies for better implementation of reforms.

Source: (Nawastheen, 2021).

This study result was also analyzed based on these seven different steps of curriculum implementation. Here, teachers' initial mindset and the mindset after implementing intervention were analyzed based on the seven steps of SoC.

Objective of the Study

Nepal school education structure changes into basic and secondary by Education policy 2019 and emphasized on competency-based model of education. However, the curriculum framework (NCF, 2019) has assumed competency as one of the principle of curriculum development at school education . Curriculum, thus, is changed into competency-based from the content-based curriculum. Within basic education, a special provision is introduced for grade 1-3, integrated curriculum, which is implemented at basic schools in Nepal focusing on a 100% School Based Assessment (SBA) system, and grades 4-8 apply 50% SBA and 50% periodic examination (NCFNepal, 2019). In this changing curriculum context, teachers' mind-set can be an important influencing factor for adoption of change in assessment system and focused on mathematical competencies in classroom pedagogy. Changes are introduced through policy and school leaders are responsible for adoption of changes, on the other hand teachers are the main implementers of the changes. In this case, implementers worry, concerns, and thoughts are key for desired change implementations. Hence, this study was focused on exploring teachers' mindsets and classroom practices regarding mathematical competencies development before and after the implementation of an action plan for the change.

Method and Procedure

This research is based on an action research design applied for the exploration of teachers' mindsets and their classroom practices regarding competencies development in mathematics regarding the changed curriculum before and after the intervention of action plan. Action research can be conducted for the three levels of change in general; individual, classroom, and school, community, and organizational change (Cohen, Manion, & Morrison, 2007). This research is focused on the change for an individual, classroom and school where individual changes focused research reflects changes regarding individuals like teachers, students and sometimes the researcher self.

This study was completed at a basic level in a government school in Kathmandu within four months. The teachers were oriented from grade one to six, but my concern was with teachers teaching at grade one and three. This study was designed with the two-stage approach – first taking teachers' mindset survey, and second, an intervention plan for addressing mind set change in implementation of the curriculum. First, this study reported teachers' mindset based on the existing practices of teaching-learning and assessment. Second, teachers were oriented to change their existing practices and explained about the intervention of action plan. There were three major intervention tools: a learning outcome log where teachers keep records of individual learners rating 4,3,2, and 1 for each learning activity, a theme-wise result sheet of learning outcomes, and a portfolio record file for each individual. While applying intervention tools at third stage, teachers were supported onsite as per their need by the researcher herself as an expert. Classes were being observed and teachers were sharing their lived experiences during action plan intervention (with the expert or within teacher community?). Information from continuous class observation and informal interaction with teachers regarding intervention were recorded in a daily logbook. Observation and interaction with teachers were made based on curriculum direction and intention.

We had focused activities regarding mathematics and its relevant competencies development practices. Analysis was done under two themes using the data triangulation for the analysis. The data were generated through interview/interaction and observation being prolonged engagement in the field with onsite teacher support. Findings were drawn based on the interpretivist paradigm where subjective reality was established. Though the finding was subjective, it was verified using member checking (Cohen et al., 2007; Creswell & Creswell, 2017) through the dissemination of the program including teachers to whom observation and the interview/interaction were concentrated.

Action Research

Action research can be undertaken to transform the situation into positive changes and improvements. Three levels of change at individual, classroom and school, community and organizational change (Cohen et al., 2007) are expected from action research in school. Individual changes focus on changes in the researcher self, classroom and school changes focus on teachers' understanding and professional transformation including school, this action research concentrates on individual, classroom and school-level changes to transform the existing situation of teachers' mindset and mathematical competency practices. The basic action plan of the research is given in Figure 1.

