Comparative institutional analysis of participation in collaborative learning

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Abstract: Recently, group learning has been introduced in various countries as part of educational reform. While there are various approaches to group learning, the focus of this study is on collaborative learning, which is based on mutual help-seeking and consultation. This requires teachers’ decision to integrate collaborative learning into their practices and all actors to participate therein. This demonstrates whether implementing and participating in collaborative learning is a game theoretic situation. However, in the majority of studies on group learning, the game theoretic aspect has not been sufficiently investigated. Therefore, this paper aims to provide a conceptual discussion on this situation in collaborative learning using a comparative institutional analysis (CIA) framework.

Subjects: Game Theory Economics; Educational Change & School Reform; School Psychology; Classroom Management & Organisation; Teaching & Learning; Continuing Professional Development; Curriculum Studies

Keywords: collaborative learning; qualitative game theory; comparative institutional analysis; group learning

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PUBLIC INTEREST STATEMENT

Group learning has attracted the attention of researchers, practitioners, and policy-makers as a vehicle for educational reform in various countries including Asia. The power of group learning is that it enables students to consult each other about what they do not know. However, this consultation requires that some students be courageous in showing to others their lack of knowledge and confidence. In this situation, students may interact with other students strategically in terms of whether to participate in group learning activities. In addition, teachers may not want to introduce group learning because it means changing their familiar practices. These aspects indicate that actors play a strategic game regarding group learning, but this has been neglected in previous studies. Therefore, this study aims to provide conceptual typologies of how actors interact with each other in group learning based on a qualitative game theoretic discussion.
1. Introduction

In human society, interaction between individuals is an indispensable element, as people aim to achieve their goals through interacting with others. However, during many such interactions, interests conflict or contradict, and eventually, the people involved must decide on their actions based on estimating those of their counterpart. Group learning has been promoted as a major approach for pedagogical reform to alter conventional one-way lecturing in many Asian countries, including Japan (Sato, 2012), Singapore (Lim, Tan & Saito, 2019; Pang et al., 2018), Indonesia (Zuhdi, 2015), and Vietnam (Saito et al., 2018). This is because group learning promotes dialogue among students, ensuring that learning is mutually beneficial. At the same time, group learning is a newly introduced reform and throws up many challenges for teachers (Baloche & Brody, 2017).

Thus, implementation of group learning requires teachers and students to take the initiative and engage in related activities, especially if they are used to conventional lectures. In other words, group learning comes with certain factors that dictate its use in the classroom. The first factor is the teachers’ beliefs: if the teachers believe that students’ knowledge is of a social constructive nature, they are likely to use group learning, but if their beliefs are more content-oriented, then they are unlikely to engage in it (Céline Buchs et al., 2017; Le et al., 2017). The second one is about students’ collaborative skills, attitudes towards participation, competence, and social relationships with other peers (Le et al., 2017). The third one is school policy and support (Ferguson-Patrick, 2016; Sato, 2012; Sato & Sato, 2003, 2011). The fourth is social settings, such as pressure of high-stakes examinations (Ferguson-Patrick, 2016). These studies are, however, based on independent views of each party, namely teachers and students. There has not been much investigation into how they interact with each other with their own strategies on participation in group learning.

There are various approaches to group learning, which can be divided into two groups. The first is cooperative learning, which aims to allow students to achieve academic and social goals based on role division (Gillies & Boyle, 2010; Law, 2014), rewards (Buchs et al., 2011; Slavin, 2015), and sometimes competition between groups (Slavin, 2015; Williams & Sheridan, 2010). The second is collaborative learning (Saito & Atencio, 2014a, 2014b; Dillenbourg et al., 1996; Olivares, 2005; Roschelle & Teasley, 1995), which underlines mutual consultation based on help-seeking and dialogue between members (Knight & Mercer, 2014, 2016; Webb, 2013; Webb & Mastergeorge, 2003) without role divisions, rewards, or competition (Saito & Atencio, 2014a, 2014b). Help-seeking is vital because it encourages those who do not understand the content to take the initiative to seek help for their learning (Sato, 2012).

