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A Review of the Historical Perspectives on Various Collaboration Paradigms

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Abstract:

Collaboration is when individuals agree to work together to find solutions. Collaboration efforts have been found to benefit student learning with varying learning levels of competencies; however, there are various aspects that can have a moderating effect like individual characteristics, group components and the nature of the tasks. This paper studies the existing literature from the early 1990's till recent work about the historical frameworks regarding collaboration, and further tries to share the understanding about the various collaboration paradigms that have been established.

Keywords: collaboration, collaborative learning, cooperation, group assessment

1. Introduction

Early research on collaboration is embedded in the work of Piaget and Vygotsky (Dillenbourg, Baker, Blaye, & O'Malley, 1996) For instance, socio-constructivists describe the cognition process in children by using Piaget's system of developmental stages children's, along with ideas linked to cognitive conflict, a sense of cognitive dissonance that happens when one becomes sensitive to a discrepancy between one's current cognitive frame and new information or experiences. As per the socio-constructivist approach, cognitive conflict is crucial in terms of how growth can be triggered. Interactions in a social setting can help assist such conflict to the degree that people work together with peers at a more sophisticated developmental level. This school of thinking propagates, group heterogeneity as a key reflection, since group mates are expected to possess diverse knowledge, different knowledge representation schemes, and reasoning mechanisms which are not identical (Azmitia, 1988).

Another example in research discusses, how in the Piagetian tradition when conservers (i.e., people who realise that pouring of water from one glass into another differently shaped glass does not alter the quantity of water) are paired with non-conservers on a conservation task, non-conserving members are most often than not will reach to the same conclusion as a result of interaction, whereas the waning of conserving members understanding is uncommon (Tudge, 1992).

However, Dillenbourg et al. (1996) is not completely convinced that disagreement and conflict are not as crucial as the communication that they facilitate and the state that the approach is too mechanistic in nature.

Vygotsky has emphasized more on the importance of social interaction on its own that can cause cognitive changes in an individual and not just getting stimulated by it (Dillenbourg et al., 1996).

In this form, there is an internalization of the social interaction which in turn creates conceptual changes in the understanding of the participating individuals. Vygotsky like Piaget enforced the magnitude of diverse groups of collaborators. As per Vygotsky, the area of proximal development is the space between what an individual can achieve individually and what he/she can realize with the help of a more competent "other." While Piagetian studies typically pair subjects of the same age group from varied developmental stages to instigate cognitive conflict, studies in the Vygotskian belief frequently pair individuals with different age groups. Instead of looking at cognitive conflict as a cause for conceptual change, socio-culturalists have an outlook that collaborative learning occurs within the space of proximal growth (Dillenbourg et al., 1996).

The more recent shared or situated cognition approach learned by researchers in sociology, anthropology, and even computer science stress the social structures in which interactions take place (Dillenbourg et al., 1996). This approach looks at the environment as a key part of cognitive performance connected to collaboration. In the same manner, it attempts to explore collaboration that ignores social structures and are likely to be biased. Based on this perspective, learning is not something that is given or exchanged from one partner to another. Instead, learning is co created through interactions between the collaborators. This view stresses on how, the whole of group behaviour is more than the sum of its individual parts. Meaning, group interactions grow in ways that are not essentially predictable based on the inputs of group members. This insight suggests that looking at the group rather than individual members of the group as the unit of analysis could generate qualitatively altered conclusions concerning collaboration (Dillenbourg et al., 1996).

From 1990s, there is a fresh thread of research on collaborative learning that centers on emerging technologies for facilitating mediation, observation, and to record interactions while collaboration emerges. This latest thread of research, is referred to as computer supported collaborative learning (CSCL), since it basically uses onlinenetworks to facilitate and record interactions that happen online between two or more people who could be located geographically and/or temporally apart. A major section of this

research has developed in tangent to new technologies that support distance interactions, like as email, web chat, instant-messaging and in more recent times, technology that can be used to synchronize video conferencing (such as Skype) (Kreijnsa, Kirschner, & Jochems, 2003).

