ELEMENTARY: Jurnal Inovasi Pendidikan Dasar
Vol. 7, No. 1, November 2026-Januari 2027
e-ISSN : 2774-7034 | p-ISSN : 2774-8014
Online Journal System : https://jurnalp4i.com/index.php/elementary

FROM ROTE TO UNDERSTANDING: ELEMENTARY SCHOOL TEACHERS' EXPERIENCES AFTER GASING TRAINING IN BAUBAU CITY (A DESCRIPTIVE QUALITATIVE STUDY)

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Diterima: *28/10/2026*; Direvisi: *17/11/2026*; Diterbitkan: *21/11/2026*

ABSTRAK

Pengalaman guru dalam mengikuti pelatihan pengembangan profesional penting dikaji untuk memahami bagaimana perubahan praktik dan keyakinan pedagogis terbentuk, terutama dalam pembelajaran matematika sekolah dasar yang masih banyak mengandalkan prosedur dan hafalan. Penelitian ini bertujuan mendeskripsikan pengalaman guru setelah mengikuti pelatihan metode GASING (Gampang, Asyik, menyeNANGkan), meliputi praktik dan keyakinan awal, respons emosional, asal keyakinan, interaksi antarpeserta, penerapan awal di kelas, serta pemaknaan diri sebagai guru. Penelitian menggunakan pendekatan deskriptif kualitatif dengan melibatkan delapan guru kelas 1, 5, dan 6 yang dipilih secara *purposive* dari 64 peserta pelatihan selama 12 hari di Kota Baubau. Data dikumpulkan melalui wawancara semi-terstruktur menggunakan 18 pertanyaan dan dianalisis dengan *reflexive thematic analysis*. Hasil analisis menghasilkan 31 tema dalam enam kategori. Seluruh guru mengungkapkan kekhawatiran terhadap pendekatan pembelajaran sebelumnya, memperoleh dukungan dari interaksi sejawat, dan mendasarkan keyakinan terhadap GASING pada perubahan yang mereka amati pada siswa. Tantangan penerapan terutama berkaitan dengan kebiasaan menghafal dan kecemasan matematika siswa. Pemaknaan guru setelah pelatihan bervariasi, mulai dari menjadikan GASING sebagai kerangka utama hingga memadukannya dengan pendekatan konseptual lainnya. Penelitian ini memberikan gambaran kontekstual mengenai pengalaman guru, tetapi temuannya tidak dimaksudkan untuk membuktikan hubungan kausal maupun digeneralisasikan.
Kata kunci: GASING; pelatihan guru; guru sekolah dasar; keyakinan guru; studi deskriptif kualitatif

ABSTRACT

Teachers' experiences of professional development are important to examine to understand how changes in teaching practices and pedagogical beliefs are formed, particularly in elementary mathematics education, where instruction often relies on procedures and memorization. This study aims to describe teachers' experiences after participating in training on the GASING method (Gampang, Asyik, menyeNANGkan), focusing on initial practices and beliefs, emotional responses, the origins of beliefs, peer interactions, early classroom implementation, and teachers' self-perceptions. A descriptive qualitative approach was employed, involving eight grade 1, 5, and 6 teachers purposively selected from 64 participants in a 12-day training program in Baubau City. Data were collected through semi-structured interviews comprising 18 questions and analyzed using *reflexive thematic analysis*. The analysis generated 31 themes across six categories. All teachers expressed concerns about their previous teaching approaches, valued support from fellow participants, and based their confidence in GASING on changes they observed in students. The main implementation challenges involved students' rote learning habits and mathematics anxiety. Teachers' post-training self-perceptions varied, ranging from adopting GASING as their primary instructional framework to integrating it with other

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https://doi.org/10.51878/elementary.v7i1.16734

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Vol. 7, No. 1, November 2026-Januari 2027
e-ISSN : 2774-7034 | p-ISSN : 2774-8014
Online Journal System : https://jurnalp4i.com/index.php/elementary

conceptual approaches. This study provides a contextual account of teachers' experiences; however, its findings do not establish causal relationships or support generalization beyond the study context.

Keywords: descriptive qualitative study; elementary school teachers; GASING; teacher beliefs; teacher training

INTRODUCTION

Number sense and counting skills in the early years of elementary education are the foundation for later mathematics learning. Research on learning trajectories shows that these basic concepts develop in sequence, so teachers can design instruction in a planned way (Clements & Sarama, 2021). Even so, many classrooms still prioritize procedures and memorization. Conceptual and procedural knowledge, however, strengthen each other and grow in alternation (Rittle-Johnson, 2017). Boaler (2016) advocates instruction that builds understanding and flexible thinking about numbers, while criticizing instruction that stresses speed and memorization.

Difficulties in learning mathematics are not only cognitive. Mathematics anxiety is negatively related to achievement, as a cross-study meta-analysis shows (Barroso et al., 2021). A review spanning six decades of research indicates that mathematics anxiety is shaped by experience and by the learning environment (Dowker et al., 2016), and a review of interventions likewise points to the role of classroom processes in this anxiety (Ramirez et al., 2018). Teachers play an important role in this process. Teachers' emotions are related to students' emotions and achievement (Frenzel et al., 2021), while teacher self-efficacy is related to classroom processes, students' academic adjustment, and teachers' own well-being (Zee & Koomen, 2016). In Indonesia, the problem is visible in student achievement. Indonesia's mathematics score in PISA 2022 was 366 points, far below the OECD average of 472 points (OECD, 2023). Rosser (2018) stresses that the main problem of Indonesian education has shifted from access to the quality of learning. Attention therefore needs to be directed to what happens inside classrooms and to the teachers who teach there.

Teacher professional development (PD) therefore becomes one of the main levers. One approach now being disseminated through intensive training for teachers across Indonesia, including remote and border regions, is the GASING method (Gampang, Asyik, Menyenangkan), developed by Yohanes Surya (Yuana et al., 2026a, 2026b; Mayabubun et al., 2026). Evidence on effective PD has been widely summarized. A frequently cited summary lists the features of effective programs: they focus on content, use active learning, encourage collaboration, provide models of effective practice, offer coaching, feedback, and reflection, and last long enough (Darling-Hammond et al., 2017).

However, this picture is no longer regarded as final. Kennedy (2016) shows that a program's effectiveness cannot be explained only by popular features such as content focus or duration; how a program triggers change in teachers' practice also needs attention. Sims and Fletcher-Wood (2021) criticize the commonly used lists of PD characteristics, and Sims et al. (2023) meta-analytically test a theory centered on mechanisms of teacher behavior change. Other syntheses provide more specific evidence. Coaching-based training has been shown to improve instructional practice and student achievement (Kraft et al., 2018), and a meta-analysis of efforts to improve STEM instruction found positive effects on student achievement with large variation across programs (Lynch et al., 2019). In low- and middle-income countries, the evidence remains mixed and often contradictory across studies (Evans & Popova, 2016). A later

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synthesis also notes a gap between the evidence on effective PD and PD practice in many countries (Popova et al., 2022).

In mathematics education, a systematic review of 58 studies on kindergarten and elementary teacher training found that reflection on practice is the most frequently used approach (Alsina et al., 2025). A review of 84 other articles shows that reflection is often treated as the main catalyst, with different learning supports for programs that target knowledge and programs that target changes in teaching (Brehmer & Ryve, 2024).