The impact of collaborative learning can be large enough to influence social relationships between students. For example, school reform using collaborative learning has been actively practised in numerous Asian countries to promote reforms of underperforming schools (Saito, Tsukui & Tanaka, 2008, 2015; Sato, 2012; Sato & Sato, 2003). In these schools, even students with resistant and rebellious attitudes towards others eventually started to engage in learning, because they appreciated the care and support patiently and frequently demonstrated by their peers through collaborative learning and by their teachers (Saito et al., 2015; Sato & Sato, 2003). That is, through collaborative learning experiences, such students started to trust others more and eventually changed their attitude (Saito et al., 2015; Sato & Sato, 2003).

However, whether an initiative can help teachers reform the pedagogy and climate of classrooms and schools depends on each school or even classroom. This is because it depends on the benefits students and teachers receive by reforming collaborative learning. Furthermore, the benefits for students and teachers depend on their strategies and how these interact with each other. Previous studies on collaborative learning have not sufficiently addressed strategic perspectives of the actors involved. Thus, this study aims to conceptually discuss the patterns of transactions and interactions of students and teachers’ strategies.
For this, the authors adopt a different stance from that of conventional studies towards collaborative learning that tend to perform statistical analyses to evaluate the impact and effectiveness (Buchs et al., 2011; Law, 2014; Webb et al., 2009) and qualitative investigations of detailed classroom discourses (Knight & Mercer, 2014, 2016). In contrast, this study aims to propose a novel viewpoint of collaborative learning through a mathematical framework using game theory that describes strategies with the help of which people can maximise their benefits in a game (Powell, 2006). As per this theory, a game is defined as a contest between two or more actors over a limited resource, by achieving a cooperative agreement and/or by application of some sort of competition. The proposed framework defines two models of games for: decisions of teachers to implement collaborative learning and decisions of students to participate in the collaborative learning. The first model represents whether teachers consider that implementing the collaborative learning has benefits for students or not. The second one takes account into students who are interested in the learning and open up to their peers about their struggles e.g., having difficulties trusting others. Here, students can possibly engage in the group activities, especially at the outset of implementing collaborative learning, in which they can share their problems with others and help those who claim to have difficulties. Those with problems opening up may reject collaboration, which might be interpreted as challenging and problematic behaviour in the class (Graham et al., 2010).

However, it is crucial not to deal with such students as troublemakers, but to consider it a game situation in which students decide on their choices based on their strategies for various payoffs in a mutually dependent way (Morris, 1994). Thus, from this perspective, the decisions of those who do not participate in group or collaborative learning can be regarded as reasonable and rational, believing that certain reasons underlie such actions, a point emphasised by both theorists and practitioners (Noddings, 1984; Sato & Sato, 2003). That is, there is a need to understand that apparently problematic actions are rational behaviours, even in cases where collaboration is rejected in collaborative learning activities.

As mentioned earlier, the research traditions on collaborative learning hitherto are broadly divided into two streams. The first is statistical analyses to evaluate the impact and effectiveness thereof (Buchs et al., 2011; Law, 2014; Webb et al., 2009), and the second is a qualitative investigation of detailed classroom discourses (Knight & Mercer, 2014, 2016). However, as mentioned, whether to participate in collaborative learning or not is highly transactional and a strategic decision between the actors. As such, a game theoretic analysis aims to analyse this type of situation. However, few game theoretic analyses have been applied thus far to investigate students’ strategies in game situations. Specifically, while it is possible to inductively interpret various cases, it is also difficult to draw more attention to subjects’ decision-making principles regarding whether to collaborate with peers. The voices of those who do not collaborate tend to not appear as often in previous studies that set out to qualitatively categorise or evaluate the impact of student remarks in group learning. Moreover, depending on teachers’ and students’ preferences, various patterns of engagement exist in collaborative learning based on the game played by the actors, which have been largely ignored in previous studies. Usually, engagement means learners’ experience in terms of concentrating on, becoming interested in, and enjoying learning about particular items (Shernoff et al., 2017), as reflected in their behaviours, emotions, and comprehension (Goldspink & Foster, 2013).