The above mentioned historical perspectives have paved the path of evolution to a variety of research paradigms, such as Dillenbourg et al. (1996) characterize research created from the Piagetian, Vygotskian, along with the shared cognition approaches and introduces the “effect” paradigm, the “conditions” paradigm, and “interactions” paradigm, correspondingly. The most recent version of the interactions paradigm can be addressed as the “computer-supported” paradigm. The paradigms and their essence can be understood more clearly based on the explanations given below.

2. The Paradigm of “Effect”

In this paradigm, the focus is to examine the results of the collaborative efforts and not really delve into the process comparing group and individual performances. Research indicates that this approach traditionally maintains that a classroom collaboration structure has dominant influences on the performance and learning of students. As Webb (1993) shared students working in a group structure of three to four on solving math performed way better than the equally abled students who worked in silos. Also, the students who received help while working in groups and collaborating and were more receptive achieved better scores than those who passively resisted help.

Students who were solving problems more accurately showed that their behaviour in a group towards collaboration was related to ability in a significant manner, where the students solved the problem audibly with minimal to negligible assistance. On the other hand, behaviour was a more prominent indicator of ensuing performance of the individual post test that ability during group work (Webb, 1994).

In a study by Saner et al. (1994) where experiential science tasks were given to students from the fifth to eight grade, it was seen that the students could be clearly categorized into three parts. The first part where the answers to short relevant information shared questions was given individually. The next part of the experiential aspect of the hands-on science tasks the activities were carried out in groups. The last portion of the task was completed individually like the first part, and required interpreting the results received by the group portion of the task and using those results to a different context (Part three). The study concluded that students irrespective of the grade levels, higher- or lower-ability students did have an alteration due to collaboration. Students who performed well with a higher ability in Part one had the inclination to perform similarly well in Part three. Additionally, the best pre-emptor of Part three performance for higher-ability students was their own score on Part one of the task. On the other hand, lower-ability students displayed a carry-over effect of the collaboration on their scores in Part three, which most likely indicated to be higher than their Part one scores. It seems, the best indicator of Part three scores for the student with lower-ability was their results in Part two. Thus, showing that collaboration does seem to give lower-ability students an advantage and it also can be seen that there seems to be no carry-over effect for students with higher-ability.

Another study was conducted on 500 students from the tenth grade who participated in a collaboration assessment of multiple stages. The first phase was about students reading and interpreting themes of what they read and answering questions, the second phase based on random selection and grouping in threes the students were asked to share a discussion on the story, while the other half continued to work in silos. In the third phase student who worked collaboratively in the groups were made to answer individually. The results display that students who were in groups and discussed showed that due to the collaboration their understanding of the facts and their interpretations were more enhanced. Post discussing in the groups those students showed better recall on facts and shared higher standards of interpretations than those students who were made to work individually, however it could also be seen that the ability of the student was also a factor on the level of affect on the performance. For instance, the lower ability students showed a higher result gain from the group discussion than the higher ability students (Saner et al, 1994).

In contrast to this in another study performed on students who were paired for a given science experiment there was a conclusion that collaboration could both increase as well as decrease performance of the students. This study had paired 153 participants who were students in the age group of 5 to 9 and were working on many tasks utilising a balance beam. The weight used on the balance beam and the distance was varied from the fulcrum, as manipulation mechanisms by the researchers. The Students had to guess on what side the beam could lean in

case the support was separated from the balance beam. It was vital that there were no inputs on if the students were sharing accurate or inaccurate results from the researchers and further since the support was always connected the results once shared was never tested to indicate if they were right or wrong. The responses shared by the students were categorised and coded based on the level of sophistication of the various rules applied, towards making the decisions to strengthen their forecast. There were four kinds of configuration of the students that was identified by the researchers: students who worked individually, students that displayed and equal rules of decisions pre-test, and students that showed an uneven set of rules for decision making at pre-test—one student adopted an elevated rule, while the other chose a lesser rule. While the collaboration process was taking The results from this study highlight the following aspects about the high impact of collaboration on how the students performed, with alterations in ways of thinking that continued for quite a few weeks subsequently. It was found by Tudge, the group of students that had a lower competence in terms of sharing rules that were weaker was in fact the only group that showed a drastic improvement on the post test. Conversely the superior decision rules students who showed higher competency displayed nearly the same results at the post test. However, the pairs that had the equal level of decision rules showed the same results almost and the students who worked in silos also sowed not much of a difference in performance in their post tests, irrespective of the scores earned in the pre-test. Accordingly, it can be understood that collaboration among students of varying competence levels had an alteration in their performance, although collaboration was as