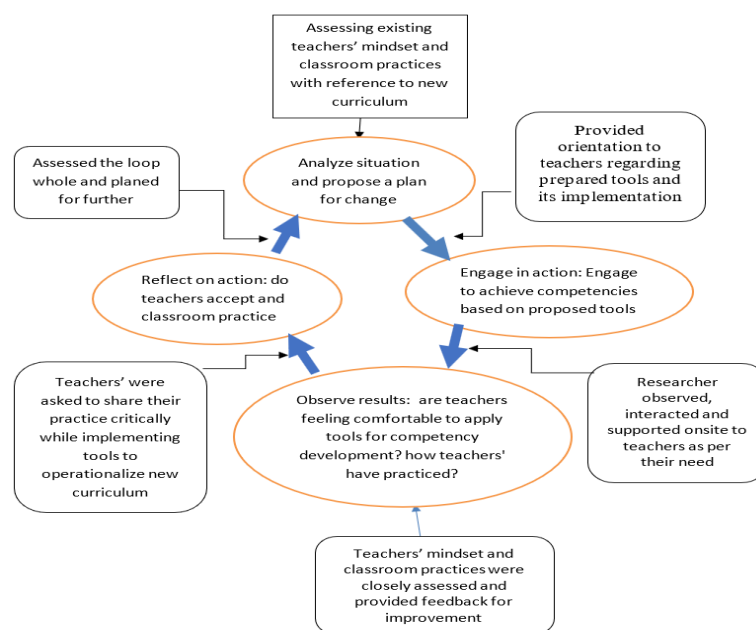


Figure 1. Action research plan adopted from (Clark, Porath, Thiele, & Jobe, 2020).

Propose a change plan: In this research, first of all, the existing teachers' mindset, had explored regarding the problems of implementation of integrated and competency-based curriculum and competencies

development in the classroom based on curriculum envisioned thought. Then, after analyzing the need of teachers, the researcher caught the teachers' sentiment and planned orientation regarding the intervention of action plan for teachers.

Engage in action: I explored teachers' need and implemented action plan as an intervention. It was expected from teachers after intervention of action plan, they would be engaged in their classroom activities to develop mathematical competencies within learners rather than injecting theoretical knowledge to students. Moreover, it was expected from teachers to be involved in application of formative assessment to improve the learning status of learners. Teachers were supported onsite to operationalize the intervention of action plan by researcher herself.

Observe results: To assess the effectiveness of the implemented plan, I was observing teachers' engagement in the classroom, behavior in the classroom and further preparation according to the intervention plan during and completion of a cycle. Furthermore, I observed students' motives and engagement in the classroom for mathematical competencies development.

Reflect on the action: In this phase, one cycle of the intervention was over. Now, again situation of teachers' mindset and classroom practices regarding mathematical competencies are reflected through the interaction with teachers and observation of classroom practices. Then the action plan cycle was reassigned based on need of teachers' mindset and classroom activities conducted by teachers. Teachers were also requested to share their obstacles, possibilities, and way out for days to come while implementing action plan to achieve learning competencies according to the curriculum.

In this way, the action plan for the study was used to explore and change the existing mindset of teachers regarding changed curriculum implementation and way of teaching practice along with assessment in the classroom.

Results and Discussion

The study focused on the grades I and III. Findings are based on two situations, before and after applying the action research plan.

Teacher's Mindset and Classroom Practices Before Intervention

Based on the theoretical stages of CBAM model of Nawastheen (2021), teachers' status was found in '0' (unconcerned) stage where teachers have little knowledge of new curricular goals but are not ready to act for the changed movement of the curriculum in the classroom. The new curriculum is developed as an integrated curriculum that demands competency-based learning outcomes and formative assessment instead of summative evaluation. But the situation was observed during field visit and interaction with teachers regarding their existing practices, subject wise content-based teaching instead integration and summative evaluation instead of formative assessment was in operation. However, the curriculum expects, the situation analysis found teachers' mindsets and classroom practices both had not been synchronized as per the new curriculum expectations.

