Research Papers

Small-Group Learning in Science Perspective towards Classroom Engagement

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ABSTRACT

This paper contributes to the understanding of teacher trainees' engagement during Problem-based Small Group Learning (SGL). Six participants were selected purposively, who filled informed consent and were affirmative in giving extra time for this experiment. The process of sharing and interaction during SGL was studied through a qualitative case study. The study components included the group, roles of participants, peer-group relations, encountered situations and the practice of sessions. Participant observation, focus group discussion and field notes were the measures for data collection. The researcher facilitated the group members during SGL in various possible ways such as observed group works, checked solutions, gave hints, clarified notations, asked and answered questions, pointed out errors and helped the group to work. The result revealed that, SGL was effective to promote socially accepted behaviours as well as cognitive behaviour. Classroom engagement consisting of behavioural engagement was demonstrated through the participation and effort of learners in activities. Consequently, classroom engagement was enhanced through pedagogical method and classroom environment.

Keywords: *Constructivism, Small Group Learning, On-Task Behaviour, Classroom Engagement*

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Introduction

Learner-centred learning is a paradigm shift in the process of teaching-learning. This approach recommends various means to facilitate it. The goal is to explore a real problem such as teachers need to integrate learner's prior experience into the learning process, need to develop higher-order thinking skills among students like, problem-solving and enquiry, and keeping students engaged with various tasks to carry out collaborative learning. Hence, teaching and learning should be conducted more interactively. Probing questions should be encouraged and classroom sessions should contain more fun, creative, collaborative, and exploratory activities for students for experiential learning (National Education Policy, 2020).

Collaborative learning is accompanied by a problem-based approach, where the problem is designed as per the needs of the students. The focus is on the learner and authentic problem. Activities on problem-solving foster students' understanding, stimulate their intellectual questioning, pose arguments and state opinions. This creates a constructivist environment among any given group of learners. Therefore, the classroom learning environment should be based on the constructivist approach to help learners enrich their understanding, especially for more complex or abstract scientific content (Dhindsa et al., 2011).

A constructivist learning environment is a situation, where learners work together in a group and collaboratively support each other. This is designed to support the learners' knowledge construction process. Learners use a variety of tools and information resources in their guided problem-solving activities. They seek each others' needs and help convincingly. The learners perceive it to be more constructivists (Gijbels et al., 2006). It is done in a small group setting.

Small-Group Learning (SGL) is an active engagement of learners in which learning occurs enjoyably. SGL is defined as a way of learning in which a small group of learners get actively engaged in dialogues and collaboration on a problem-solving task.

Literature Review

Constructivism is a learner-centred theory. Its emphasis is on the process of learning to prepare the learners actively. It stresses on learners' understanding on the construction of knowledge.

It tries to answer the question; 'How do learners acquire knowledge?' Knowledge is constructed by and embedded in each learner, not something 'outside' (Sultan et al., 2011). Constructivist approaches have brought a paradigm change in science education. This view considers group learning in which all participants present their ideas strongly and remain open to the ideas of others. Learning science involves putting learners in a problematic phase where they can go beyond empirical enquiry. 'Learner-centred learning', 'learning by doing' and 'application of real-life situation into classroom learning' are the core values of problem-based science instruction. The participants get engaged in science-based enquiry activities. They are posed with hands-on and mind-on activities, and are introduced to dialogue and discussion related to their activities. The gain of varieties of learning experiences results in their scientific findings (Abd-El-Khalick and Lederman, 2000).

