The Influence of Collaboration on Students' Learning Approaches in a Geography Task

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Abstract

Learning approaches are the ways students tackle and address the learning tasks, which are categorized by deep and surface components. The aim of this study is to illuminate the impact of collaboration on students' learning approaches while executing a geographic task. Students' learning approaches were compared between students working individually and those working in small groups via discourse analysis. The findings show that working in small groups is effective when utilizing the deep learning approach. Collaboration supports small groups becoming more active while executing tasks and selecting learning strategies and developing positive attitudes toward the task.

Keywords: collaborative learning; learning approach; deep learning; surface learning

Introduction

Collaborative learning has been emphasized in K-12 education, higher education, and workplaces as one of the major 21st century skills. In response, the Assessment and Teaching of the 21st Century Skills (ATC21S) involved collaboration and communication as imperative learning skills to succeed in a career (Binkley *et al.*, 2012). In 2015, the Organization for Economic Co-operation and Development (OECD) also emphasized the importance of collaborative learning by publishing a draft of the Programme for International Student Assessment (PISA) on collaborative problem-solving (OECD, 2017).

Along with the national and international attention, collaborative learning in geography classes is often explained and utilized in conjunction with active learning which stresses students working in groups for student-centered learning (Dochy *et al.*, 2003). Collaborative learning environments support students actively leading the geography projects with a higher responsibility, obtaining a deeper understanding of the topic, and applying their geographical knowledge to real-world issues within project- and problem-based learning or participatory action research (Genc, 2015; Harmer & Stokes, 2016; Kim, 2018; Wall & Halvorson, 2011). Lee (2020) also indicated that working in groups in inquiry-based fieldwork elicits students to actively exchange their ideas and be more adventurous and responsible on complicated tasks in the field. Students stated that collaboration in a small group is fundamental to successfully complete the tasks. Collaborative learning has been widely suggested as an instructional strategy in geography for supporting student-led learning (e.g., Golightly, 2020; Kirschner & Peltan, 2019). However, the effects of collaborative learning in geography classes have been described as one of advantageous learning outcomes of active learning, rather than examined how collaborative environments support students addressing the tasks. Research has yet to mainly focus on the influence of collaborative learning in problem solving process and dynamics of small groups within a specific learning context, and the distinctions between individuals and small groups while working on geography tasks.

Solely using learning outcomes of collaborative learning to understand how students approach the tasks and build their knowledge during the activities presents an obvious limit. As such, in the specific context of geography classes, student learning should be explored with interactive problem solving. Wiegand (2002), for example, used discourse analysis to examine children's learning approaches to cognitive map-making in collaborative cartographic problems. The findings revealed that higher order maps with older students (ages 13-14 compared to 11-12) encouraged reasoning and questioning strategies to solve the tasks, and group discussions supported a solving process by elaborating ideas. Beyond this, students' collaborative learning experience in geography classes can also be investigated regarding the students' attitudes and perceptions. According to Tan, Sharan, and Lee (2005), students in group investigation activity demonstrated positive attitudes toward collaborative learning with deeper understanding and higher engagement on the tasks. However, one-third of students stated concerns regarding troubles with team members. By concentrating on students' learning process and approaches, such in the above two studies, more in-depth consideration can be given to geographical teaching-learning processes leveraging the strengths of collaborative learning.

The primary purpose of this study is to examine the influence of collaboration on the learning approaches of students while participating in a geography task. To investigate how students cope with the tasks, the concept of

learning approach–deep and surface–is employed (Biggs, 1989; Entwistle, 1998). In this study, the learning approach represents how students tackle and approach the learning tasks, which is explained by integrative features from cognitive, affective, and strategic components during the problem-solving process (Entwistle & Smith 2002). In tandem with the learning approaches, the research questions are: (1) What are the influences of collaborative learning on students' learning approaches; and (2) Do the influences differ across the learning approaches of individuals and small groups.

This study explores students' approaches to learning with 9th grade students who conducted a geography task which requires them to find where their school is losing heat with a thermal imaging camera and to suggest possible solutions to the heat loss problem. This study compares the features of learning approaches between individuals and small groups by analyzing their discourses with the learning approaches in cognitive comprehension and affective perception concerning the tasks, as well as the strategic practices that students have adopted in a geography task.