2. Approach of the study
As explained in the previous section, we propose a novel game theory-based framework for a conceptual discussion on the patterns of engagement in collaborative learning. As the game theory estimates benefits of strategies for people (teachers and students in this study), we employ comparative institutional analysis (CIA) to define conditions for terminations in games. CIA is a micro-economic approach to investigate institutions, namely the socially held beliefs among actors regarding practices in given organisations, regions, or countries, as elaborated in the next section. Institutions as socially held beliefs are considered to be in “equilibrium”, a state in which actors can sustain their current practices because of the highest set of payoff for each actors...
involved in the practices if they do not experience crises or shocks that lead them to revisit the meaning and effectiveness of given practices. CIA explains how equilibrium can be made based on the rules of the game (North, 1990), depending on their strategies practised by the teachers and students. This approach to conceptually analysing implementation as a strategic transaction to bring about equilibrium has not been actively applied in previous studies on collaborative learning.

This idea of equilibrium provides an opportunity to revisit our views on practices. That is, the idea of equilibrium can guide us to ensure that we do not become judgemental and evaluative of the actors, teachers, and students, and their decisions regarding participating in collaborative learning. Rather, it leads us to investigate the reasons, payoffs, and strategies underlying their decisions. Furthermore, by knowing the background of actors’ decisions, it becomes possible to discuss how to push equilibrium into different points by changing the conditions of this background.

To achieve this goal, the study is organised as follows. After the introduction, the analytical framework is introduced, namely CIA. In this study, the qualitative game theoretic approach (Oltean et al., 2016) is applied, instead of a rigorously mathematical one. Next, the five modes are described, which are based on different sets of choices of actors in the game with the highest payoffs. Finally, discussions are going to be provided.

2.1. Analytical framework
In this section we first present terms used in game theory. We then describe how we apply it to collaborative learning. Finally, we describe comparative institutional analysis that is used in this study to define conditions about terminations of a game.

2.1.1. Terms used in game theory
In general, there are three components in the game theory: actors, strategies, and payoffs. Each game has at least two actors, and they can each come up with a strategy. The payoffs represent how well they will benefit from the given strategies. In each game, actors select strategies to arrive at an equilibrium, which means if the other actor does not modify his/her strategy, there will be no improvement in his/her payoff, and then, s/he has the option of moving on.

From strategic perspectives, there are two types of games. One is a non-cooperative game, in which information is not shared among the participants because of the competitive nature of the game. All play simultaneously without any mutual agreements, as per the rules or their self-interest (Powell, 2006). The other is a cooperative game, in which the actors play in a sequence of constructing agreements because of their willingness to maximise their benefits (Powell, 2006). Further, there are two types of expressions of the game. The first one is a matrix, in which the actors make their moves simultaneously and their benefits are drawn in each cell of the matrix, but the effect of each actor’s choice is unknown, because the moves of others are not known until after all actors’ decisions. Alternatively, if decisions are made sequentially, the sequence will be drawn in what is called an extensive form (Powell, 2006).

2.1.2. Terms of game theoretic analysis in this study
In this study, a game has three actors, namely the teacher, Student1, and Student2. For simplification, a premise is given that in game theoretic situations, the students consider their own benefits and the teacher not be influenced by factors beyond the classroom, namely policies of his/her school or government.

2.1.2.1. Types of the game. In this study, the game is defined as a sequential type expressed in an extensive form. In other words, the teacher first makes a decision on whether to conduct collaborative learning or not. During this decision process, the teacher would consider the three aspects, namely cognitive, social and ethical ones (Cazden, 2001) to order to estimate whether learners would benefit from collaborative learning. First, the teacher should consider whether
collaborative learning would provide cognitive advantages for the students. Second, if the teacher believes that this type of group learning can help students strengthen their collaboration and teamwork skills and provide them with opportunities for mutual support as well as relationship building, she/he will favourably consider introducing it in the lesson. Third, if collaborative learning is perceived as nurturing students’ identity as active, responsible learners and knowledge generators, the teacher will likely implement it.