Problem-based learning implements the important aspects of the constructivist framework (Hmelo-Silver, 2004). Its implementation comprises of explaining how students learn science in classrooms. Learners are exposed to encounter scientific ideas in a social environment. Scientific ideas can be introduced through problem-based small group learning. SGL is a way of creating a social learning environment in which students work together to enquire about their task and are well suited to a science lesson to engage students (Shachar and Sharan, 1994). In SGL, the problem drives the learning situations that are in the learner's real-world and presented as problems. A major concern for this approach lies in posing of a complex problem, and carrying out learning activities in a free and fair environment. As learners engage themselves in an activity during PBL, they develop an understanding of the importance of the problem, comprehend the relevance of the topic and construct knowledge through their experiences. Intellectually challenging questions lead to student engagement (Zeegers and Elliot, 2019). This is an instance of deeper learning in the classroom. Hence, the learners must determine their own learning needs and issues based on the problem that they encounter. Thus, it explores students to get solution of challenging questions and its application in a real-world learning (Agarkar, 2019).

PBL plays an instructional role for small groups. Students get actively engaged in different tasks, while working together in collaboration such as problem identification, procedure(s)

description, mathematical problems solving, essay writing, drawing of diagrams, project designing and knowledge construction. Their work consists of interaction among participants that include assigning tasks, holding each individual accountable for their learning, engaging in probing questions, providing team-building activities, communication and discussing ways of group work for accomplishments (Bennett et al., 2010). They maximise their learning through sharing resources, viewpoints and helping in each other's learning. Learners interact with each other in a safe collaborative environment from which knowledge emerges. Group work demands 'mutual engagement' in a coordinated effort to solve the problem together (Webb et al., 2006). Well-managed group work allows students to develop communication skills by countering their work based on evidence, learning from others and engaging them in problem-solving (Patchen and Smithenry, 2015). Shepardson (1996) stressed that group work establishes positive interdependence, individual accountability, equal participation and good social skills.

A typical size of a 'small group' consists of Classes VI to VIII learners supported by the facilitator. Small-group learning intends to keep learners engaged through free discussion on a particular topic. However, 'group size' is less important than what the group does. The importance of small-group learning is that it must be learner-centred (Mccrorie, 2019). In small group learning, learners are divided as per their roles and responsibilities into different tasks such as planning the task, entering the data, calculating and estimating mathematics problems and reporting the finding(s). Learning is a form of collaborative problem-solving. Therefore, the type of collaboration in the small group includes resource identification, a process of relating and structuring ideas, looking for underlying principles, finding relevant evidence and critically evaluating knowledge (Loyens et al., 2013). Draskovic et al. (2004) viewed that learning mechanisms in small-group comprises of task-related interaction, knowledge elaboration and knowledge acquisition. So, the learning context and a way participants work get facilitated in the group plays an important role. Van Boxtel et al. (2000) argued that, collaborative learning has the potential to engage students in activities that are valuable in the process of understanding concepts, reasoning out scientific themes, asking and answering questions, conflicts in opinions, evaluation of explanations and negotiation of conflicts. The engagement

emphasises group and collaborative activities. The formation of a small group, their dynamics and how well they function are important considerations in SGL. This strategy enhances various kinds of skills; behavioural skills and cognitive skills, which can be assessed effectively. The functioning of SGL is represented in Figure 1.

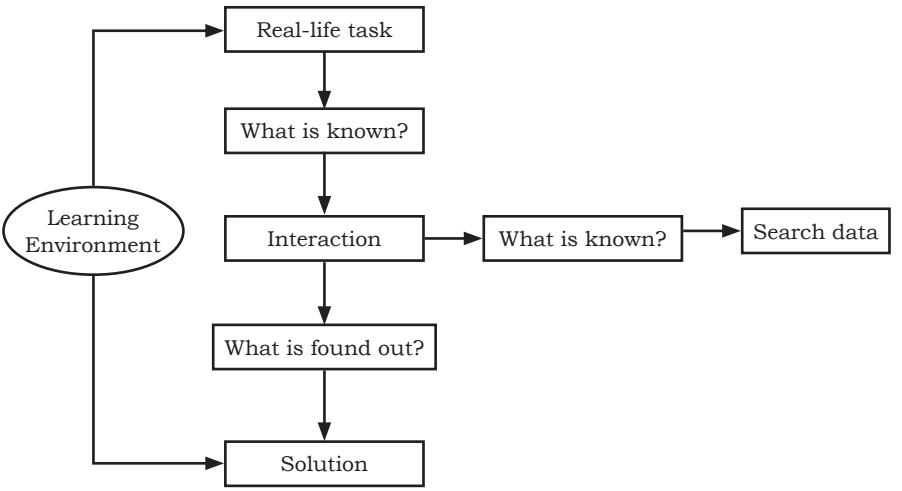


Figure 1: Work model of SGL (Author's Conceptualisation)