Teachers were asked about the expected learning outcomes of students intended by new curriculum, but they were unconcerned about the learning outcomes set by the curriculum and following previously practiced procedures. A teacher teaching in grade three turned pages of a book and said by pointing, "*Learning outcomes are given in the book then why do we need to see the curriculum? The book itself is prepared based on the curriculum. So, we are following the book instead curriculum*". Out of three teachers, two teachers had the same voice as quoted for sense with 'book as curriculum' and one teacher who had gotten training from the local government about the implementation of the new curriculum in the classroom realized that more competency-based learning outcomes are expected from the curriculum. In the case of new curriculum implementation, a teacher realized and said, "*expectations of curriculum are different than our daily classroom practice*" but she thinks, "*implementation of new curriculum is impossible because of too many learning outcomes expected in curriculum that cannot be achieved within school time frame*". Teachers shared that implementing a new curriculum is very challenging and even impossible to achieve curricular goals set by new integrated curriculum. Teachers were not much happy with teachers' performance evaluation system



at school also. They shared their feelings as, “*cares*, Information collected from the field regarding teachers’ mindset towards implementation of new curriculum was found synchronizing the sense of ‘book as curriculum’, ‘unachievable curriculum’ and ‘curriculum as burden’.

Regarding the practice of competencies development in the classroom, teachers were just focusing on content delivery and rule memorization rather than competencies development. When I was in a class, *‘the teacher was teaching divid e analyzing the rule of division for grade three students. The eyes of many students were not catching the rule for two-digit division (56÷2). The teacher tried to remind the rule of division and said to remember the rule with more practice of examples. Some of them operationalized the teacher’s instruction but many of them felt difficult.’* After observation of grade three class, I moved in grade one. The grade one teacher was teaching the multiplication, *‘She wrote table of 2 and 3 on a whiteboard and read it out once loudly making students to follow her voice. Then, she made to read loudly to a boy and ordered rest of the students to follow the voice of the boy’.* Here, the curriculum has instructed activities to develop different mathematical concepts under different themes associated with different competencies, but teachers are far from the instructions provided by the curricula and found focusing to rote learning.

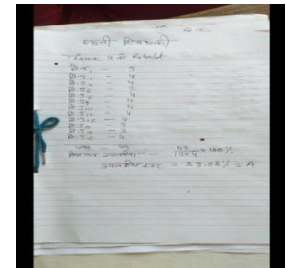
Regarding the Assessment of learning, there was a practice of paper pencil test as the routine test. There were not any formative assessment practices applied to the student assessment. I asked to teachers regarding formative assessment activities, a teacher replied, *“we do some extra activities instructed in book for students but do not associate with learning and assessment”.* Extra activities used to be for students’ fun without associating with learning. During the field study, it was found ‘content focused instruction’ ‘decontextualized instruction’ and ‘Inadequate teacher awareness on curricular competencies’ while concerning to situation analysis of mathematical competencies development process. Finally, assessing teachers’ mindset and observing existing classroom practices teachers are not responding the changes in new curricular intents.