Recent studies on GASING generally use one-group pretest–posttest designs or classroom action research, and report increases in teachers' and students' scores. GASING training for elementary teachers in South Manokwari was evaluated with a one-group quasi-experimental design (Yuana et al., 2026a). A training in Bojonegoro involving teachers and students was evaluated without a control group (Yuana et al., 2026b), and a training in West Manggarai was evaluated with a pre-experimental design (Mayabubun et al., 2026). Classroom action research with grade 1 and grade 3 students also reported increases in mean scores after learning with GASING (Anggraini et al., 2026; Windani et al., 2023). These studies answer the question "did scores go up?" They do not, however, explain how teachers experienced the training: what they felt when their way of teaching was questioned, where their old beliefs came from, what helped or hindered them, and how they made sense of themselves as teachers afterwards.

One thing that remains unanswered in this literature is how teachers themselves experience such change. Guskey (2020) argues that experience shapes teachers' attitudes and beliefs, not the other way around. The important question is therefore which experiences make teachers confident. In addition, teachers' old practices are often unnoticed. The concept of the *apprenticeship of observation* explains that teachers enter the profession with models of teaching formed over years as students, so old practices are often unconscious reproduction (Taylor et al., 2022). Changing practice also involves identity: teachers do not merely swap techniques but also reinterpret who they are as teachers. Teacher professional identity is dynamic and multidimensional (Hanna et al., 2019), and research on identity in mathematics education has become an established field (Darragh, 2016; Graven & Heyd-Metzuyanim, 2019).

Transformative learning theory provides a language for discussing such change. According to this theory, adults' perspectives can change through disorienting dilemmas, critical reflection on assumptions, and discourse with others, with the role of emotions increasingly recognized (Hoggan, 2016; Taylor, 2017). However, the term "transformative" needs to be used with care. Hoggan (2016) proposes criteria and a typology of change outcomes, and Hoggan (2023) criticizes the use of the label without supporting evidence; a broader review of critiques and developments of the theory is available in Hoggan and Hoggan-Kloubert (2022). This article takes that lesson: the theory is used as a lens for interpretation, not as a claim that transformation has occurred.

This article fills that gap with a descriptive qualitative study of the experiences of eight elementary school teachers after a 12-day GASING training with 64 teachers in Baubau City. Its contribution is deliberately limited to three points. First, it provides a systematic, data-based description of teachers' experiences in GASING training, complementing score-based studies. Second, it presents a list of themes with their distribution and a cross-case comparison, so readers can trace the findings for each theme and each case. Third, it interprets the findings with the PD literature, identity theory, and transformative learning theory cautiously, without claiming that the training caused the changes teachers reported. The research questions are formulated as follows.

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e-ISSN : 2774-7034 | p-ISSN : 2774-8014
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RQ1. How do teachers describe their internal conditions, socially, emotionally, and in terms of beliefs, regarding the use of the GASING method when their old way of teaching is questioned during training, and where do those old beliefs come from?
RQ2. What is the role of fellow training participants in teachers' process of learning and accepting the GASING method?
RQ3. How do teachers plan, implement, and begin applying the GASING method in elementary school mathematics, including the challenges and convincing events they encounter?
RQ4. How do teachers make sense of and explain their experience of applying the GASING method after the training?

METHODS

1.1 Research Design

This study uses a descriptive qualitative design. The design was chosen because its aim is to present participants' experiences in language close to the data, without building new theory and without testing hypotheses (Kim et al., 2017). This approach demands care in distinguishing what participants said from what the researchers interpreted, and in presenting the two separately. Interviews were conducted after participants completed the training and applied GASING in their classrooms, so the accounts cover experiences during the training as well as early experiences of applying it. The data are therefore retrospective, and no causal relationship can be inferred between training components and the changes teachers reported. The research flow and the stages of the GASING method that was trained are presented at the end of the Method section (Figures 1 and 2).

1.2 Training Context

The training ran intensively for 12 days in December 2024 in Baubau City, Southeast Sulawesi, and was attended by 64 elementary school teachers. According to participants, the training introduced GASING counting techniques practiced directly, small-group work and discussion, and elements of games, songs, movement, and concrete objects that teachers later used in their classrooms. One participant described the schedule as "two full weeks from morning to evening".

1.3 Participants and Sampling

Sampling aimed to obtain teachers who could describe their experiences after attending GASING training and trying to apply it in their classrooms. Participants were therefore purposively selected from the 64 elementary school teachers who attended the 12-day GASING training in Baubau City in December 2024. Candidates had to meet three criteria: (a) attended the entire training, so that they had experienced all of its content; (b) had applied GASING in their classroom before the interview, so that they could speak about classroom practice and not only about the training; and (c) were willing to be interviewed. From the teachers who met these criteria, eight were chosen on the basis of readiness to be interviewed. The researchers considered the grade level taught, but diversity was limited: one grade 1 teacher, five grade 5 teachers, and two grade 6 teachers.

The number of eight participants was determined by the principle of *information power*. This principle states that the narrower the study aim, the more specific the sample, and the richer the interview data, the fewer participants are needed (Malterud et al., 2016). This study meets the first two conditions. Its aim is narrow, namely teachers' experiences after one particular training, and its sample is specific, namely participants of the same training. On the other hand, the study does not test theory, and cross-case comparison is limited because the number of teachers at each grade level is small. The findings are therefore limited to a

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description of experiences in this sample and are not intended to be generalized. To maintain confidentiality, participants were given the codes P1 to P8, and the names of fellow participants they mentioned were disguised.

Table 1. Participant profile and early GASING implementation according to teachers' accounts (N = 8)

Code	Grade	Teaching approach before the training	Early GASING implementation mentioned
P1	6	Entirely based on the textbook; procedural	Addition of large numbers, then multiplication, division, and subtraction
P2	5	Entirely following the textbook	Basic addition, with *ice breaking* and the GASING song
P3	1	Column procedure from ones to tens	Number concepts with sticks and concrete objects; pairs of 10; basic addition
P4	6	Column addition and subtraction starting from the ones	Material not specified; mentions adaptation to a more dynamic teaching style
P5	5	Written procedures and repeated practice exercises	Number recognition; gamified learning
P6	5	Step-by-step procedures and memorization (standard algorithm)	Number recognition; gamified learning
P7	5	Column addition with the standard algorithm	Multiplication with ×9 and ×5 patterns
P8	5	Entirely relying on the textbook	Building basic concepts step by step before more complex material

Note. Table contents were compiled from the interview transcripts. Other demographic data (age, sex, length of service) were not analyzed.

1.4 Instrument

Data were collected with a semi-structured interview guide of 18 questions, three for each aspect. The six aspects were drawn up with reference to the six phases of transformative learning theory (Hoggan, 2016; Taylor, 2017): (1) the shift between old teaching habits and the GASING approach; (2) emotional responses; (3) the origins of pedagogical beliefs; (4) the role of fellow participants; (5) early implementation in the classroom; and (6) re-making sense of oneself as a teacher. Other phases were not asked about because they require long-term observation. The theory was used only to construct the guide; the analysis in this article is descriptive and does not map answers onto theoretical phases. The guide was reviewed by three qualitative researchers and tested for readability with two teachers who were not participants. Interviewers could ask follow-up questions according to participants' answers.