likely to decline at the same time as improve performance. These former results put forward that this finding is not just an object of regression to the mean. The authors justify this point by stating how students receive no pointers on their results. Therefore, the students who used higher reasoning and were not too confident in their forecasts, were more inclined to get influences by their partners with weaker decision rules in the lack of evidence that confirmed or denied their own reasoning.

3. The Paradigm of “Conditions”

Studies that focus on this paradigm focus mainly on the various conditions that influence the effect of collaboration on learning. Conditions like characteristics of the individuals in the group, the kind of heterogeneous factors of the group members and the number of members in the group.

Take for instance a study that discovered a considerable difference in the learning experiences based on collaboration. The boys in the group showed a higher tendency to share and receive a detailed explanation which also displayed a higher group acceptance rate than the girl members in the group. It was also noticed that boys received a higher response rate to their queries for help. This could have been due to them asking more questions that were precise and frequent. The groups had the same ability levels but it could be seen that the boys clearly performed better than the girls. In fact, in spite of collaboration the boys' performance didn't seem to differ, however the girls' performance seemed to deteriorate due to collaboration. The pattern of how the group members participated could have been different due to the differing ability levels. The study showed how participants with higher competencies tended to share an explanation in depth and also was willing to receive alternate explanations and in contrast the low competency members tended to lose the task. An interesting aspect is that the ability level which was relative of the member played a more crucial role than the ability. This means, that members who performed moderately well and were placed in a group of low performers, showed similar interaction patterns as the members with higher absolute ability.

The structure of varied members of the group, particularly of their gender and competencies is also a key element in influencing the effect of collaboration.

Taking the example of another study there was a meta analyses of 17 studies that explored collaboration in group work. The study showed that the pattern of interactions and the effects of collaborative group work differed across the groups with due to a variety of ability-levels. The groups were divided into five groups. A mixed group with a broad range in of ability in terms of high, medium and low ability. The second mixed group had a narrow range in comparison to the first in terms of ability starting from combinations of high with mediumor the low with medium abilities. The next group was homogeneous with high-ability, average-ability, and groups with low ability. In groups that had a mix of abilities students who had either high or low abilities showed signs of developing bonds with their teachers while the average ability students didn't and also shared lesser reasoning that the other members. However, in the mixed groups with the narrow range the average abled students performed better than the last. This was because all the students participated wholeheartedly and sought more help, more questions were asked and the average students tended to share more information thereby achieving better performance. The groups that had the same ability had mixed results. In homogeneous groups with high-ability, the students repeatedly believed they knew how to the answers to all the problems. These students could only give few explanations and landed up with very poor performance on the tasks in comparison to mixed groups with high ability students. In a group with low ability and which was homogenous, showed a lack in necessary skillsets and the students failed to proved accurate reasoning to each other and thereby performed poorly in comparison to heterogeneous group of students who had lower abilities groups.

In another recent study on how students in grade 7 and 8 performed in a science experiment that was designed to measure their conceptual knowledge explaining the relationship among voltage, current, resistance etc. Students were found participating individually and in groups. The study shows that collaboration did seem to positively influence average performers the most; however, there was a difference amongst the heterogeneous versus the homogenous groups. Even the performance of the high ability students seemed to be affected when paired with low ability students but tended to perform better in a homogenous group. Hence based on these findings the use of homogenous groups has been recommended.