Teachers’ Mindset and Classroom Practices After Intervention

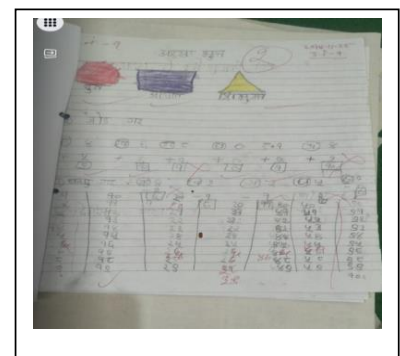
Teachers’ mindsets had been changed and they were focusing on developing competencies rather than just transmitting the content knowledge to students’ minds after intervention of action plan. The preliminary existing situation analysis of teachers’ mindset regarding new curriculum and classroom practices of teaching, learning and assessment paved the way to plan action cycle for research. Before implementation of action plan, teachers were provided orientation to inform about intervention and to prepare them mentally for curriculum implementation. After getting orientation, teachers were convinced to follow the intervention plan and also, they showed their willingness to learn about prepared tools going to apply in the classroom. Here, teachers’ level was uplifted in stage 1 (Informational) according to CBAM model where teachers showed their willingness to learn. While developing the action plan, curriculum was in center and based on the curricular materials, tools (portfolio record files, learning outcome log form, theme-wise result sheet) were prepared for intervention. These tools keep records of learners’ activities (portfolio), rate their learning outcomes with scale 1,2,3 and 4 and collect in a ‘learning outcome log’ form of all activities. Finally, teachers assess the all-learning objectives achieved by students from a theme and prepares the result of individual students based on a theme. This process provides feedback to students and teachers instantly during the achieving process of learning mathematical competencies that help to identify loophole of learning and to supplement for better achievement. For the intervention of the plan, teachers got curriculum, activity log form and portfolio files for the record of students’ activities. While they started to apply these tools with onsite support to teachers as per their need, they slowly stepped up to stage 2 (Personal) where teachers started to think about impact of new curriculum implementation at a personal level and about their limitations related to the new curriculum. Teachers became excited more and said, *“we thought, applying strategies instructed by new curriculum is impossible but it is more comfortable and believable due to observable to all, through portfolio record for how students have achieved the targeted competencies”.* Now, teachers started to focus on teaching learning process and designing tasks (stage 3, management) to be given to students that helps to develop targeted competencies expected by curriculum. Focusing on task and process, teachers started to think critically about its impact on students (stage 4, consequence).



For the task preparation, they felt book is not sufficient and other curricular materials like, teacher's guide, assessment log etcetera are the necessary materials for planning activities to develop skills and competencies. A grade three teacher said, *"I realized now, book is just a supportive material, not a complete document"*. With this realization, teachers begin to share their ideas and observe what their peers are doing for better learning achievement (stage 5, collaboration). Till the stepping up to 5th stages, teachers were passes through many knots and had recorrected many times. In this action cycle, continuously put teachers' effort and researcher's support, teachers had concentrated on more strategies for better implementation of new curriculum as expected for stage 6th (refocusing) in CBAM model of Nawastheen (2021). When teachers implemented action plan, their mind set regarding 'impossible to implement new curriculum' found changed into 'easy to develop skills and competencies within students as intended by new curriculum'. During the plan implementation, teachers started to apply slowly activity-based teaching strategies and tried to develop skills and competencies within students instead of just transferring core content knowledge. Teachers' mindset of 'book as curriculum' had been changed into 'curriculum is fundamental' and books, teachers' guide are supportive materials to achieve the curriculum intent. The practices of 'assessment of learning' was transformed to 'assessment for learning'.



Teachers got support onsite for assessing and maintaining portfolios for students' learning achievement along with the themes-wise result calculation idea. The necessary support to teachers for teaching and assessment activities was applied based on the classwise teacher's guidebook. Talking about the curricular activities with the teacher, a teacher of grade one said, *"Following instructed curricular activities is easier and more effective to achieve the curricular goals"*. Teachers now are friendly with the use of curriculum and curricular material. They had a misunderstanding regarding the achieving learning outcomes set by the curriculum. They used to say 'it is impossible to catch all these learning outcomes' but now, they says 'it is easy to achieve all the leaning outcome through different activities indicated in curriculum and teacher's guide. Teachers realized that keeping a record of students' work (managing portfolios) is very effective in providing student feedback. Students got the opportunity of self-evaluate and find their weaknesses themselves to overcome their weaknesses. A teacher teaching in grade three said, *"We thought, maintaining the portfolio, calculation theme wise result, maintaining achievement based on many learning outcomes are too haggel but when we got support onsite with tools, it is found easily applicable"*. For the first time, when we talked about the way of instruction and assessment, they had been applying in the classroom differed from curricular goals and needed to be updated, teachers denied our proposal. But when we shared intervention tools and promised to be there onsite with teachers to support them, they started to apply. I was always with teachers onsite till teachers had completed at least a theme with complete result calculation. After completion of teaching a theme, teachers reflected that developing competency within students is possible through different activities instead of repeatedly rote and rule learning. Finally, teachers realize, that we can change ourselves and others according to changes in time and policy as well. Later on, teachers provided feedback for the intervention tools to make it more teacher-friendly and more implacable to achieve the changed curricular goals.