1.5 Procedure and Ethics

Interviews were conducted after participants completed the training and applied GASING in their classrooms. Each interview lasted 45–60 minutes and was recorded with the participants' written consent. The recordings were then transcribed, and the final transcripts were used as the sole source of analysis. The interviews were conducted online on 15–16 June 2026.

Ethical considerations followed the principles of respect for participants, confidentiality, and non-maleficence. Before each interview began, the researchers explained the purpose of the study, the form of participants' involvement, and how the data would be used. Participation was voluntary, and participants could decline to answer any question or withdraw at any time

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without consequence. Participants' identities were protected with the anonymous codes P1 to P8 throughout the manuscript, and the names of fellow participants mentioned by participants were disguised. Recordings and transcripts were stored on the researchers' devices, are accessible only to the research team, and are not published.

1.6 Data Analysis

The analysis followed the principles of reflexive thematic analysis (Braun & Clarke, 2019, 2021), which regards codes and themes as the result of the researcher's active engagement with the data, not as something that "emerges" by itself. Because the study has a descriptive design, themes were kept close to the content of the answers. The steps were as follows. First, all transcripts were read repeatedly. Second, each participant's answer to each question was summarized. Third, the summaries were coded in a mixed way: initial categories were derived from the six aspects of the guide (deductive), and subcategories were then formed from the content of the answers (inductive). Fourth, similar codes were grouped into 31 themes in six categories, and each theme was given an operational definition. Fifth, the distribution of themes was summarized in a table (Table 2) and the cases were arranged in a case comparison table (Table 3) so that variation and similarity could be traced. Sixth, representative quotations were chosen for each theme and presented in the results text. A participant could fall under more than one theme within the same category if the answer contained more than one idea. The number of participants per theme (n of 8) is reported as a picture of distribution within this sample, not as statistical inference. Quotations were checked word for word against the final transcripts in the original interview language (Indonesian) and are presented here in the authors' English translation, with the meaning left unchanged.

1.7 Quality, Reflexivity, and Reporting

The quality of the analysis was safeguarded with the trustworthiness criteria for thematic analysis (Nowell et al., 2017): an audit trail in the form of a codebook and a theme distribution table, sufficient quotations for each theme, and re-checking of quotations against the transcripts. Two procedures common in qualitative studies were not carried out in this study and are acknowledged as limitations: double coding by a second analyst and member checking. Member checking should not itself be regarded as an automatic guarantee of validity (Birt et al., 2016).

The lead researcher is a certified GASING trainer who was not involved in organizing this training or in designing this study. This closeness may ease the relationship with participants, but it also carries two risks: interpretation that leans in favor of GASING and participants' answers that lean towards pleasing the interviewer. Social desirability bias in qualitative interviews does need to be deliberately detected and limited (Bergen & Labonté, 2020). For this reason, results are presented as close as possible to participants' own words, non-uniform answers are reported as they are (for example, the three teachers who initially doubted the idea that rote memorization makes things harder for students), and no claims are made about the effectiveness of the training. The researcher's position is also stated in the conflict of interest statement.

1.8 Research flow and the flow of the GASING method taught

Figures 1 and 2 summarize the journey of this study in two interlinked tracks. Track A (Figure 1) shows how the research was designed and carried out, while track B (Figure 2) describes the GASING method that was taught, that is, the learning experience that teachers later narrated. Each step is explained below.

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Track A. Research flow

Step 1. Starting from a concern and a gap. The study began from the observation that GASING training is usually assessed through changes in scores, while teachers' stories about what they doubt, feel, and believe are rarely examined.

Step 2. Turning the gap into four questions. The gap was formulated into four research questions that follow the teachers' journey: internal conditions and initial beliefs (RQ1), the role of fellow participants (RQ2), planning and early classroom implementation (RQ3), and making sense of the experience after the training (RQ4).

Step 3. Choosing the design and the narrators. A descriptive qualitative design was chosen so that teachers' experiences are presented close to their own words. Eight teachers of grades 1, 5, and 6 were purposively selected from the 64 training participants and given the codes P1 to P8.

Step 4. Listening through interviews. Semi-structured interviews of 18 questions lasted 45–60 minutes online, were recorded with written consent, and were transcribed; the transcripts became the sole source of data.

Step 5. Building meaning from the data. The transcripts were read repeatedly, summarized, coded, and grouped through reflexive thematic analysis into 31 themes in six categories. The distribution of themes and the cross-case comparison are summarized in Table 2 and Table 3.

Step 6. Reporting the findings together with their limits. The findings are presented according to the four research questions and interpreted cautiously with the literature. The report closes with a clear statement that the data do not support causal claims or generalization.

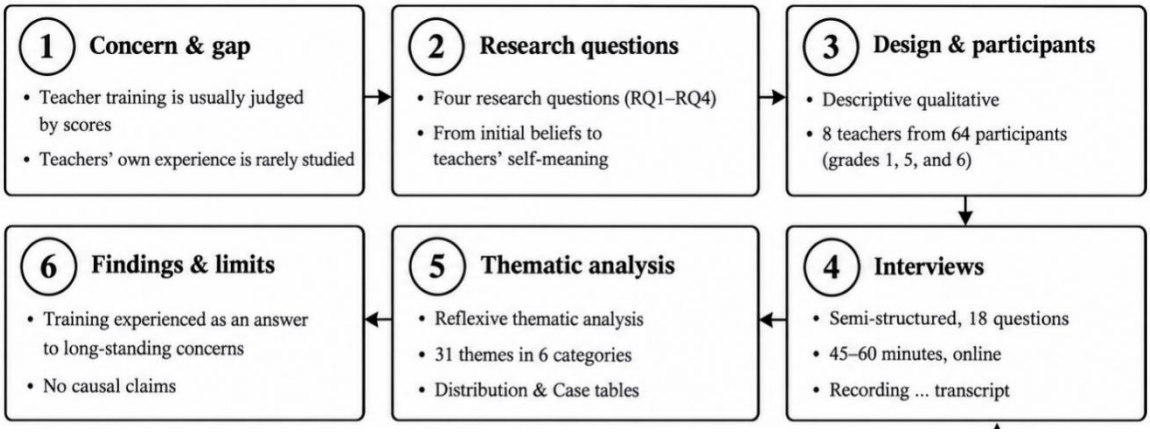


Figure 1. Research Flow

Track B. Flow of the GASING method taught

Track B places the teachers' accounts in context. GASING learning generally moves from the concrete to the abstract (Anggraini et al., 2026), and the flow in Figure 2 was compiled from participants' accounts and the GASING literature. The following four stages were taught over 12 days to 64 teachers.

Stage 1. Concrete. Teachers become acquainted with concepts through real objects, sticks, and teaching aids, accompanied by games, songs, and movements that they later used in their own classrooms.

Stage 2. Patterns and techniques. Building on concrete experience, teachers learn techniques that make calculation feel sensible and efficient, for example completing to ten, pairs of 10, and the ×9 and ×5 multiplication patterns.