The above figure explains the working principles of SGL. The group work starts with an authentic task, which is designed to take real-life experiences into account. The group exploration is based on the 'given data' and 'data to be found out'. The group formulates tentative solutions by generating data and evidence. In the discussion, the dialogue continues to accept or reject the possible solutions. This form of interaction engages the learners until they reach general agreements on the solution(s).

In the group, the learning needs are diversified. As the small group becomes the focus of learning situation in a classroom then, the teacher becomes the facilitator of each small group. The facilitator determines the size of the group, working interaction type and learning task to be posed. In SGL, the group is more likely to consist of students of similar abilities. The facilitator's control of the learning process and the organisation's changes are the issues that sustain the learning process (Cunningham et al., 2011).

Small group provides benefits in learning through various ways such as development of discussion skills and thinking, exploration of attitudes, and sharing and reflecting upon experiences. The core skill of small-group learning is interaction. It comprises of questioning, active listening, responding and explaining. It is very important to ask questions and to listen effectively to whatever is told in a discussion to understand its implicit meaning. It needs mutual engagement in a coordinated manner to solve the problem. Small group learning is effective for both the cognitive and affective development of learners as it ensures knowledge, and understanding of a topic, and increases the ability to reason out and solve a problem, enhances empathy towards others, develops inter-personal skills, builds team-working skills and increases responsibility for learning.

Meaningful learning emphasises on conceptual understanding of the learners because it provides authentic tasks. National Curriculum Framework (2005) directs that teaching of science should be recasted to enable the learners to examine and analyse everyday science. Meaningful activities on everyday life tasks develop a deep understanding of the important ideas to be learned. Activities decide the promotion of thoughtful engagement on the part of the learners. The learning environment plays an important role in which each and every learner's learning experience plays a significant role (Boghossian, 2006). The learners are given opportunities to identify the learning issues as per their goals and objectives. Individual pedagogical goals design learning as engaging. The constructivist learning environment is beneficial in mediating students' knowledge and skill (Rikers and Loyens, 2011). The discussions among the students and the teachers facilitate in acquiring a deep understanding of the subject matter. An active learning environment fosters interactions with both teachers and students. Learners remain engaged in activities that enable them to find scope to think in various ways and solve problems accordingly (Meeuwisee et al., 2010).

Constructivism emphasises on social action and social interaction for the intellectual development of a learner. Active interaction through social relationships facilitates the creation of richer meaning from experience. Hence, learning should reflect the inter-dependence between teacher development and learner through a collaborative teaching approach (Kojima, 2012). A small group learning environment is made conducive to ensure the classroom engagement as well as social communication of learners.

Engagement in a learning activity creates a collaborative environment within a group. It even extends outside the formal classroom when learners are motivated enough. This is known as active engagement. The learners during small group work access open learning materials, discuss and dialogue in a collaborative way, ask questions, formulate hypotheses and resolve the issues through negotiation. Reeve and Tseng (2011) proposed that learners' involvement in assignments as a part of a group is an aspect of students' engagement. This is an example of the active engagement of students. SGL is such a platform, where learners are involved actively with different kinds of activities.