First, we outline the concept and influence of collaborative learning on learning approaches with preceding research. Then, we introduce the participants and the geography tasks, and methods of data collection and analysis. The findings are presented following the research questions. To conclude, we discuss the implications and insights on what we need to consider facilitating student learning with collaborative learning.

Literature review

Collaborative learning

Learning by working in groups, such as collaborative and cooperative learning, has been widely researched with strong evidence that enhancing students' knowledge, social skills, and motivations for learning (Johnson & Johnson, 2009; Sawyer & Obeid, 2017). Collaborative and cooperative learning have rooted in social constructivism and shared similar educational goals, but those have discernible features. Collaborative learning aims students to build knowledge together through open-ended problems and achieve common goals by self-management and flexible roles among group members (Davidson & Major, 2014). In contrast, cooperative learning emphasizes students systemically work together to achieve common goals in a mutually helpful manner within assigned group roles and intentional grouping (Johnson & Johnson, 2009). Collaborative learning has been studied across a wide range of learning contexts in two lines of research. One line of research focused on learning outcomes of collaborative learning on cognitive and affective benefits. In cognitive outcomes, collaborative learning has been shown to promote higher achievement on tasks and reinforce cognitive development due to positive peer interactions (Albay, 2019; Roseth, Johnson, & Johnson, 2008). Students working in groups can improve higher order thinking

skills (Dolmans & Schmidt, 2006), critical thinking (Mosley, Ardito, & Scollins, 2016), and pose thought provoking questions (King & Rosenshine, 1993). As the research revealed, socio-cognitive interactions in a group elicit cognitive development, which leads to higher learning performance by coordinating multiple student perspectives (Albay, 2019; King & Rosenshine, 1993; Schwartz, 1995) and shares the cognitive load of complicated tasks (Kirschner, Paas, & Kirschner, 2009). Collaboration also enhances motivation, confidence, and interest on learning (Baker, Miller, & Timmer, 2018; Mosley, Ardito, & Scollins, 2016; Savery, 2015). Students can reduce fear and anxiety on difficult tasks and become more engaged and adventurous with team members (Albay, 2019; Lee, 2020). Wismath and Orr (2015) insisted that collaborative environments build a safe atmosphere for students to consult with others and take risks.

The other line of research pinpointed how to optimize the effectiveness of collaborative learning (Sears & Reagin, 2013). The strategies and factors contributing to the effectiveness have been investigated on external scaffolds and interventions which encourage collaborative activities or focused on internal collaboration among group members without external supports. Research indicated that external interventions such as ill-defined and complex tasks (Sears & Reagin, 2013; Wismath & Orr, 2015), purposeful team-forming (McGlynn & Kozlowski, 2016), or structured scripts (King & Rosenshine, 1993) increase the effects of collaboration. In contrast, some studies have identified factors reinforcing the benefits of collaboration without external structures and instead, emphasizing interplay and interdependence inside of small groups. Barron (2000), for example, studied the characteristics of between-participant interaction by comparing two triads' conversation during mathematic tasks. The group which has three active members performed better than the other group having one main speaker, because the first group had a high level of mutual interaction, consistent attention, and efforts on problem-solving. In a similar vein, Ikpeze (2007) elucidated group dynamics that influence students' learning approaches by qualitative content analysis. The study ascertained that if the group members provide feedback directly and actively to each other, the quantity and quality of the discussions are further increased, and this process leads to in-depth understanding.

This line of research can also examine the development and patterns of collaboration. According to Wismath and Orr (2015), students were likely to work alone at the beginning but when they faced difficulties, form groups to consult and reflect upon different ideas, which links to better performance. Likewise, the necessity of research revealing the variability of collaborative outcomes by group dynamics and the diverse problem-solving approaches has been increased to move beyond static examination on the learning outcomes of collaborative learning (Barron, 2000; Chang *et al.*, 2017; Wismath & Orr, 2015).