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Stage 3. Abstract. This understanding is then linked to mathematical symbols and language, including working a problem from the highest digit, which for some teachers contradicted years of habit of working from the lowest digit.

Stage 4. Mental calculation (*mencongak*). This stage trains teachers to calculate quickly and accurately without relying on written steps, then to try it directly and apply it in class. Small-group work and peer discussion accompany all stages.

The two tracks meet at Step 4: the interviews trace teachers' experiences after going through flow B, rather than measuring how well those stages work.

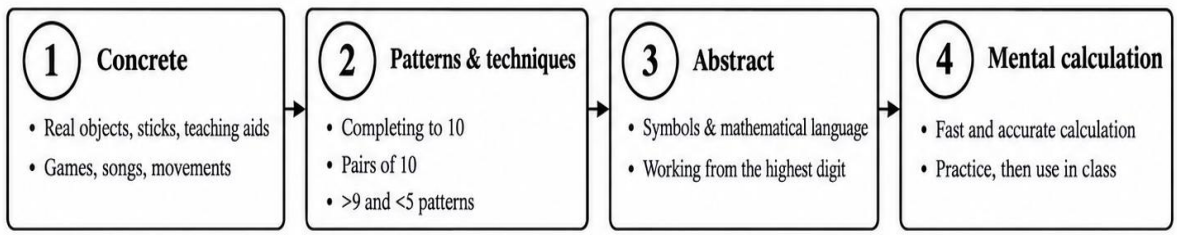


Figure 2. Flow of the GASING method taught

RESULTS AND DISCUSSION

Results

Overview

The analysis produced 31 themes in six categories, whose distribution of teachers per theme is shown in Table 2. Four themes were reported by all eight teachers: the worry that the old way of teaching made things harder for students, the realization that fellow participants were also confused, a positive view of the presence of other participants, and a conviction in GASING that rests on changes observed in students. Other themes show meaningful variation across cases, particularly the initial response to the idea that rote memorization makes things harder for students, the challenges of implementation, and the way teachers made sense of themselves. The following sections present the results according to the four research questions.

Table 2. Distribution of themes by category

Category	Themes and number of teachers (of 8) whose answers were coded to the theme
A. Initial practices and beliefs	Moment of realization: GASING technique felt more efficient (6); Teaching with standard procedures or algorithms (5); Immediately agreed that rote memorization makes things harder for students (5); Teaching relied on the textbook (3); Initially regarded rote memorization as normal or necessary (3)
B. Emotional responses	Had worried that the old way made things harder for students (8); Regret that turned into enthusiasm (3); Openness without shame (3); Productive discomfort or critical awareness (2)
C. Origins of beliefs	Own learning experience as a student (4); Memorable teachers during school years (4); Learning conditions (early foundations, learning pace) (2); Abacus or finger counting in elementary school (2)

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Category	Themes and number of teachers (of 8) whose answers were coded to the theme
D. Role of fellow participants	Realized that colleagues were also confused (8); Viewed the presence of other participants positively (8); Lively, cheerful, energetic atmosphere (5); Peer interaction changed or accelerated understanding (4); Mutual help and solidarity (3)
E. Early implementation in the classroom	Belief rests on changes observed in students (8); Main challenge: students' rote habits or anxiety (4); Returning to basic concepts first (3); Encountered no major challenge (2); Mentioned influence from home or family (2)
F. Self-meaning	Reported affective change in students (6); Teacher's role shifted (facilitator, designer, companion) (5); Viewed GASING as the main framework (4); Passed GASING on to colleagues at school (3); Routine self-reflection (2); Patience and emotion management (2); Flexible teacher; GASING as a tool (2); Conceptual first or blending both (2)

Note. Figures in parentheses are the number of teachers out of 8. Bold type marks themes reported by all teachers. Themes are ordered from the largest number of teachers within each category.

Initial practices and beliefs and emotional responses (RQ1)

Teaching approach before the training

All eight teachers described their way of teaching arithmetic operations as conventional and procedural. Three teachers (P1, P2, P8) said they followed the textbook entirely, and five teachers (P3–P7) mentioned standard procedures or algorithms, for example column addition from the ones to the tens (P3, P4, P7). P1 said that "I taught mathematics entirely from the textbooks available at school", with a procedural approach. The most striking change after getting to know GASING was formulated differently: a shift from a procedural to a conceptual approach (P1, P5, P6, P7), the use of concrete objects and a more logical sequence of concepts (P3), working from the highest digit by using patterns (P4), the availability of various new methods (P2), and learning that is "packaged in a format resembling a game" (P8).

Reactions to the idea that rote memorization makes things harder for students

Five teachers (P2, P3, P4, P7, P8) immediately agreed, generally on the basis of classroom experience. P2, for example, stated that "students really struggle when asked to memorize, especially multiplication tables, without the underlying conceptual understanding". Three teachers (P1, P5, P6) had initially regarded rote memorization as normal or unavoidable. P1 said:

> "My initial reaction was doubt and skepticism. I assumed that memorization is a natural foundation in learning mathematics" (P1)

That view changed during the training: "after attending the training sessions, I began to understand that memorization without conceptual understanding becomes a cognitive burden that hinders students when they face problems different from the ones they usually memorize" (P1). No one described this stage as a threat to themselves as a teacher.

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Moment of realization

Six teachers (P1, P3, P4, P5, P6, P7) pointed to the moment when they tried or saw a GASING technique that felt more efficient and sensible. P7 gave the example of completing to ten:

> "the addition 8 + 5 is explained through the concept of completing to 10: from 8, 2 is needed to reach 10, so 5 is split into 2 + 3, giving 10 + 3 = 13" (P7)

P5 said that he or she "immediately thought that I should have known and applied this way a long time ago". Two other teachers pointed to something different: P2 saw that GASING builds conceptual understanding gradually from the simplest to the most complex, and P8 saw students engaged and enthusiastic without boredom.

Emotional responses

When their way of teaching began to be questioned, teachers' answers fell into three groups. *Regret that quickly turned into enthusiasm* was experienced by P1, P5, and P6. P5 said that "the regret was soon balanced by strong enthusiasm", while P6 "chose to interpret that moment as an opportunity, not as criticism of my competence as a teacher". *Critical awareness or productive discomfort* was experienced by P2 and P3. P3 admitted "experiencing a kind of cognitive dissonance", but saw it "as an impetus to grow, not as a negative judgment of me as a teacher". P2 called it "a turning point that pushed me to change my approach immediately". *Openness without shame* was expressed by P4, P7, and P8; P4 stated, "I did not feel uncomfortable or ashamed when my way of teaching began to be questioned."

All eight teachers admitted having worried that the old way of teaching made it harder for students to understand. They responded to this in different ways: acknowledging the diversity of student ability and the need for differentiation (P1), switching consistently to GASING (P2), becoming more open to alternatives (P3), becoming more selective and student-centered (P5, P6), and changing practice gradually (P7, P8). P3 said that the training "came at just the right time to answer that professional restlessness". Seven teachers (P2–P8) stated they were enthusiastic from the start, while P1 adapted gradually: "the intensity of the training, two full weeks from morning to evening, felt quite tiring", but he or she then became increasingly engaged.