Some cognitive and affective behaviours are manifested during activities. The learners are engaged in a learning process directly. This is the behavioural engagement of students (Nguyen et al., 2018). Classroom engagement refers to students' cognitive involvement, active participation and relational attachment with the specific learning task. Students' relational attachment is perceived as a motivated behaviour. Behavioural engagement is related to learning success and motivation (Dotterer and Lowe, 2011). Engagement in the group involves cognitive as well as relational behaviours to solve the problem-based task. Cognitive behaviours refer to problem-solving exercises with the use of cognitive strategies. These strategies are coding, analysis, interpretation and generalisation. Relational behaviours are learning behaviours, whose element are students' sense of belongingness (Fredricks et al., 2004) and students' self-regulatory strategies to monitor the learning process (Chapman, 2003). The integration of both cognitive and relational behavioural patterns contributes to the success of SGL.

Rationale of the Study

In this study, the perspective of small-group learning is described as a problem-solving process. The constructivists advocate that face-to-face work on problems having multiple solutions facilitate cognitive growth. From this point of view, the platform for students to discuss, debate and present their perspectives is an important element in small group learning. Classroom engagement is based on constructivism assumptions that learning is influenced by how a group of learners participates in purposeful learning activities (Coates, 2007). Active learners contribute more to tasks and on-task behaviour, initiating interactions that are related to achievement.

They perceive greater satisfaction during interactive learning (Curran et al., 2008).

Small group learning in science helps in improving both cognitive achievement and student attitudes toward science. Students' intentions to understand and construct the meaning of the content to be learned are associated with deep learning (Gijbels et al., 2009). They adapt to the learning environment in which they find themselves significantly in a greater autonomy and more engaged. Students' perception of participating in small groups, working interaction with students of varying abilities, contribution of ideas and suggestions, cooperation with other students to finish the task tended to be more positive. So, SGL supports positive engagement. How learners undertake task management and participate in learning activities, illuminate positive classroom engagement (Martin and Liem, 2010). Social constructivism claims that learning occurs best in social groups. Learning is social with knowledge being co-constructed through interactions with peers (Wentzel et al., 2010). The affective aspects of behaviour play an important role in small group learning. Classroom engagement is predominantly affective (Wang and Holcombe, 2010). Therefore, manifestations of these behaviours of group effect cannot be ignored.

One key area of research on small group processes is the helping behaviour of students during learning. Learners work together in small groups to accomplish a common task. It encompasses motivation and sustenance in the participation of a variety of learners (Feden and Vogel, 2003). They learn best while working with peers. They become able to negotiate what they have to do, what decisions to consider and when it is to be presented in the group. A positive perception of peer tutoring was also evident by Ling-Gan and Hong (2010). Learners learn and enjoy when they are intensively involved in their activities. Learners' engagement is invested in an effort directed towards learning, understanding, and mastering knowledge and skills. So classroom engagement is self-regulating through involvement in the task at hand, persistence, participation, attention and effort in activities (Christlie et al., 2008).

Classroom engagement is usually collaborative. It depends on significant amounts of self-directed learning on the part of students but there is little knowledge about studies on engagement during SGL. Engagement can be measured through understanding student satisfaction, active learning in a group and participatory

involvement in the activities of thinking processes. SGL is not associated with only cognitive area but the relational aspects can also be associated with the learning goal. Thus, there is a need to consider the relational aspect of small-group learning in exploring classroom engagement. Studies on engagement are using quantitative tools like, survey questionnaires or rating scales (Appleton et al., 2006). Qualitative tools for the assessment of engagement can bring in-depth exploration. For this, the qualitative methodology was used to capture classroom engagement.

Purpose of the Study

The researcher positioned SGL to meet the needs of learners and to enhance their learning engagement. Learners' engagement in the group is required to share and interact with others. Hence, the process of sharing was explored through a qualitative case study with the following objective and research questions.

Objective of the Study

- To understand the engagement of teacher trainees of mathematics and science education by exploring the process of sharing, and interaction during problem-based small group learning.

Research Questions

1. How do the participants interact with others to achieve their goal of learning?
2. How do the participants engage themselves to indicate on-task behaviours?