Next, if the teacher decides to implement collaborative learning, then the students must consider whether they want to participate in that. In this study, the teacher expects the students to base their decisions on the cognitive, social, and ethical aspects of learning (Cazden, 2001; Inagaki & Sato, 1996). That is, first, they would consider whether there is a cognitive advantage to learning with others. Second, they would consider whether it is worthwhile to risk being regarded as incompetent by their peers. On the other hand, if they are asked for help, they must consider whether to help their peer until they understand. Third, they must decide whether participating in collaborative learning ethically challenges their present values. That is, a challenge exists with respect to whether they are responsible for their own learning in the process by taking initiatives to ask questions or revising their understanding of the topics by re-examining content in dialogues with their peers.

2.1.2.2. Equilibria types. The teacher can play “Introduce or Do not introduce”. Introduce means that the teacher will introduce collaborative learning in his/her practice. Do not introduce implies that the teacher will not introduce collaborative learning. The teacher’s strategies are indicated as TR = {Introduce, Do not introduce}.

Likewise, the students can play “Collaborate or Do not collaborate”. Collaborate implies students’ interest in organising and participating in collaborative learning. Do not collaborate means that students do not participate in collaborative learning with their peers. Thus, the set of strategies by students 1 and 2 are expressed as STi = {Collaborate, Do not collaborate}, i = 1, 2.

The qualitative payoff values are considered for all actors. To simplify the situation, it was supposed that there are only two values, namely high (H) and low (L), with P = {H, L} and H > L. To make a decision on the payoff, each actor considers the following criteria, as discussed earlier: (1) cognitive advantage of introducing collaborative learning (teachers) and learning with others (students), (2) risk of being regarded as incompetent by peers, and (3) cost of changing their present values.

2.2. Comparative institutional analysis (CIA)
The CIA approach was employed as an analytical framework in this study. As noted, according to the CIA, practices that sustain equilibrium in one region or country differ between regions and organisations (Aoki, 2001). CIA focuses on the institution, a set of beliefs about how to interact to achieve economic, political, or social aims. This approach contends that actors negotiate and interact according to the “rules of the game” (Aoki, 2010; Greif & Laitin, 2004; Hall & Taylor, 1996; Morgan et al., 2010). Furthermore, institutions are believed to remain in a state of equilibrium (Aoki, 2001, 2010), because of the lack of incentive to change (Greif & Laitin, 2004). However, equilibrium can change and shift to a new equilibrium (Aoki, 2010) if actors perceive risks or crises (Aoki & Takizawa, 1996). CIA explains the reasons for establishing or shifting the equilibrium.

The basic components of CIA are generally mathematical analyses based on game theory and historical analysis. Game theory was developed to analyse and predict one or more actors’ decisions in situations to achieve individual or collective goals through interaction with others (Von Neumann & Morgenstern, 1944). Game theory is actively employed as an analytical framework in economics and other social science disciplines including law (Geçkil & Anderson, 2010), psychology (Colman, 2003), and political science (Greif & Laitin, 2004). In this study, emphasis is laid on analysis of the game situation on participation in collaborative learning and possible typologies of equilibria with the combination of highest payoffs for each actor, as explained below.
In education, game theory is primarily employed to analyse school choice (Abdulkadiroğlu & Sönmez, 2003; Kojima & Ünver, 2013). However, in this type of examination, schools are considered black boxes, and the situation among actors therein is neglected. In daily practice, various game situations manifest between actors, in this case, teachers, students, managers, and local stakeholders.

However, with some exceptions (Chikamori et al., 2014; Law & Pan, 2009; Stull, 2006), game situations in schools are largely neglected in the literature. Even in the exceptions (Chikamori et al., 2014; Stull, 2006), the focus is on teachers’ decisions regarding curriculum choice or creation, with limited attention on the actual classroom situation. In addition, teachers’ choice of curriculum and pedagogy depends on students’ responses to these decisions (Cerit, 2013). However, these responses or actions are essentially ignored in previous studies using game theory, excepting very early research by Correa and Gruver (1987). Therefore, there is opportunity for game theory to be applied to theoretically clarify complex game situations between teachers and students in the learning process.