Origins of beliefs

Four teachers (P1, P5, P6, P7) traced the belief that mathematics is difficult, or that memorization is appropriate, to their own learning experience. P1 explained that mathematics used to be presented as procedures to be memorized; "That experience is what I then unconsciously replicated when I became a teacher." P7 pointed to senior high school, when "teaching methods were dominated by a pattern of copying and memorizing with little conceptual exploration". Two teachers pointed to learning conditions: weak conceptual foundations in the early grades (P2) and a conventional system that did not accommodate differences in learning speed (P4). P3 mentioned the mistaken assumption that "knowing the procedure means understanding mathematics", while P8 mentioned personal difficulty with advanced material such as calculus and statistics, which did not reduce his or her interest in mathematics.

On the question about formative figures or experiences, four teachers (P2, P3, P4, P7) mentioned memorable teachers from their school years, while P5 and P6 recalled learning the abacus and counting with fingers in elementary school, which, according to P6, GASING seemed to "revive and formalize an intuition that had long existed". P1 admitted to having no role model; for him or her the GASING training was the first time he or she felt a strong emotional attachment to mathematics. P8 mentioned a new habit after the training, namely

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ELEMENTARY: Jurnal Inovasi Pendidikan Dasar
Vol. 7, No. 1, November 2026-Januari 2027
e-ISSN : 2774-7034 | p-ISSN : 2774-8014
Online Journal System : https://jurnalp4i.com/index.php/elementary

independently searching for fast-counting techniques from online sources. When asked to convey a message to themselves at the start of their careers, teachers mentioned the importance of prioritizing students' understanding (P1, P2, P4, P5, P7), continuing to learn (P1, P4, P5, P6, P8), and making mathematics enjoyable and meaningful (P3, P5, P6, P7). P2 stated, "A teacher's main task is not only to deliver material, but to make sure every student truly understands it."

The role of fellow participants (RQ2)

All eight teachers realized that other teachers were also confused. P4 mentioned the first moment of seeing "that a problem can be worked from the front, contrary to the habit of working from the back for years". This realization brought relief to P3 ("I did not feel alone in facing a fairly big conceptual change") and normalized the learning process for P7, who concluded that adapting to a new approach is a "universal experience, not an individual weakness". P8 admitted, "Even I sometimes was slow to grasp the material when sitting at the back of the room."

On the question of whether conversations with fellow participants changed their perspective more than the official sessions, four teachers (P1, P2, P7, P8) answered that peer interaction changed or accelerated their understanding. P7 stated that "explanations from fellow participants who share similar context and experience are often easier to digest". P8 said:

> "Informal chats outside the official sessions, for example during breaks together, turned out to give perspectives as important as the formal material." (P8)

P3 and P4 answered that informal interaction did not change their views more than the official sessions did, but was still valuable. P3 formulated it as a division of roles: "The official sessions provide the theoretical framework, while informal interaction strengthens the conviction to put it into practice." P5 and P6 answered that prior knowledge and discussion among participants strengthened their conviction, without comparing it with the official sessions.

All teachers viewed the presence of the 63 other participants positively. Five teachers (P1, P2, P5, P6, P7) described a lively, cheerful, and energetic atmosphere, and two of them (P1, P7) linked it to the courage to try. P7 stated that "every participant was braver in trying, asking, and making mistakes as part of the learning process". Three teachers (P3, P4, P8) stressed mutual help and solidarity; P8 concluded that "learning together in a community is far stronger than learning alone".

Early implementation in the classroom (RQ3)

First experiences

Early implementation took place in grade 1 (P3), grade 5 (P2, P5, P6, P7, P8), and grade 6 (P1, P4) with varied material (Table 1). Three grade 5 teachers decided to return to basic concepts. P5 found that "some students do indeed have gaps in their understanding of the concept of numbers and how to write them correctly", so the number recognition material could not be skipped. P8 started from basic concepts step by step. P7 reported that in the ×9 and ×5 multiplication material, students who had previously struggled began to understand and were "able to explain the logic behind the technique to their friends"; for him or her, "the ability to explain a concept to others is the strongest indicator of understanding".

Biggest challenges

Four teachers (P5, P6, P7, P8) named students as the main source of challenge, namely mathematics anxiety (P5, P6) and ingrained rote habits (P7, P8). P6 stated that "many students already feel defeated psychologically even before the lesson starts", and P5 described students

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ELEMENTARY: Jurnal Inovasi Pendidikan Dasar
Vol. 7, No. 1, November 2026-Januari 2027
e-ISSN : 2774-7034 | p-ISSN : 2774-8014
Online Journal System : https://jurnalp4i.com/index.php/elementary

who were tense even before the lesson began. P8 stated that "patterns of memorization and conventional ways of learning that have become habits cannot be changed quickly", and said these habits came from previous schools as well as the family environment. P7 stressed that "this transition process requires time and patience".

Two teachers (P1, P2) did not encounter major challenges. P2 found that "students' readiness to accept change is often higher than teachers assume", while P1, who taught grade 6, expected that "the more real challenge will be faced in the lower grades". Two teachers mentioned other challenges. P4 pointed to himself or herself: "At first I felt nervous because I was not yet fully accustomed to the delivery rhythm required." P3, the only grade 1 teacher, mentioned a challenge from outside the classroom:

> "The biggest challenge in implementation actually came from outside the classroom, namely from the home environment. When parents help with homework using a different conventional method, students become confused because they receive two different ways of solving the same problem." (P3)

In addition, P2 added the need for continuity so that GASING "is also applied in the next grades by different teachers".

Convincing event

All eight teachers anchored their conviction in something they observed in students. Three teachers (P1, P2, P4) pointed to a student who had been passive or uninterested and suddenly answered correctly. P1 recounted:

> "a student who had never been active in class, even rarely emotionally present in learning, was suddenly able to answer questions and showed genuine joy" (P1)

Two teachers (P3, P7) mentioned students who answered quickly and correctly or were able to explain the technique to friends, and P8 mentioned students' genuine joy as they spontaneously said that "this new way is faster and better". P5 and P6 mentioned results of the TKA (Tes Kemampuan Akademik, Academic Ability Test), which, according to both, placed many of their students at high ranks with "the highest mathematics score reaching 96", as well as high enthusiasm in gamified sessions. This figure is a teacher's report and was not verified against results documents.

Teachers' self-meaning (RQ4)

Change within. Five teachers (P1, P3, P5, P6, P8) described a change in role or focus: from deliverer of procedures to facilitator or learning designer, or to a companion who builds meaningful relationships with students. P1 mentioned "professional courage" to teach concepts that he or she used to consider difficult. Two teachers (P4, P7) stressed routine self-reflection; P4 stated, "I have become a more reflective teacher." P2 mentioned patience and emotion management as the most noticeable change and admitted to having previously "often felt frustrated in class and vented it unproductively". P8 also said he or she is now more patient.

How teachers view struggling students. P2 now views learning difficulty not as student failure, "but as a signal that the approach used needs to be adjusted". P8 stated that "a student who struggles does not mean unable; they just need more time, more patient guidance, and a different approach". P1 became more proactive in noticing students who fall behind. Six teachers (P1–P6) described affective change in students: from passive to enthusiastic, or from afraid to curious. P4 noted that "students increasingly rarely depend on their fingers when counting", and P5 judged that "this affective change is, for me, as important as, perhaps even more important than, mere improvement in grades".