Method

The study was focused on the process of small group learning through a qualitative case study. The study components of the SGL process included the group, roles of participants, peer-group relations, encountering situations and the practise of sessions. Therefore, the researcher tried to become part of the field and an active member of the group. The active involvement in daily activities of participants in a small group setting was participant observation. Field notes were prepared by recording the activities of events. The elements of group dynamics during exploration, open conflict and assignment of various tasks among participants were discussed through focus group discussion. SGL was an event

where the relevant behaviours could not be manipulated. Thus, a case study relied on techniques like participant observation, focus group discussion and field notes through which data were generated (Miles et al., 2014).

Participants

Six B.Ed. teacher trainees were the participants of SGL. They were from the science and mathematics method group. Their entry qualification into B.Ed. course was B.Sc. in (PCM or CBZ group). Overall, a classroom consisted of 10 teacher trainees that included 2 males and 8 females. Out of which, 1 male and 5 females were chosen as a sample of the study. Six participants who showed interest and filled informed consent, and were affirmative in giving extra time for this innovation were selected purposively. They were informed that participation was voluntary and would not influence their result in the examination.

Tools Used

The researcher used qualitative research tools to collect data. It included observation through videotapes, participant observation through recording their approaches of conversation, discussions and interactions, and exhibited behaviours of participants by using field notes, focus group activities during problem-based learning, learning log, which included the recorded viewpoints, ideas, issues relating to the problem-based learning, diagrams and sketches in their reflective diaries.

Procedure of Data Collection

Procedure of data collection was based on the following three phases:

Phase 1: Entering into the Research Context

- Finding SGL Problem Scenario: The scenario was multi-disciplinary. It was based on real-world life, which seeks multiple solutions. The researcher identified the environmental issue for the SGL problem scenario. The major concepts included in this problem were the understanding of global warming, greenhouse effect, ozone depletion, etc.
- Orientation towards SGL: Two hours of orientation on theoretical aspects of constructivist pedagogy in general and problem based small group learning in particular was

carried out through PPT presentation. Doubts were cleared through question answer session. This was followed by one hour group work in which the researcher informed about how to work with others during the activities of PBL. Clear instructions were given about the group members, timings, content of the PBL, open book resources available including internet and recording of the events. The group activity was finished in 10 days. Each day activity was of one hour duration. The reflective diary was maintained by each teacher trainee to prepare their learning journal. This journal contained different ideas and viewpoints of the trainees according to the steps of SGL activities.

- Context of SGL: The SGL was initiated by posing a problem scenario. The participants were given the guidelines of small group operation. The members were introduced to the new material orally to the entire class, and through worksheets and text materials. The facilitator interacted with group members in various possible ways, observed group works, checked solutions, gave hints, clarified notations, asked and answered questions, pointed out errors, provided encouragement, helped the group to work and overall classroom management. The conflict was resolved by putting ideas together.

Activities of SGL

The activity of the PBL was organised as per the following steps:

1. Loud reading of the problem scenario.
2. Exploration of the problem—discussion on the problem statement was initiated. The participants were deriving the meaning(s) of keywords seen in the statements. Each concept and its meaning(s) were declared.
3. Listing out the known data—the given data were located.
4. Listing out the unknown data—'What was known' to them and 'What was needed to know' to them were traced out.
5. Listing out the hypotheses—they derived possible solutions. These were listed out serially as per the strength and weakness points of consideration.
6. Plan of Action—A list of actions to search different types of resources and reaching solution(s) were derived. The learning journal was maintained to record the accomplishments and progress of learning.

7. Write-up Solutions—the solutions were encountered and reviewed by participants to reach the concrete idea(s) of the solution.