Influence of collaborative learning on students' learning approach

Students' approach to learning involves students' motivation toward learning and the students' use of appropriate learning strategies (Zhang & Stenberg, 2000). The concept of the learning approach originated in the 1970s by Marton and colleagues with their answer to "Why some students learn better than others" (Marton & Booth, 1997). They identified student qualitative differences in understanding and problem solving, with two major distinctions - deep and surface approaches to learning - which implies how they interpret the learning contexts and how students perceived the tasks (Entwistle & Smith, 2002). The deep and surface learning approaches include the cognitive and affective aspects of comprehension and perception regarding the tasks, and the strategic aspect of the learner's practices for accomplishing the tasks (Biggs, 1989, Table 1). Learning approaches largely depend on the personally preferred learning method, but this can be altered by the interactions between the learner, the tasks and learning environments (Mäkitalo *et al.*, 2005).

Table 1. Characteristics of students' learning approaches (reconstructed Entwistle, McCune, & Walker, 2001; Marton & Säljö, 1976)

	Deep learning approach	Surface learning approach
Cognitive	• Connecting prior knowledge, experience, and new ideas • Finding hidden patterns and principles • Checking evidence to support claims • Critically examining logic and arguments • Recognizing that understanding is developing in the process	• Memorizing facts and solve problems through repetitive processes • Fragmentation of some unrelated knowledge • Seldomly finding the value or meaning of the task • Working on the task without reflecting objectives or strategies
Affective	• Actively interested in the content and process • Intrinsic motivation	• Focusing on difficulties in realizing new ideas • Feeling excessive pressure and anxiety about the failure • Extrinsic motivation
Strategic	• Managing time and effort efficiently • Finding appropriate conditions and materials for learning • Considering evaluation criteria and requirements to reflect learning • Self-regulation and metacognition on learning	• Focusing on evaluation criteria and requirements to complete the tasks • Repeat few points of task by doing little work • Seeking extrinsic helps for the tasks

The deep learning approach highly encourages learner's engagement and in-depth understanding in their learning process. Learning environments, such as collaborative learning and problem-based learning, which facilitate group discussions on problems related to the real world or ill-structured tasks (Schatteman *et al.*, 1997; Wilson & Fowler, 2005), are known to promote a deep learning approach. Additionally, in a deep learning approach, various types of thinking can facilitate and improve students' understanding of new ideas and help teachers to understand students' learning approaches. Meanwhile, surface learning approach often occurs when the learner seeks to reduce the experience of failure, meaning the motivation for learning arises extrinsically (Laird *et al.*,

2014). The surface learning approach may be appropriate for a basic or a limited range of tasks, as well as for tasks that can be executed by memorization with repetitive learning (Biggs, 1989). Deep learning approach could be actively associated with constructivist and learner-focused environments, like problem-based learning or collaborative learning, which encourage cognitive processes to transform and build own knowledge, whilst surface learning approach is relevant to teacher-led instruction that transferring information from teachers to students (Çolak, 2015; Desierto *et al.*, 2018). However, deep and surface learning approaches are also often utilized together in the learning process. When these two approaches are combined, students can accomplish a deeper level of understanding and achievement at the end (Entwistle, McCunne, & Walker, 2001).

Learning approach has been widely used to substantiate the statistical associations between students learning strategies, learning environment (e.g., PBL), and learning outcomes (Loyens, Rikers, & Schmidt, 2008; Prosser, 2004). However, little research focused students' learning process in the relations of students' learning approaches and collaborative learning. Schatteman *et al.* (1997) studied the effects of interactive working groups on students' learning style characteristics. Students working in groups actively adapted deep learning approaches with self-regulated strategies along with higher personal interests. While students who did not work in interactive groups utilized externally regulated strategies such as asking the advice of their teacher. Moreover, Wilson and Fowler (2005) indicated the differences of collaborative performance by students. The group projects induce higher deep learning approaches of motivation and strategy for students who preferred surface learning approaches in pre-test, but students who originally favored deep learning approaches did not show any meaningful changes. The studies substantiated the associations between students' learning approaches, collaborative learning, and learning performance in cognitive, affective, and strategic components. However, they pointed out the limitation which lacks examination about the variability produced by students and task-specific contexts, and the difference between students working in groups and individually (Schatteman *et al.*, 1997; Prosser, 2004; Willson & Fowler, 2005). Vermunt and Donche (2017) also insisted that further empirical research investigating the variability is needed to improve our understanding on the relations of collaborative learning and students' learning approaches moving forward.