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Vol. 7, No. 1, November 2026-Januari 2027
e-ISSN : 2774-7034 | p-ISSN : 2774-8014
Online Journal System : https://jurnalp4i.com/index.php/elementary

Self-view: GASING teacher or conceptual teacher? Four teachers (P1, P2, P3, P4) made GASING their main framework. P1 stated that "GASING is not merely a collection of tricks, but a philosophy of learning that places conceptual understanding above procedural memorization". P2 affirmed that this commitment does not mean closing oneself to other approaches, and P3 stated that "GASING is not an alternative to the old method, but a development of better pedagogical principles". Two teachers (P5, P6) viewed GASING as a highly effective tool for mathematics but saw themselves as flexible teachers; both said GASING taught them to become "active learning designers" (P5, P6), with P6 adding the word "adaptive". Two teachers (P7, P8) prioritized a conceptual approach or blended the two. P7 stressed the core principle of "reducing dependence on mechanical memorization and replacing it with meaningful understanding that lasts", while P8 blended both: "the two are not mutually exclusive choices, but complement each other".

Dissemination to colleagues. Three teachers (P2, P5, P6) said they had passed GASING on to colleagues at school, and P8 hoped the method could "spread throughout the region and be applied in more schools". P5 said that his or her enthusiasm "also spread to fellow teachers at school when I did the dissemination after returning from the training". The interview guide did not ask about this directly, and the teachers' accounts do not explain whether the dissemination was on their own initiative or part of a program.

Cross-case comparison

Table 3 arranges the cases side by side. Three things stand out. First, the teachers who initially doubted the idea that rote memorization makes things harder for students (P1, P5, P6) did not converge on one final pattern: P1 made GASING the main framework, while P5 and P6 saw themselves as flexible teachers. Second, the main challenges appear to differ by grade: grade 6 teachers mentioned smaller challenges or ones originating from themselves, four of the five grade 5 teachers (P5–P8) mentioned students' habits and anxiety (P2 did not encounter a major challenge), and the only grade 1 teacher mentioned the home. With one grade 1 teacher and two grade 6 teachers, this pattern is only indicative. Third, P5 and P6's answers are very similar on several questions (for example about abacus experience, TKA results, and the challenge of student anxiety), so the two should not be read as independent evidence; this similarity is reported here so readers can weigh it.

Table 3. Case comparison: initial response, main challenge, convincing event, and self-meaning

Case	Initial response to the "rote hinders" idea	Main implementation challenge	Convincing event	Self-meaning
P1 (G6)	Skeptical, then accepting	Not major; expects it to be harder in lower grades	A passive student suddenly answers	GASING as the main framework
P2 (G5)	Immediately agreed	Not major; highlights continuity across grades	A passive student becomes the first to answer	GASING as the main framework
P3 (G1)	Immediately agreed	Different ways of working at home	Quick, correct answers to spontaneous questions	GASING as the main framework; old method integrated

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ELEMENTARY: Jurnal Inovasi Pendidikan Dasar
Vol. 7, No. 1, November 2026-Januari 2027
e-ISSN : 2774-7034 | p-ISSN : 2774-8014
Online Journal System : https://jurnalp4i.com/index.php/elementary

Case	Initial response to the "rote hinders" idea	Main implementation challenge	Convincing event	Self-meaning
P4 (G6)	Immediately agreed	Teacher's own teaching agility	A passive student raises a hand and answers correctly	GASING as the main framework
P5 (G5)	Skeptical, then accepting	Students' mathematics anxiety	TKA results and enthusiasm in gamified sessions	Flexible teacher; GASING as a tool
P6 (G5)	Skeptical, then accepting	Students' mathematics anxiety	TKA results and enthusiasm in gamified sessions	Flexible teacher; GASING as a tool
P7 (G5)	Immediately agreed	Students' rote habits	Students explain the technique to friends	Conceptual first
P8 (G5)	Immediately agreed	Rote habits from school and family	Students' genuine joy	Blending GASING and the conceptual approach

Figure 3 summarizes the pathway of experience the teachers narrated: initial practices and beliefs, experience during the training, early implementation, and self-meaning, with the company of fellow participants as support during the training. This pathway is a descriptive summary of the accounts of eight teachers and not a causal model.

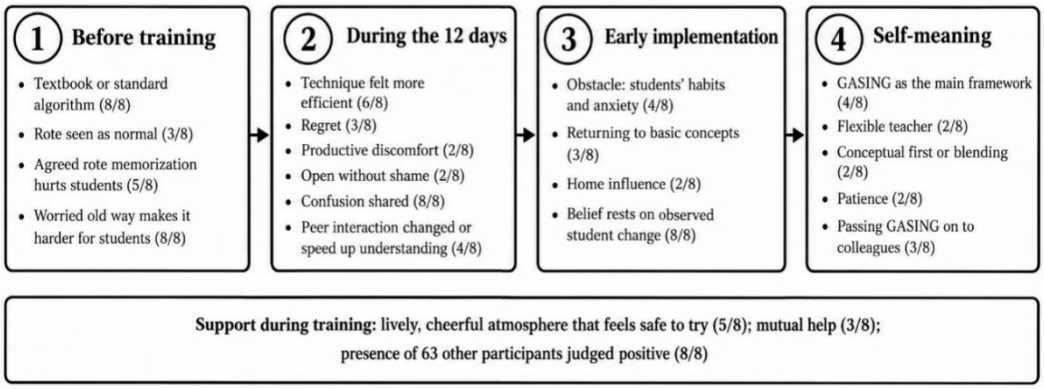


Figure 3. Thematic map of the teachers' experience pathway according to the eight participants. Figures in parentheses are the number of teachers out of 8.

Discussion

Summary of findings and how to read them

This study described the experiences of eight elementary school teachers after a 12-day GASING training. Four common threads persist across the cases. First, all teachers had previously taught with textbooks or standard algorithms, and all had worried that this approach

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ELEMENTARY: Jurnal Inovasi Pendidikan Dasar
Vol. 7, No. 1, November 2026-Januari 2027
e-ISSN : 2774-7034 | p-ISSN : 2774-8014
Online Journal System : https://jurnalp4i.com/index.php/elementary

made things harder for students. Second, all teachers realized that colleagues were also confused and viewed the togetherness of participants positively. Third, all teachers anchored their conviction in the changes they saw in students. Fourth, after the training teachers did not converge on a single identity: some made GASING their main framework, some saw themselves as flexible teachers, and some blended it with other conceptual approaches. All of the following interpretations are read with one boundary: the data are retrospective accounts of eight teachers collected after the training, without classroom observation and without measures of learning outcomes. This section therefore discusses the fit of the findings with the literature, and does not prove that the training caused change.

Training as an answer to existing concerns

The most consistent finding is that all eight teachers already had concerns about their way of teaching before or while the training took place. P3 even said the training "came at just the right time to answer that professional restlessness". In other words, the training was not experienced as something coming from an empty space. This interpretation fits the concept of the *apprenticeship of observation*, namely that teachers' practice is largely shaped by years of experience as students (Taylor et al., 2022). Four teachers traced their old beliefs to their own learning experience, and P1 said that this experience was "then unconsciously replicated when I became a teacher". Practices that originate from such experience tend not to be questioned until there is a reason to see them from the outside. In this study that reason, according to the teachers, was the gap between their way of teaching and the difficulties of students they had already seen.