While applying and analyzing action plan, how teachers are trying to achieve mathematical competencies was under close observation. It was found teachers played a prominent role in developing mathematical competencies associating mathematical content with context.

During the time of field study, teachers of grades one and three both of them were in theme third, 'hamro samudaya (Our Community)'. The grade one teacher was preparing to teach the mathematical concept 'odd and even numbers and the grade three teacher was teaching 'measurement'. I asked to a grade three teacher about her previous activities (before action plan implimentation) applied for teaching 'measurement of length and breath' she said, *"We used to ask to draw lines on copy and make them to measure length"*. There was

not found aware in application of even integrated sense of curriculum, subject focused teaching was in practice. When teachers were empowered implementing the action plan along with onsite support providing a teacher's guidebook, learning competencies log related to content from curriculum, and learning outcomes log, then teachers planned activities in different ways. For the same mathematical content 'measurement' the teacher asked to write the lengths of different materials like books, copies, and length of pencils of different friends. Mathematical content was applied for the measurement of our context breaking the concept of mathematics is isolated subject. Finally, after teaching the concept of length measurement, the teacher instructed students for the homework to estimate and measure the length of the table and bed available in their home along with the record of difference in estimated length and real length. Such types of activities really showed integration of curriculum and developed the mathematical competencies.

The teacher of grade one preparing to teach the concept of 'odd and even numbers' planned to teach playing game of musical chairs at school. She instructed to write the numbers on whiteboard based on the total number of students (13), number of students out from the process of game (1,2,3,4...12), and number of students playing the game (13,12,11,...2). From these numbers written in white board, teachers developed the relevant mathematical concept. Finally, she gave homework to count and make a table for odd and even numbers from the family members of self and from neighbour. In this way, continuously teachers taught different mathematical content associating with different relevant context. We can see the change in teacher's mindset and impact on mathematical competencies development before and after implementation of action plan in Figure 2.