Phase 2: Focused Exploration

- Participant Observation Using Video Tape: The researcher meticulously documented all the facts and relevant details during the events. The approach of discussion demonstrating cognitive and social behaviours was recorded.
- Focus Group: The activities of a small group during problem-based learning were recorded. The researcher followed the issues raised during the discussion of each event.
- Field Notes: The main way of recording data was through field notes. It was prepared immediately, during and just after the completion of an event. Information including time duration of each activity, the learning resources searched from the internet, materials used by the teacher trainees during PBL were the part of contents of the field note. The sharing of resources, ideas, openings, cooperation among participants, confusions and negotiations related to particular aspects of questioning and answering were written in the field note.
- Transcription of recorded content in Video Tapes: The video recorded verbal and non-verbal activities, and behaviours were transcribed.
- Learning Log: Relevant diagrams and certain ideas, which stormed into participants' minds during PBL were recorded. These were learning logs, which were then analysed.
- Iterative analysis: A preliminary analysis was commenced as soon as the activities of PBL progressed. The data collection and analysis were also carried out simultaneously.

Phase 3: Result Dissemination

The data was organised systematically to reduce the scrambled words. Themes were determined and the result was obtained.

Procedure of Data Analysis

Large amount of descriptive data were managed through analysis. The analysis was made in the following ways:

1. Preliminary Analysis: The information which was found in a field note, reflective diary of the trainees, observation and

video recordings were part of qualitative data. The analysis explored the qualitative data. These were processed in response to the research questions of the study.

2. Transcript: Video recorded data were transcribed. The verbal and non-verbal behaviours shown by the teacher trainees during each step of PBL were sequentially formatted. This was a data reduction activity of qualitative analysis.
3. Identification of Meaningful Themes: The researcher searched out the themes to locate the cognitive and social kinds of behaviour. The descriptions of verbal as well as non-verbal interactions were categorised into themes. The repetitions of occurrences of behaviours demonstrated during activities of PBL were searched out. The meaningful behavioural patterns were examined to develop the themes of behavioural engagement. These were listed out to illustrate the meaning of the behavioural engagement of teacher trainees during solution of problem scenarios. A careful, detailed and systematic examination of patterns was done to construct the meaning of engagement.

Case Analysis

TT1 (First Teacher Trainee) read out the written series of points. She narrated the list of 'known data' of the problem scenario. She showed the following sequence of given data located in the problem scenario:

1. Civilisation is growing up in the world.
2. Thermostat—a constant temperature
3. Causes of new carbon numbers are:
   (a) our modern cities
   (b) consumption of crops that are made up of pesticides
   (c) air and water used
   (d) passage of season
   (e) a global average temperature of about 57°F
   (f) psychological calendar according to three seasons

The detailed points under 'known data' were agreed upon by other trainees.

TT2 approved the list of data on 'What is given?' Other teacher trainees read out the statements repetitively and approved her list. She, then, found another step in problem-solving, that is, informed

the group to find the list of 'Need to Know'.

TT3 found certain issues during learning and made a list of learning issues. All were easy, comfortable, looked towards each other, smiled and opened a reflective diary for recording their information.

TT4 and TT3 both were helping TT1 about what was to be recorded under the column 'Need to Know'.

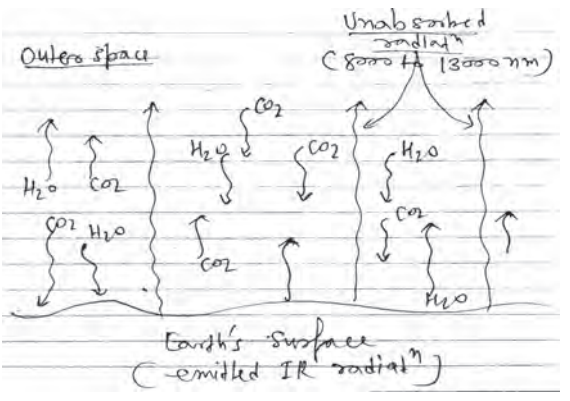
During those times, TT5 and TT1 were silent and grave. They were engaged in writing those things on their diaries.

TT2 pleaded two points for 'Need to Know'.

1. Accumulation of water (H_2O) droplets
2. Formation of glaciers

TT6 was excited to make clear meaning of the greenhouse effect through a diagram. He produced a picture by making arrow marks and straight lines (Learning Log 1).

The figure was appreciated with open clapping by all teacher trainees.