Variation in initial responses enriches this picture. Five teachers immediately agreed that rote memorization makes things harder for students, while three teachers (P1, P5, P6) had initially regarded memorization as normal. This division is worth noting because views on procedural knowledge are not necessarily wrong. A review of the development of mathematical knowledge shows that conceptual and procedural knowledge strengthen each other (Rittle-Johnson, 2017). The skepticism of P1, P5, and P6 therefore need not be read as blind rejection. Importantly, all three described a change of attitude accompanied by awareness of the origin of their initial belief, not a change that was forced on them. This study cannot determine whether the change occurred because of the techniques they tried, because of the togetherness of participants, or both, and the teachers' accounts do not separate these factors.

The pattern of emotional responses also deserves consideration. No one described having their way of teaching questioned as a threat. P3 admitted experiencing "cognitive dissonance" but interpreted it as an impetus to grow, and P4 stated he or she did not feel ashamed. The literature on teacher emotions shows that teachers' emotions are related to students' emotions and achievement (Frenzel et al., 2021), so how teachers bear discomfort while learning is not merely a private matter. There are, however, reasons for caution. The interviews were conducted by a researcher who is a GASING trainer, and uniformly positive answers about emotional experience are a pattern that Bergen and Labonté (2020) describe as prone to social desirability bias. That two teachers (P2, P3) mentioned real discomfort, and one teacher (P1) admitted to being tired by the intensity of the training, slightly adds to confidence that answers were not all made uniform, but does not remove the risk.

Evidence from students as an anchor of belief

All teachers anchored their conviction in something they saw in students: a passive student who suddenly answers, a student who explains the technique to a friend, genuine joy, or test results. This pattern is in line with Guskey's (2020) assertion that experience shapes teachers' attitudes and beliefs, not the other way around. In P4's account, "that affective change

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ELEMENTARY: Jurnal Inovasi Pendidikan Dasar
Vol. 7, No. 1, November 2026-Januari 2027
e-ISSN : 2774-7034 | p-ISSN : 2774-8014
Online Journal System : https://jurnalp4i.com/index.php/elementary

was precisely the strongest evidence", and P5 judged that change to be as important as an increase in grades. It is interesting that the evidence teachers held was largely affective and behavioral (students daring to raise their hands, looking happy, no longer relying on their fingers) and not scores. Six teachers reported affective change in students, while only two teachers (P5, P6) mentioned test results.

This tendency can be linked to mathematics anxiety. Meta-analysis shows a negative relationship between mathematics anxiety and achievement (Barroso et al., 2021), and a review of six decades of research shows that this anxiety is influenced by learning experience and environment (Dowker et al., 2016), while a review of interventions points to the role of classroom processes (Ramirez et al., 2018). If so, for a teacher who sees students who "already feel defeated before the lesson starts" (P6), seeing students who were once afraid become curious can feel like more direct evidence than numbers. Two notes need to be stressed. First, teachers' reports of affective change are teachers' perceptions and were not verified by observation or measurement. Second, the highest score of 96 mentioned by P5 and P6 is a figure reported by the teachers and does not represent a training effect, because there is no comparison. With this boundary, the findings can only be said to be consistent with Guskey's assertion, not to test it.

The role of fellow participants, a sense of safety, and active learning

On RQ2, all teachers viewed the presence of other participants positively and realized that confusion was shared. This realization normalizes the learning process; P7 called it a "universal experience, not an individual weakness", and stated that every participant became braver in trying, asking, and making mistakes. This resembles the idea of psychological safety, namely the perception of the consequences of taking interpersonal risks in a group (Newman et al., 2017). This study did not measure psychological safety, so all that can be said is that teachers' accounts use language similar to the concept. Even so, when training asks teachers to question ways of teaching they have followed for a long time, an atmosphere in which mistakes are acceptable appears to be one of the conditions teachers felt.

Four teachers said that interaction among participants changed or accelerated their understanding, and P8 judged informal chats outside the official sessions to be as important as the formal material. This pattern recalls the review of teachers' everyday informal learning, which maps learning activities, antecedents, and outcomes outside formal programs (Kyndt et al., 2016). It is also in line with the collaboration element in the summary of evidence on effective PD (Darling-Hammond et al., 2017). Sims and Fletcher-Wood (2021) remind us that such lists of features need to be read critically, so this study does not show that collaboration "causes" change. What can be said is that teachers themselves place togetherness as part of their story. Two teachers (P3, P4) even answered that informal interaction did not change their views more than the official sessions, and P3 formulated it as a division of roles: the theoretical framework from official sessions and the strengthening of conviction from informal interaction. This difference is a reminder that the role of fellow participants is not uniform.

Other elements mentioned by teachers are games, concrete objects, and movement (P3, P5, P6, P8). A meta-analytic review found small positive effects of gamification on cognitive outcomes, motivation, and learning behavior (Sailer & Homner, 2020), and studies of *embodied design* view action and manipulated objects as a foundation for mathematical reasoning (Abrahamson et al., 2020). This study did not test these things. The connection is only that the elements teachers referred to are in line with the direction of that literature, and that for P5 and P6 the gamified sessions were recorded as one of the convincing events.

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ELEMENTARY: Jurnal Inovasi Pendidikan Dasar
Vol. 7, No. 1, November 2026-Januari 2027
e-ISSN : 2774-7034 | p-ISSN : 2774-8014
Online Journal System : https://jurnalp4i.com/index.php/elementary

Implementation challenges: habits, anxiety, home, and foundations

On RQ3, the main challenge mentioned most often came from students: ingrained rote habits and mathematics anxiety (four teachers). This finding is in line with the literature on mathematics anxiety mentioned above (Barroso et al., 2021; Dowker et al., 2016; Ramirez et al., 2018) and suggests that a change of method does not automatically erase affective experiences that have already formed. P7 stated that the transition requires time and patience, and P8 stated that patterns of memorization cannot be changed in a short time. Two other teachers (P1, P2) did not encounter major challenges, but P1 taught grade 6 and himself or herself expected the challenge to be more real in the lower grades, while P2 taught grade 5 like the colleagues who mentioned anxiety or rote habits. With a small sample, this difference cannot be interpreted as a grade-level effect.

The challenge mentioned by P3, the grade 1 teacher, was of another kind: two different ways of solving the same problem when parents help with homework in the conventional way. A review of parental involvement shows that its relationship with academic achievement depends on the form of involvement studied (Boonk et al., 2018). P3's account illustrates that forms of involvement at home can clash with classroom methods, and P8 also mentioned habits originating from the family. These are only two cases, but the implication is practical: training that targets only teachers may not reach the way parents accompany their children. In addition, P5 found gaps in understanding of numbers among some students, and three grade 5 teachers returned to basic concepts. This choice is in line with the view that early mathematical ideas develop along sequential trajectories (Clements & Sarama, 2021). If early foundations are not yet solid, even a neat technique will be hard to understand, and P2 also mentioned the need for continuity so that GASING is applied in the following grades.