It is possible to discuss institutions through CIA without using mathematics. For example, a theoretical enquiry has been conducted into types of coordination in the nuclear power plant disasters at Three Mile Island, Chernobyl, and Fukushima based on open source documents (Aoki & Rothwell, 2013). Moreover, using game theory, it is possible to analyse the situation qualitatively (Oltean et al., 2016). This study also performed a qualitative game theoretic analysis (Oltean et al., 2016) to conceptually discuss possible equilibrium through engagement in collaborative learning.

3. Analysis: modes

3.1. All willing (All-in mode)

In this mode, all actors are willing to participate in collaborative learning. The game mode is depicted in Figure 1. Both the teacher and students acknowledge the cognitive advantages of learning with others; likewise, they perceive less social risks regarding losing face by asking their peers questions, and they feel it less costly to change their values through collaboration.

Thus, the dominant strategy for the teacher is Introduce, and the game becomes a decision matter for students 1 and 2. The decision of students 1 and 2 is Collaborate. Thus, the strategies

![Figure 1. All-in mode.](image-url)
(Introduce, Collaborate, Collaborate) have the highest payoff (H, H, H). In this mode, all actors collaborate; thus, it is termed the “all-in mode”.

3.2. Only teacher willing (teacher-driven mode)
In this mode, the teacher recognises the advantage of implementing collaborative learning. The game model is depicted in Figure 2. However, the students are not interested in engaging in collaborative learning. As such, students do not realise the cognitive advantage of collaboration and are reluctant to seek help from others, even though they do not know how to solve the task. In addition, it is difficult for them to risk changing their present values to step out of their comfort zone.

Thus, the dominant strategy for Teachers is Introduce, and that for students is Do not collaborate. Thus, the strategies (Introduce, Do not collaborate, Do not collaborate) have the highest payoff (H, H, H). In this mode, only the teacher aims to promote collaborative learning; thus, it is named the “teacher-driven mode”.

3.3. One student unwilling (Isolation mode)
In this mode, the teacher and Student1 recognise the advantage of engaging in collaborative learning. However, Student2 is not interested in participating therein. In other words, student 2 does not acknowledge the cognitive advantage of collaboration and is reluctant to seek help from others, even though he or she does not know how to solve the task. In addition, it is difficult for Student2 to risk changing his or her present values to step out of the comfort zone. The game model is depicted in Figure 3.

Thus, the dominant strategy for the teacher is Introduce and that of Student1 is Collaborate. The dominant strategy for Student2 is Do not collaborate. Thus, the strategies (Introduce, Collaborate, Do not collaborate) have the highest payoff (H, H, H). In this mode, only Student2 is not interested in collaborative learning; thus, it is named the “isolation mode”.

3.4. Only teacher unwilling (Informal consultation mode)
In this mode, the teacher does not acknowledge the cognitive advantage of collaboration and is reluctant to introduce collaborative learning, because of the fear of losing control. In addition, it is difficult for Teachers to risk changing their present values to step out of their comfort zone. On the other hand, students 1 and 2 recognise the advantage of engaging in collaborative learning. The game model is depicted in Figure 4.
Thus, the dominant strategy of the teacher is *Do not introduce* and that of students 1 and 2 is *Collaborate*. As such, the strategies (*Do not introduce, Collaborate, Collaborate*) have the highest payoff (*H, H, H*). In this mode, students consult each other informally; thus, it is named the “informal consultation mode”.