Research design

Sample

Ten 9th graders from a Korean middle school participated in this study. The participants possessed previous experience with collaborative learning and student-led projects with the teacher in the social studies class. The division between individuals and small groups was made voluntarily by students in a class.

Students who disagreed with participating in this study during or after the class were excluded from data analysis, which resulted in data being used from only two individual students out of six individuals. To correspond with the two individuals, two small groups (four students per group) were selected following teacher recommendations and researchers' field notes.

Task and procedure

A geography task, *Heat Busters!,* was developed that suggests a mission to identify places where heat loss occurs in our daily lives and to suggest solutions by choosing places where actual improvement is needed. The project was designed to encourage collaborative problem-solving by adopting portable and easy-to-use technology, portable thermal imaging cameras and smart mobile devices (iPad, smart phone, etc.).

The geography task was administered over six class periods (45 minutes for each period) in a social studies class. The class began by posing societal and environmental issues of heat loss and energy saving. The project expanded with "How can we investigate heat loss?." Students learned scientific concepts and principles of heat transfer through experiments and studied thermal remote sensing using real-world examples such as satellite imagery of urban growth. Next, students planned their field investigation in search of the answer to "Where is the heat losing out in our everyday living space?". While exploring in and outside of the school, students utilized a portable thermal-imaging camera attached to a smartphone and in their search for heat leaks. Based on the collected data, students suggested effective heat loss and energy-saving solutions. The data that were obtained by the students throughout the phases were integrated and utilized to produce a final product "Improvement proposal on heat loss of our school."

Data collection

To determine the influence of collaborative learning on students' learning approaches during the problem-solving process, the data of video recordings and interviews were collected from two individuals and two small groups. First, video recordings of students were taken to examine the relationship between the collaborative learning and the characteristics of learning approaches during the activities. Portable mini cameras attached to the student's chest captured the students' conversations and actions during the data collecting activity, which took approximately 30-40 minutes. The students were trained in a think-aloud protocol with the teacher for a week before the first class began. The video data were transcribed for coding.

Second, interviews of the individuals and small groups were administered to better understand the discourses from video recordings and to identify challenges faced in working as a group or individually, along with ways that students overcome such difficulties. For instance, did you collect the data

aligning with your original plan? If not, how did you solve the situation? Did you have any unexpected issues while collecting data in the field? How did you cope with the problems with your group members? The interview was conducted with each of the two individuals and two small groups approximately 30-40 minutes after the last class.

Data analysis

The transcripts of video recordings from students' discourse were classified and analyzed with two individuals and two small groups. The students' discourse was analyzed using the semantic method. The analysis of semantic units conceives the meaning of a discourse as a unit and analyzes the same meaning as one combined unit in consecutive sentences or discourses. The unit of analysis may include not only verbal discourse but also nonverbal behavior (Van Dijk, 1985). In this study, each unit was segmented when students had a conversation on one subject. When moving to a different kind of topic in the consecutive dialogue, this was divided as a separate unit.

The data were analyzed by thematic analysis (Braun & Clarke, 2006). The preliminary coding scheme was based on Entwistle, McCune, and Walker (2001; Table 1) with the characteristics of the deep and surface learning approaches specified into cognitive, affective, and strategic aspects. Subsequently, each discourse was counted, and the frequency of each learning approach among the individuals and small groups was compared to examine the influence of collaboration on students' learning approaches. Additionally, the discourses were further analyzed to delve into the main features of learning approach in individuals and small groups. The analysis process was primarily conducted by one researcher, the main author, and then triangulated and discussed with the other researchers.

Findings

Comparing learning approaches of individuals and small groups enables to address the first research question: *What are the influences of collaborative learning on students' learning approaches?* The frequency of student discourses on deep and surface learning approaches indicated when students work as a group, they employed more deep learning approach rather than surface approaches. The detailed results are presented in Table 2.