The other key aspect that affects the group mix is also the gender of the group members. Gender could also possibly have an effect on the patterns of interaction; it could influence the collaborative effect on how students learn. A study done by Webb (1991) discovered that with groups that had an equal mix of both genders had no variations in how either boys or girls interacted. It was seen that in groups that had more boys the boys tended to ignore the girls and the girls didn't achieve much success in getting answers to their queries. It was also fascinating to see how even in a group with more girls, the girls directed questions to the boys who also seemed to ignore them similar to the previous group. Thus, we saw that in both the groups irrespective of which gender had a majority the boys performed better than the girls irrespective of the fact that both the genders were equally competent.

Lastly there are suggestions on how the features of the task could influence the effects of collaboration on student group learning A study done by Mercer (1996) discusses how the level of collaboration is dependent on whether the task given requires the group members to work with each and communicate in order to deliver solutions to the problems presented to them as a group. Unless the activity shared needs the participants to plan discuss and then decide and share interpretations, the members will only then need to interact and work with each other to complete the same successfully. In such cases, cooperative strategies are more relevant than competitive strategies. According to Webb (1991) even rewards that are structured to encourage group performance and not on individual results have a likelihood to promote collaborative behaviour. According to Dillenbourg et al. (1996) a necessary task aspect could vary based on the paradigm of performance. From a Vygotskian outlook, tasks that focus on acquiring skills, partnered planning, creating categories and memory will be the most useful, alternatively from a Piagetian standpoint, tasks that measure management and synchronization must engage diverse opinion inclusion, scheduling, and solution finding.

4. The Paradigm of “Interactions”

The paradigm of interactions has evolved based on the challenges learnt from the previous paradigms that try and understand the mediating elements between collaborative group performance and learning achievements (Dillenbourg et al., 1996).

This streak of research is specific in trying to segregate the various features and interaction processes based on which learning gets affected due to collaboration. For instance, one of the mediators to learning could be the detailed explanations given during collaboration (Dillenbourg et al., 1996).

It is found that Mercer (1996) argues that interactions that enable more detailed knowledge sharing help the students in understanding the core principles of the practical processes which help in the students learning things

in a more holistic manner that can be applied to future situations. In some of the first studies on collaboration there was evidence that was collected on social interactions among the participants. Webb (1991) The nature of the interactions does seem to influence the learning through collaboration as well as student performance.

The levels of Verbal disagreements among students were found to be related with achievement, meaning that extremes of the disagreement decreased performance while average disagreement actually improved performance.

The study further discusses how explanations improves learning based on many aspects such as the student who receives help truly requires it, the time and relevance of the details shared and if the help received is understood, and whether the participants have future platforms to display the acquired skills on their own Webb (1991).

5. The paradigm of “Compute Support”

Lastly this latest research that is growing in trying to understand if all the previous mentioned collaboration paradigms that have been observed in a one on one person setting can also be transferred in the space of compute based interactions. For example, Kreijns et al. (2003) caution that, unlike person to person interactions, technology based social interactions cannot be taken for granted solely based on the presence of technology. In terms of asynchronized and text interactions studies show that there isn't a huge variation compared to face to face communication. There is a likelihood that some pattern will be more visible than the other in either of the mediums used. Curtis and Lawson (2001) in a study talk about how students plan more online since they might not know each other too well to challenge ideas and opinions. This could also be due to how online media have features that stress on the importance of planning rather than on work coordination. However, studies conclude that irrespective of variations experiences through both mediums, it can be acknowledged that collaboration can be successfully accomplished through online medium and computer supported technology.

6. Conclusion

Based on the historical frameworks shared regarding the impact of collaboration on learning and the current studies with regard to each paradigm, it is very clear the collaboration clearly does influence learning levels of individuals. However, there are other elements to also keep in mind that can influence the impact of collaboration on learning. Things like individual, group, task characteristics and the respective paradigm perspective are important moderators in the success of collaboration and to what extent it can influence student learning. Thus, future research can certainly explore the influence of collaboration on student learning. Collaboration research can contribute to the improvement in student learning and needs to be further explored.

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