Learning log 1: Figure of the greenhouse effect

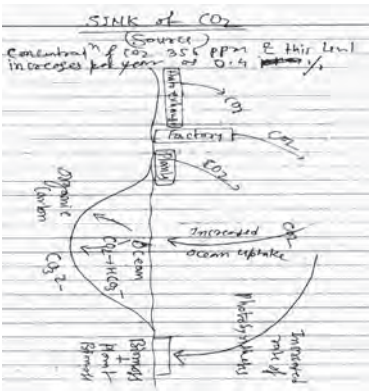
TT6 again tried to clarify the effect of an increase in CO_2 in the atmosphere. TT2 and TT3 were exchanging their viewpoints with TT6. TT5 was open to talk with TT6. She reasoned out the cause and effect of CO_2. She received the answers to the effect of CO_2 from TT6. She had firm eye movement at TT6. Her palms of both hands were open during her argument to claim the cause of CO_2 towards situations of the atmosphere. She was nodding her head, while collecting the responses from TT6 and other teacher trainees. The teacher trainees were silent during their conversation. They accepted their points. They recognised the key points from their discourse. While the discussion of the greenhouse effect was going on, a significant point was raised by TT6, i.e., sinking of carbon dioxide. He presented the idea through a figure (Learning Log 2).

TT3 clapped, being happy with this figure.

TT4 marked the figure as correct.

TT1 and TT5 understood the central idea of the figure. All were looking to this figure.

TT3 recognised the concept of the figure as a new one. TT4 had eye contact with TT6, while TT3 was saying.



Learning log 2: Figure of a sink of carbon dioxide

Observation

The teacher trainees in the group had a particular task during learning. The task was distributed as per the steps of the SGL process. The steps were identified as 'Known Data', 'Need to Know', 'Learning Issues', 'Possible Solutions', etc., when one was preparing 'Known Data', other two listed out 'Needs to Know' and another trainee collected the issues to make ready a list of 'Learning Issue'. This implied a clear distribution of work in the group. Thus, a ' division of work' principle was adopted, which proved the group was formed as a 'community'. Also, participation was spontaneous among teacher trainees during the discussion, dialogue and conversation on related issues and drawing of figures. They took responsibility for their distributed work and shared their views. They also worked in pairs. They worked together during the conversation and drawing of figures. So, it is concluded that sharing, cooperation and collaboration were the social behaviours that developed during the group work.

Further, one trainee led the group to learn a new concept. It developed trust in others. This demonstrated the confidence of the trainee. Thus, learning results in autonomy in doing satisfaction and overall enjoyment to them. Pleasure and gratitude were other distinct components of social behaviours found in the group.

The teacher trainees were engaged in finding the carbon's mathematics number in a group. They were keen in calculating mathematics numbers. They desired to see the logic of this calculation. So, it is understood that teacher trainees were deeply thinking. It inferred their development of socially accepted behaviours like eagerness, interest, stimulation of action, excitement and empathy.

Results and Discussion

The study was carried out on knowledge sharing, interactions and building of on-task behaviours. The teacher trainees worked on a science-related case problem. They first activated their prior knowledge and afterwards discussed it with the material collaboratively. This contributed to the use of active and collaborative learning techniques, provided experiences that emphasised on thinking and problem-solving activities in the group. These were the academic challenges faced by the learners. This improved learners' classroom engagement (Umbach and Wawrzynski, 2005).

The results showed that during SGL process, the teacher trainees demonstrated cognitive behaviours. They worked collaboratively to clarify ideas and used appropriate language. Discussions with other trainees enabled them to get involved in explaining concepts. This facilitated them to work together cooperatively to accomplish shared learning goals. This helped to remove misconceptions and allowed clarification of ideas by learning from each other (Aldridge et al., 2012). This was a collaborative engagement style (Coates, 2007).