Table 2. Learning approach of individual and small group (%)

		Individual		Small group	
		A	B	C	D
Deep	Cognitive	-	-	25	50
	Affective	-	-	12.5	10
	Strategic	12.5	-	37.5	20
Surface	Cognitive	50	54	12.5	10
	Affective	12.5	10	-	-
	Strategic	25	36	12.5	10

Individuals A and B primarily used the surface learning approach in cognitive (50% and 54%, respectively), affective (12.5% and 10%, respectively), and strategic (25% and 36%, respectively) aspects. Neither individual A nor B exhibited cognitive and affective components of deep learning approach while addressing the task. However, small groups C and D mainly utilized deep learning approach on all three aspects, compared to individuals. Small groups also exhibited a different usage of learning approaches. In small group C, they devoted to deep learning approach in cognitive and strategic aspects rated at 25% and 37.5% respectively. Meanwhile, small group D attempted to cope with tasks primarily using the cognitive approach of deep learning (50%). Small group D tended to use more deep learning approaches cognitively than small group C.

Students' learning approaches of individuals and small groups also showed different characteristics in cognitive, affective, and strategic aspects while solving the geography tasks (Table 3), which addresses the second research question: *Do the influences differ across the learning approaches of individuals and small groups?* The learning approach features of individuals were aligned with the surface learning approach, and small groups matched with the deep learning approach.

Table 3. Main characteristics of learning approaches while participating *Heat Busters!*

	Individuals	Small groups
Cognitive	• Focusing on the surface of problems without considering reasons or principles • Collecting data through simple and repetitive processes • Seldomly finding connections between prior knowledge and collected data • Working on the task without reflecting objectives or strategies	• Building explanation and interpretations • Closely observing and describing the phenomenon • Considering different viewpoints • Making connections • Wondering and actively asking questions
Affective	• Having pressures on devising new ideas • Feeling anxiety about the failure • Feeling undue uncertainty on their data	• Positively overcome the unexpected difficulties • Being proactive to explore new ideas • Enjoying group discussions
Strategic	• Asking helps to the teacher to determine the adequacy of collected data or to find new ideas • Rigid time control to complete task quickly • Keeping original plan during field investigation • Exploring a small range of investigation area	• Regulating the tasks by communicating with team members • Reflecting team members' ideas whether the ideas are aligned with their intention • Checking the effective route during field investigation • Manipulating technology devices consistently to collect clear and intended data • Exploring a wide range of investigation area

While students were confronted with ambiguities or unexpected situations in the geography tasks, cognitive problem-solving of individuals was driven by the surface learning approach. Both individuals were often observed to check the simple color difference of thermal images and repetitively take multiple pictures. However, they quickly moved to the next objects they had planned without judgement whether the pictures aligned with the purpose of the task or not. This characteristic was also demonstrated in an excerpt by individual B:

> Why do we have so few (heat loss places) in our school?
> It is not this either.
> This is... just an equipment...not this.
> Not here either. The time is almost over.
> I do not know what I have done is right.

Meanwhile, small groups largely utilized the deep learning approach in a similar situation that required determining the appropriateness of data. Small group C, for instance, employed 'considering different viewpoints and perspectives' to discuss alternatives when heat loss did not occur on their planned site. In the case of small group D, the students used 'closely observing and describing' to determine whether the data were clear enough to support their claims. They also discussed the appropriateness of a picture when the thermal image appeared different from their expectation and recollected data that better met the task criteria.

> A: Is that your hair silhouette? Then take a picture at different angles.
> B: Oh, you are right. My head is reflected on the wall.
> A: How about like this? It is better.
> D: Should I take a normal picture as well?
> A: Yes, please take a normal picture, and I will take a thermal image. We can compare them.

When individual students faced new observations in the field, individual A and B commonly tried to stick to their original plan. For example, individual A found a new observation that heat loss occurred at the edges of walls in the hallway, but after looking around a bit, he moved straight to another place, following his plan. After the class, individual A pointed out the limitation of working alone:

> I want to be in a group next time. I was just stuck in my frame, so my thoughts were also constricted in that frame. I may have conflicts with team members, but I think it would be nice to share diverse ideas.

Small group D, however, employed 'building an explanation and interpretations' for their new observations in the field. They found that heat loss

occurs in the elevator passage while observing the outside of the school building. In addition to the original plan, the students added the idea of comparing thermal images of an elevator from inside and outside of the school.