### 3.5. All unwilling (all-out mode)

In this mode, no actors are willing to implement collaborative learning. Thus, the dominant strategy of the teacher is *Do not introduce* and that of students 1 and 2 *Do not collaborate*. Thus, the strategies (*Do not introduce, Do not collaborate, Do not collaborate*) have the highest payoff (*H, H, H*). In this mode, no actors engage in collaborative learning; thus, it is named the “all-out mode”. The game model is depicted in Figure 5.
4. Discussion

4.1. Comparison between the modes

This study aimed to conceptually discuss the patterns of engagement in collaborative learning. As discussed above, the two extreme poles are the all-in and all-out modes, between which other equilibria exist. The teacher-driven and isolation modes depict the situations in which the teacher aims to introduce collaborative learning, while students prefer working individually. This situation arises when students are not used to working in groups or convinced of the positive impacts thereof on their achievements (Zuhdi, 2015). Furthermore, students may consider it more efficient or effective to follow examples than determine their own solutions through group consultations (Khong et al., 2017; Zuhdi, 2015).

On the other hand, the informal mode manifests in the form of “chitchats” or gossiping among students while the teacher conducts a one-way lecture or provides tasks for students to solve individually. In such circumstances, teachers do not regard their conventional practices as problematic or see the need to revise them (AustralianCurriculum, Assessment and Reporting Authority, 2018; Saito et al., 2008; Bjork, 2005). Otherwise, while the authorities or school leaders may encourage them to change their practices, the teachers are either hesitant to do so or unsatisfied with the recommended new practices (Bjork, 2005).

In conventional lectures, students would not have official opportunities to talk with each other but may gossip or informally talk among each other. However, gossip or rumours have important roles in society, even influencing politics or causing social violence, such as Indonesia (Herriman, 2015). In some cases, rather, some teachers underline the importance for students to informally murmur their confusions to their peers, as a possible primitive form of giving a signal for help-seeking. In such situations, students can possibly consult each other informally when they do not understand certain topics even in conventional lectures.

4.2. Collaborative or individualised views

Furthermore, the above-mentioned modes depend on the actors’ ideas or preferences, namely whether they prefer learning as joint activities with others or individualised ones. The teachers may simply be convinced that one-way lecturing is the most appropriate way to disseminate subject knowledge to students (Saito et al., 2008). As discussed earlier, while some teachers may believe in individual ways of learning, others are reluctant to teach in collaborative ways, because their environments and facilities cannot sufficiently support these activities. Furthermore, students may want to retain their knowledge...
as their own private property, rather than share it as the common good, or penalise other team members who do not seem to contribute well to the group (Lee, 2009; Pang et al., 2018).

In addition, it depends on whether actors believe it possible that students will be able to change and grow through working with others. The more teachers believe in maintaining the status quo of students’ capabilities (Bjork, 2005), the less likely they are to acknowledge the advantages of collaborative learning. Likewise, the more students believe they are too incompetent to handle the tasks (Saito & Atencio, 2014a, 2014b; Khong et al., 2017), the more rational it becomes to not engage in solving or questioning each other about the tasks.

4.3. Benefits and risks of each mode

There are benefits and risks for each type of equilibrium. First, regarding the all-in mode, students 1 and 2 can construct their knowledge based on transactions with each other, especially if seeking help (Webb, 2013). In this way, students develop better relationships and build their trust in others (Cazden, 2001; Inagaki & Sato, 1996). Moreover, by having a high quality of learning with others, students begin to feel thankful and willing to serve their peers (Saito et al., 2015). At the same time, the teacher will be required to professionally and rigorously work on his or her teaching.

In contrast, regarding the all-out mode, if all actors are psychologically mature and sufficiently capable, they can minimise time and labour costs. In addition, freedom is maximised because of fewer interactions and contact with each other. On the other hand, if a student cannot cope with the situation or get along with peers, strong dissatisfaction would emerge, because there is no one to listen or with whom to share such emotions (Sato & Sato, 2003, 2011).

For the teacher-driven mode, if students 1 and 2 have sufficient capability and maturity, the cost will be minimal. Even though students’ abilities and maturity may vary, and if students 1 and 2 as well as the teacher are happy with completing tasks without interactions, the cost will be low. On the other hand, if abilities vary between students 1 and 2, the gap between them will broaden, and even if the teacher provides them with opportunities to collaborate, the pair will be unable to help each other understand the content, especially those with a lower level of understanding (Saito et al., 2014a, 2014b). Moreover, if both students are not keen on learning and exercise so-called “everyday politics”, demonstrating their resistance against or disagreement in indirect ways (Kerkvliet, 2005) with the teacher, the emotional labour would be immense, especially if she or he chooses to introduce collaborative learning as a mandated item rather than as part of his or her own reform agenda (Hargreaves, 2004).