They learned how to socialise. The study revealed that a high level of interactive quality significantly affects learner's social presence as well as learner satisfaction (Oyarzun et al., 2018). The group members assisted each other through explanations and certain types of helping responses. At times, in a group, teacher trainees rendered more help to each other such as providing directions with prompts like 'that is right', 'okay', 'see the level of the picture', etc. They were approaching behaviours with others. They were proven to solicit behaviour as a part of their socially-oriented behaviours. Verbal as well as non-verbal communicative behaviours were seen among teacher trainees. The group was involved in activities that were new and more innovative. When teacher trainees were involved in SGL activities then, social and communicative values of each member were developed. Teacher trainees were more comfortable in oral communication within the group. It was such involvement in the task that encouraged teacher trainees to ask questions, provide explanations, clarify the points and participate in discussions. Group learning strategy prompted them to interact with one another and encouraged them to articulate their perspectives. Trainees were actively involved and vested in engagement (Howe, 2010). Through this engagement, teacher trainees learned to plan ways to proceed

with their work and communicated their new ideas to their mates. In effect, as Vygotsky (1986) observed that they used language as a medium to relate to each other, to facilitate others to learn, to scaffold each other's learning. So, it became their own and it developed ownership of their learning. This corresponds with a more constructivist, learner-centred approach to classroom engagement (Adams, 2006).

SGL was effective in engaging in the learning activity. The teacher trainees solved problems through sharing knowledge in collaboration. Shared experiences and feelings related to learning were helpful for almost all of the participants. Positive interactions and regulations in social interaction were meaningful for their collaborative learning process (Isohatala et al., 2019). These features enabled them to consider their artefacts from different points of view resulting in optimisation of their design of activities (Cakiroglu et al., 2017). Group engagement was ensured according to the improved performance of each member within a group. All members were capable of presenting. According to Dumont et al. (2010), teacher trainees are central to the learning process. Thus, learning requires that teachers should encourage students' active engagement. The facilitator provides autonomy, support, positive feedback, attention and more empathy for their students in a learner-centred classroom engagement (Adams, 2006). It can also be inferred from the study that the success of SGL was accountable for three components: task, group and sharing. It can be justified as:

1. the task was based on real-life problem scenario.
2. the teacher trainees worked on the task in a small group.
3. the group conversed as a whole for a time of sharing.

It was understood that posing a problem-solving task in a small group was the first component of student engagement. In 'understanding by design', it was emphasised that meaningful activities developed a deep understanding of the important ideas to be learned and promoted thoughtful engagement on the part of the group of learners. This engagement occured during problem-solving activities concerning common problem-solving goals. It was viewed as sharing an understanding of the task (Sears and Reagain, 2013). Thus, classroom engagement was established on the identification of two domains of behaviour; socially accepted behaviours such as pleasure and gratitude like eagerness, interest and stimulation of

action, excitement, empathy, confidence, satisfaction, cooperation, and collaboration as well as cognitive behaviours like sharing for solving the problem. Classroom engagement consisting of behavioural engagement was demonstrated through participation and effort of learners in activities. Learning was enjoyable and satisfactory for them. This confirmed that positive classroom engagement increased student satisfaction (Carini et al., 2006).

Small group learning was seen effective on the ground that the problem was solved with multiple solutions. The learners gained different learning experiences creating an environment. Thus, SGL was proved as a dominant pedagogical strategy to attribute classroom engagement. According to Haug et al. (2019), classroom engagement is enhanced due to pedagogical methods and classroom environment. Learning sustained engagement in small group learning. Hence, classroom engagement is a process but not an outcome of small group learning.

Implication of the Study

The study has following implications for mathematics and science teacher education.

1. Pre-service teachers should be encouraged to practise small group learning for the active engagement of learners.
2. Teacher education programmes should provide a problem-based learning context in which pre-service teachers can practice constructivist teaching strategies in real classrooms.
3. Teacher education programmes should emphasise on the affective aspect of behaviours along with cognitive behaviours of learners for classroom engagement.
4. Heterogeneous grouping is needed to extensively investigate the effectiveness of small group learning.

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