A: Isn't that an elevator? Hey, let's go.
B: Oh iron! Iron! Because there is so much iron!
C: Oh, does iron become hot because of sunlight?
B: Is that so?
A: Oh, you found an awesome thing! Great job!
C: Thanks!

In regard to affective aspect, the difference in attitudes between the small groups and individuals became particularly evident when students encountered unexpected situations. Individual students exhibited undue anxiety and hesitation on unanticipated or uncertain situations. Even though individuals A and B possessed clear plans, they were confused as to what to investigate and what to collect in the field. The teacher thus kept reminding them about the purpose of the task and suggested some new ideas during the activity. The following comprises an example of a conversation between individual B and the teacher:

(Returning to the classroom too early)
Teacher: What did you take?
B: The classroom doors, windows, and computer.
Teacher: What was your intention in taking picture of the computer? Do you think it is real heat loss? Do you want to go one more time? We still have plenty of time. I think you just took a picture of the temperature difference. How about finding where the heat is being lost that needs improvements, not the temperature difference.
B: Oh...yes. Quick, quick.

Students in small groups showed a more active and positive attitude toward the task. Small group C sought permission to take a picture of the PE teacher's room. The teacher refused, so they unexpectedly failed to collect the planned data. To find a different heat loss place, small group C re-engaged to exchange new ideas and assess the appropriateness of them. In the interview, Student K of the small group explained reasons why they could overcome the difficulties of elusive or unexpected situations in the field:

Head-to-head, I think we can handle a lot more than when I am working alone. We have four heads and eight eyes, and our interest is also various. We can find four different cases and places where we want to collect data. Also, we can think about a case with diverse perspectives.

In the problem-solving strategies, students who worked as individuals commonly focused on strict time control and consistency with their plan. Individual A and B kept checking time and tried to complete their plan on time. The post-interview of individual B showed his strategy while performing the task.

> I think it would be better to be alone. If there are others, it might have a conflict when we are gathering opinions. I was alone, so there was no conflict. Also, I could take a picture of what I want freely, and I can find it faster and quicker.

Individuals also exhibited their strategies for determining the scope of their movement and route. Individual A and B planned and collected data that were restricted to areas around the classroom such as classroom doors, windows, hallways, and school offices. Although they went out again to collect new data under the teacher's additional guidance, the area of activity was remained narrow enough to just look around the upper and lower levels of the classroom.

Meanwhile, small groups tended to control the task by themselves with active evaluation and reflection of the data and new ideas. Team members in small group C, for instance, kept reminding each other of the intention and requirements of the task:

> A: Do you want to take a picture of that?
> B: Yes, over there.
> A: But it is not recognized by the camera. Is it too far from here?
> C: Hey, we need to take a picture where heat leaks away. That is just a temperature difference.
> A: Oh, that is true, but I cannot find it here.

Small groups' conversations concentrated more on data quality and strategies to collect better data. It was also frequently observed that the students were manipulating the device settings and adjusting the angle of the thermal-imaging camera to obtain clearer data. Both of small groups wandered around inside and outside of the school building and used the full 30-40 minutes. It was observed that they went to the gym, auditorium, school exterior, neighbor school's building, neighbor apartments and so on.

Discussion

This study examined how collaborative learning influences students' learning approaches in a geography task. The findings revealed that the characteristics of the small groups' learning approaches feature more deep learning compared to individuals (Biggs, 1989; Laird *et al.*, 2014). In small groups' deep learning approaches, it is considered important to address the task based on a variety of perspectives and to coordinate various ideas among team members. Small groups utilized various cognitive approaches (e.g., considering different viewpoints)

when they faced ambiguous or unexpected situations. Additionally, when they faced new observations in the field, they approached them by building an explanation and interpretations to interpret the new observations using their prior knowledge. Small groups C and D demonstrated in the interview that they could maintain a positive attitude because they could rely on other team members psychologically and experienced less burden in reconsidering alternative ideas. Likewise, collaborative learning encourages students to construct a proactive environment to discuss ideas in complicated tasks that require decision-making (Kirschner, Pass & Kirschner, 2009; Schwartz, 1995).