Regarding the isolation mode, if Student2 likes to work individually, the cost would be minimal if his or her freedom is allowed. At the same time, from the perspective of Student2, if he or she can wait for Student1, the cost would not be high. However, if Student1’s proposal is ignored or rejected by his or her counterpart, then the costs for Student1 would increase.

Regarding the informal mode, as long as consultations between students 1 and 2 are not restricted, they can obtain the benefit of increased understanding. In addition, the teacher can keep conducting lessons according to his or her preferences. Furthermore, if the teacher does not acknowledge consultation as a legitimate classroom activity, then students have no guarantee they will spend sufficient time on properly understanding their problems or challenges.

4.4. Possibility of transition between equilibriums

Possibly, the equilibrium may shift to another type for various reasons. There may even be a large, gradual shift between the two poles, namely the all-in and all-out modes. However, the shift is more likely to occur through the other three types of equilibrium. There are two possible routes to reach the all-in mode from the all-out mode. The first route is a transition via the teacher-driven and isolation modes. Here, the teacher may decide to implement collaborative learning in the classroom, and students will eventually participate in the activities. The second route is via the informal mode. In
this second type of transition, whether the teacher notices students' increasing demands for consultation as a legitimate activity is crucial in terms of allocating official time to this in the lesson.

5. Concluding remarks
This study attempted to provide a different perspective from that in conventional statistical analyses (Buchs et al., 2011; Law, 2014; Webb et al., 2009) and qualitative approaches towards classroom discourses (Knight & Mercer, 2014, 2016). To this end, a CIA framework based on qualitative game theoretic discussions was employed. Specifically, this study conceptualised various types of equilibria of participation that result from actors’ transactional and strategic decisions. This study is significant as it proposed typologies of group learning participation based on various mutually dependent payoffs (Morris, 1994) by considering decisions as reasonable and rational (Noddings, 1984; Sato & Sato, 2003), even in cases where collaboration is rejected in collaborative learning activities.

Moreover, this study can provide a basis for developing a new approach in the economics of education, namely institutional economics in education. Decision-making regarding participation was examined here as the coordination of learning, where coordination refers to planning and adjusting actors’ actions to interact with each other for resources, knowledge, and information (Douma & Schreuder, 2002; Milgrom & Roberts, 1992). In the field of the economics of education, the focus is on the economic value and effects of education with reference to monetary factors. However, institutional issues inside educational organisations like schools have mostly been neglected. A classroom situation such as collaborative learning is one important aspect of how students and teachers coordinate to learn in cognitive, social, and ethical terms (Cazden, 2001). CIA provides a framework through which to further analyse coordination in educational institutions. In addition to the coordination of professional development in schools (Saito et al., 2020), this study provides a basis to analyse how actors inside the classroom coordinate their teaching and learning processes. Thus, this study is the first step towards developing a new approach, namely the institutional economics of education.

Note that this study was a conceptual investigation of participation and did not focus on the context of actors; thus, the historical effects of their interactions were not considered. As such, the analysis would be more applicable to the initial stage of implementing collaborative learning. However, as observed in previous studies (Saito et al., 2008, 2015; Sato, 2012; Sato & Sato, 2003), actors can eventually develop trust in each other and their belief in the positive impacts of collaborative learning, although this chronological development was beyond the scope of this study and should be investigated in future research.

Finally, this study was based on the premise of a very simple interaction with a limited number of participants under simple decision-making conditions. It can be further developed by including a larger number of participants, applying evolutionary game theory, and introducing more complex conditions based on the findings of empirical studies, which would render the situation more realistic. In so doing, the issues will be further clarified as matters for policymakers and practitioners to anticipate when implementing pedagogical and school reform.

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