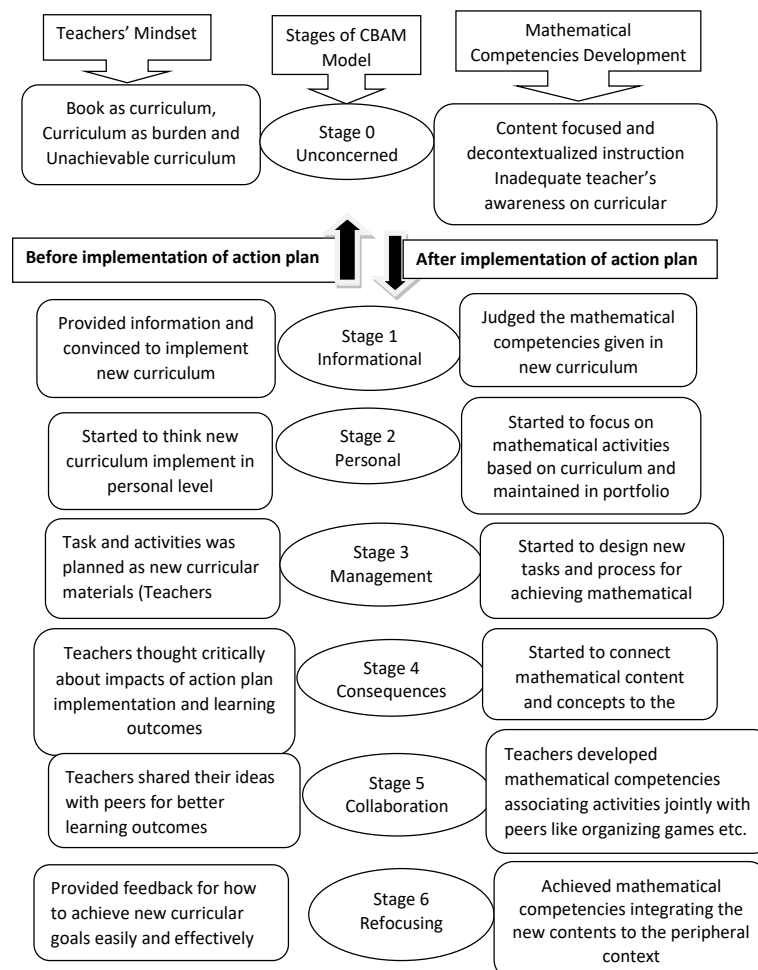


Figure 2. Development before and after implementation of action plan.

Discussion

Teachers' perceptions and beliefs influence the meaning of a changed curriculum and their acceptance eventually plays a vital role in classroom implementation (Rahman, Pandian, & Kaur, 2018). Teachers' effort with a fixed mindset instead of a growth mindset (Boaler et al., 2021; Dweck, 2006) impacts the change implementation. During the situation analysis period before the intervention, teachers were in a fixed mindset where they did not try to make an effort to change their thinking and not to take risks. Though teachers were known about the curriculum is lunched but they did not try to learn about changes and stayed on an unconcerned level for mathematical competencies development (Nawastheen, 2021) before intervention. Willingham (2017) discussed that goal monitoring practices such as focusing on students thinking and evaluating student progress against a mathematical learning path align well with globally accepted assessment practices. So, during the intervention period, it was always focused on teaching goals as mathematical competencies set by the mathematics curriculum. While providing support to teachers, they stepped up from the informational stage(stage 1) to refocusing stage (Stage 6) (Nawastheen, 2021). When we started to inform about curricular goals concerning mathematical competencies, there was found teachers' willingness to implement change and concentrate on solving problems and difficulties related to the reforms. "Teachers can and have been initiators of change in their classrooms and schools, and this is where powerful reform can take place" (Stewart, 2018, p. 2). associating with this explanation, the consequences (stage-4) were developed to observe the effects on students of change of teachers' mindset and aligned activities. School's teacher evaluation system is a prominent factor to discourages curriculum implementation (Rahman et al., 2018; Cheema et la., 2023; Cheema et la., 2023). When teachers started their planned activities focusing on competencies development, there was found positive change in students' achievements as well as learning motives. Then school administration admired teachers' work then teachers started to share their ideas with peers for betterment as (Nawastheen, 2021). Finally, teachers explored new ideas and strategies for better implementation of change realizing teacher as a change agent.

The growth mindset of teachers always encouraged students to better mathematical competencies development (Cocks, 2019). When teachers had changed their previous mentality of 'new curriculum implementation is impossible', their activities were focused on competencies development through organizing learners-focused activities and individual feedback-based assessment. Dweck (2010) explained that when students are struggling with learning, teachers should take it as an opportunity to teach students to step back to try the next effective strategies. In a similar way, teachers in the classroom used learning outcome records and maintained portfolios for each individual that reflected the learning level of students themselves and teachers treated them as per need. Students were found much happy in improving themselves in mathematical competencies that were informed by the teacher. The literature (Ostroff, 2016; Ronkainen et al., 2019) indicated that teachers' mindset has a direct impact on students' achievement (Shoshani, 2021). Hence, this study also found a similar result of the intervention in action research.

Conclusion

Teachers are the main change agents for quality education. However, the curriculum is changed and decorated with new vibes, it cannot influence the classroom if teachers are not ready mentally to implement it. If proper support according to teachers' needs is provided onsite, implementation of changes is possible. It is supposed that mathematics is isolated from the community. But if teachers are well supported in their needs, mathematics can be developed as a basic functional tool for life and mathematical content can develop essential competencies for human life.

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