The spectrum of teacher identity and the limits of a transformative reading

On RQ4, teachers did not converge on one identity. Four teachers (P1–P4) made GASING their main framework, two teachers (P5, P6) saw themselves as flexible teachers who use GASING as a tool, and two teachers (P7, P8) prioritized a conceptual approach or blended the two. Table 3 shows that the three teachers who were initially skeptical are spread across the first two groups. From the standpoint of the identity literature, this is natural: teachers' professional identity is dynamic and multidimensional (Hanna et al., 2019), and research on identity in mathematics education stresses that identity is built in context, not installed by a single program (Darragh, 2016; Graven & Heyd-Metzuyanim, 2019). It is interesting that P3, who made GASING the main framework, stated that GASING "is not an alternative to the old method, but a development of better pedagogical principles", while P8, who blended, stated that the two "complement each other". Their statements almost meet, even though the naming differs. The difference between groups may therefore be more a matter of how teachers name themselves than a matter of practice, but this conjecture can only be tested with classroom observation.

Transformative learning theory provides a language for reading these accounts. In transformative learning theory, a change of perspective is understood to involve disorienting dilemmas, critical reflection on assumptions, and discourse with others (see Hoggan, 2016); Taylor (2017) adds the role of emotions and not fully conscious ways of knowing. The pathway described by teachers (Figure 3) does contain these elements: the gap between ways of teaching and students' difficulties, discomfort interpreted as an opportunity, and conversations with fellow participants. This reading must nevertheless be limited. Hoggan (2016) defines transformation as a significant and not easily reversed change in the way a person experiences, understands, and interacts with the world, and Hoggan (2023) criticizes the use of the label

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ELEMENTARY: Jurnal Inovasi Pendidikan Dasar
Vol. 7, No. 1, November 2026-Januari 2027
e-ISSN : 2774-7034 | p-ISSN : 2774-8014
Online Journal System : https://jurnalp4i.com/index.php/elementary

transformative without adequate evidence (see also Hoggan & Hoggan-Kloubert, 2022). This study has only short-term accounts after the training; it cannot show a significant and lasting change. The findings are therefore stated as teachers' self-meaning, and the theory is used as a lens, not as a claim that transformation occurred. Boaler (2016) describes mathematics learning that emphasizes understanding and flexibility of thinking about numbers, and the shift in role reported by five teachers (from deliverer of procedures to facilitator, designer, or companion) is in line with that direction, but once again as an account, not as observed practice.

Relation to earlier GASING studies

Published GASING studies mostly answer questions different from those of this study. The training in South Manokwari reported an increase in teacher competence in a one-group design (Yuana et al., 2026a), the training in Bojonegoro reported increases in teacher and student achievement without a control group (Yuana et al., 2026b), and the study in West Manggarai reported an increase in numeracy with a pre-experimental design (Mayabubun et al., 2026). Two classroom action studies reported increases in student scores (Anggraini et al., 2026; Windani et al., 2023). These studies give a picture of score change, with design limitations stated by their own authors, but do not explain how teachers experienced the process. This study complements them in a limited way: teachers' accounts point to what may lie behind the scores, namely the togetherness of participants, evidence from students, and adjustments to students' anxiety and foundations. This relationship is hypothetical, not confirmatory. It should also be noted that the developer of the GASING method is among the authors of two of the studies referred to (Yuana et al., 2026a, 2026b), so readers need to weigh them with the same caution as other claims in this article.

Limitations and Research Agenda

This study has limitations that readers should consider. (1) *Single data source.* All findings come from teachers' retrospective accounts. There was no classroom observation, documents, or measurement of learning outcomes, so reports of changes in students and in the teachers themselves cannot be verified. (2) *Small, selected sample.* Eight of 64 participants were purposively chosen on the basis of willingness to give in-depth accounts, so teachers who were less enthusiastic or who did not continue implementation may not be represented. Grades 2 to 4 are not represented, and comparison by grade rests on one grade 1 teacher and two grade 6 teachers. (3) *Researcher position and social desirability bias.* The lead researcher is a certified GASING trainer. Although not involved in this training, that closeness may affect participants' answers and interpretation. (4) *Quality procedures.* Double coding by a second analyst and member checking were not carried out, so coding consistency was not quantified and the interpretation has not been confirmed by participants. (5) *Similarity of answers.* P5 and P6's answers are very similar on several questions, so the two cannot be regarded as fully independent. (6) *Teacher-reported figures.* The TKA scores mentioned by teachers were not verified. (7) *One training, one city.* The findings cannot be generalized to other trainings, other regions, or other methods.

Future research should (a) add classroom observation and learning documents to test the fit between accounts and practice; (b) follow up the same teachers several months to years after the training to assess whether self-meaning persists; (c) involve teachers who did not implement or stopped implementing the method; (d) interview students and parents, given the challenge from home; (e) use comparison designs to test claims about the role of togetherness among participants or feedback from students; and (f) use interviewers and analysts who are not affiliated with the method studied.

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ELEMENTARY: Jurnal Inovasi Pendidikan Dasar
Vol. 7, No. 1, November 2026-Januari 2027
e-ISSN : 2774-7034 | p-ISSN : 2774-8014
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CONCLUSION

According to the accounts of eight teachers, the 12-day GASING training was experienced as an answer to existing concerns about teaching based on textbooks and standard algorithms. This experience was sustained by togetherness with fellow participants, which normalized confusion and made trying a new way feel safe. Early implementation met students' rote habits and mathematics anxiety, and in one case differences in how work was done at home. Teachers' conviction rested on what they saw change in students, especially on the affective side. After the training, teachers made sense of themselves in varied ways: some made GASING their main framework, some became flexible teachers, and some blended it with other conceptual approaches. Because the data come from self-reports of eight teachers without classroom observation and without measures of learning outcomes, the findings do not prove that the training caused changes in practice or student achievement and cannot be generalized. The contribution is a systematic, traceable description and a set of testable hypotheses, namely the role of shared safety, evidence from students, and support after training, in research with more varied data and stronger designs.

With all the limits above, there are several implications that are proposals to be tested, not proven recommendations. First, the recent PD literature reminds us that mechanisms of change matter more than lists of features (Kennedy, 2016; Sims & Fletcher-Wood, 2021; Sims et al., 2023). Teachers' accounts point to three mechanisms that can be designed and studied: the direct experience of trying a technique that feels more efficient, a sense of safety with other participants, and feedback from students. Second, reviews of mathematics teacher training show that reflection is the most frequently used approach and is often treated as a catalyst (Alsina et al., 2025; Brehmer & Ryve, 2024). In this study reflection appears in teachers' stories, but the interview guide was not designed to assess the quality of reflection, so all that can be said is that two teachers mentioned routine reflection as a change within themselves. Third, coaching has been shown to improve teachers' practice in quantitative synthesis (Kraft et al., 2018), while the evidence on PD in low- and middle-income countries is mixed and the gap between evidence and practice remains wide (Evans & Popova, 2016; Popova et al., 2022). Teachers' experience in this study, that early implementation faces students' habits, differences in ways of working at home, and the need for continuity across grades, suggests that support after training deserves consideration. The three teachers who said they had passed GASING on to colleagues (P2, P5, P6) point to a path that could be studied further, but this study provides no information on whether that dissemination was effective.

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