On the other hand, students who participated as individuals often exhibited efforts to complete the task with repetitive data collection without reflection. The students also experienced anxieties about the uncertain data and difficulties in applying ideas in the field (Albay, 2019). As individual students responded in the interviews, the presence of team members could positively influence the task-solving process in that they could approach the task with diverse ideas and perspectives. Individuals might also experience heavier pressure tasks to come up with novel ideas solving a complex task compared to small groups (Entwistle, McCune, & Walker, 2001). Similarly, concerning the strategic aspect, individuals employed strategies focused on controlling the time and scope of activities (Vermunt & Donche, 2017).

Amidst the key findings, one notable finding was that learning approaches were influenced not only by the difference between small groups and individuals, but also by the role of each team member, which explains the differences between small groups C and D. In the case of small group D, three out of four students demonstrated active participation as facilitators. As a result, they were able to share various ideas within the team and inquire about the ideas, which subsequently helped specify their ideas that were closely aligned with the task. In comparison, however, small group C consisted of one facilitator student who shared opinions freely, but it remained difficult to actively utilize the deep learning approach. This can be explained by the study of Barron (2000) and Ikpeze (2007) on group dynamics among team members. Team members' active participation and interaction comprised one of the factors that reinforced an in-depth understanding of the task. According to the research, which analyzed group dynamics in small group activities, every team member acts as a facilitator for completing the task and supports each other for in-depth understanding by initiating discussions and combining ideas with leadership and responsibility. Therefore, while small group C featured only one student facilitator, three students of small group D positively led each other as co-facilitators. This finding indicates that the facilitator helps initiate the deep learning approach, and the other team members' active response to newly suggested opinions influence on the dynamic interaction (Ikpeze, 2007). Specifically, in collaborative learning as a small group, *the existence of team members in itself* builds a learning environment

where the deep learning approach is likely to occur, and *the role of each team member* amplifies meaningful discussions in the learning approach.

Despite this study's findings regarding students' learning approaches in the collaborative learning process, limitations should be considered. The number of participants is not large enough to represent general small groups and individuals. As such, more case studies should be conducted in the future with a larger and wider pool of participants to clearly illuminate the relationship between collaborative learning and learning approaches. Additionally, this study did not consider group dynamics for team-forming. The teams were formed by student preference, so the influence of team facilitators could be randomly affected on the findings. For this reason, it is recommended for future studies to refer to the role of the facilitator (such as team members and teachers) and team-forming on students' learning approaches.

Conclusion

The main objective of this study was to explore the effect of collaborative learning on student learning approaches of individuals and small groups while learning geography. The findings demonstrated that collaborative learning could provide an environment to execute complicated tasks with a deep learning approach. The geography tasks in *Heat Busters!,* which is based on authentic and ill structured problems, require students' decision making on unexpected or ambiguous situations. While solving the problems, students of small groups underwent trials and errors for finding new ideas and connecting them with prior knowledge by active discussions, which assists the students to have low anxiety on the tasks. Students working individually were in situations that they should make every decision-making by themselves with a lack of various perspectives. The individuals chose their own effective ways to complete the complex tasks alone, but with high pressures on failures, which resembles with the features of surface learning approach.

Our findings suggest that caution should be taken when constructing group activities in a class. The instructors' vague positive expectation of group work without deliberate initiatives can reversely place pressure on students due to coordination processes with team members or relatively larger amounts of assignments (Kirschner, Paas, & Kirschner, 2009). Therefore, educational lessons needed to be tailored with well-organized instructions, content and learning environments that can initiate the learner's deeper engagement. Moreover, diverse and unexpected situations from the task sometimes constitute unwelcomed variables or ramifications, but at the same time they provide a rich learning opportunity. It is conducive to create a learning environment that enhances authenticity in learning by exposing students to various situations and people with whom to communicate (Mäkitalo *et al.*, 2005).

This study contributes to illuminating a black box in collaborative interaction and comprehending students' learning approaches in the specific context of geography task-solving processes. It also offers insights about how a geography task, learning environment, and group dynamics are interrelated to student experience with collaborative learning. An interesting follow-up to this study would be to examine the influence of team-forming with a larger number of participants, and the learning style preferences of instructors as well. Through this study, the geography educators could understand how collaborative learning can be implemented effectively for active engagement and change their class with the specific examples.

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