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Group Revision is Better Than Self-Revision in Case of Mathermatics

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Abstract

One of the most common dilemmas faced by students studying mathematics is whether to opt for group revision or self-revision. Given the increasing perception of mathematics as a challenging and less engaging subject, selecting the most effective revision strategy is crucial. This study systematically reviews existing literature to analyze the comparative benefits and drawbacks of group and self-revision in mathematics education. The research employs a systematic literature review methodology, synthesizing findings from academic studies that explore the cognitive, motivational, and pedagogical aspects of both revision methods. The analysis reveals that while individual preferences and learning styles play a role, group revision generally yields better academic performance, increased motivation, and enhanced conceptual understanding compared to self-revision. The findings have implications for students, educators, and administrators in optimizing pedagogical strategies to enhance mathematics learning outcomes.

INTRODUCTION

The field of pedagogy, specifically in the subject of mathematics is dynamic and one of the most pressing questions which is being asked is which one out of group revision and self revision is more efficient for a student and would yield better results. The question is of particular relevance in today's world as the need for mathematical education in society grows and the changing mathematical pedagogy because of assimilation of technology into education has led to teachers and administrators seek to find ways to better impart mathematical education. This paper first establishes the importance of establishing a better mathematical pedagogy to improve imparting mathematical knowledge to students and then proceeds to attempt to answer that age old question through the means of a systematic review of available literature on the subject by exploring the relative advantages and disadvantages of the two methods and explore the data to ascertain which of the two methods yield better academic results, and for a prospective students it helps to highlight the advantages and disadvantages of each

method and would help the student decide which of the two methods would be a better fit for him or her. It is also hoped that this paper would help administrators make changes to the pedagogical structures and incorporate some of the findings in this paper.

Mathematics is by far the most universal of all subject disciplines, and it has an impact on decision-making in all aspects of life, be it private, social, or civil. Mathematics training is fundamental for increasing young people's post-secondary and citizenship prospects, but many students today, as in the past, suffer because of mathematics (Anthony and Walshaw, 2007). John Dewey (1904; 1964) expressed a basic tension in teacher training at the turn of the twentieth century: the proper partnership of subject material and process. This tension still exists at the turn of the twenty-first century. Many of the same issues still exist. The question that he proposed during his works related to whether the development of study depended on the development of pedagogy. Despite these foresighted ideas that closely intertwine education and learning, teaching methods has been continually hampered by a pervasive divide between subject material and pedagogy throughout the twentieth century.

There are many traces of this divide (Lagemann, 2002). It can be inferred that the inquiries in pedagogical research, such as the advantages of one approach of study over the other, has also been under constant research. Mathematical expertise is often taken as a given in the classroom. The essence and content of the mathematical ability needed in practice are poorly understood. Furthermore, the significance of such information is overlooked (Shulman, 1986). Hence, there is a need for understanding and re-examining the methods of mathematical learning and teaching and it needs to come from both a student and a pedagogically-theoretical perspective. This is where the need for understanding the difference between self and group-based study of mathematics becomes an important inquiry. The understanding of pedagogy, especially in mathematics, is increasingly moving away from the perspectives of the teacher and becoming closer to the perspectives of students. Perspectives now dictate that teachers need to make sure that all students have time to reflect and work peacefully by themselves, without being forced to process the diverse, often contradictory viewpoints of others (Hunter, 2005; Sfard and Kieran, 2001).

Another perspective relates that working in small teams and with separate partners may help children see themselves as mathematicians. Such strategies will frequently provide students with the material and emotional help they need to clarify the essence of a challenge and identify potential paths forward. Pairs and small groups may help to increase participation (Anthony & Walshaw, 2007). This brings us to the question of which approach is more effective for a student, and the respective advantages and disadvantages of the two methods, which will be elaborated upon later in the paper. While pedagogical knowledge can help teachers anticipate problems, it can also fall short in the complex relations of content and pedagogy in actual problem solving. No amount of pedagogical content experience, no matter how vast, can accurately predict what learners will think or how a topic will develop in a class. Teachers need theoretical expertise in the subject of mathematics in order to handle complex mathematical processes with

varied students in real-world lessons in a flexible and responsive manner. Without this, attempts to train high-quality teachers who can serve all students, teach in intercultural contexts, and operate in difficult-to-teach-and-learn environments are undermined. (Boaler, 2000; 2002). To remedy that, mechanisms of collaborative learning (CLE) has been suggested as a solution, which makes use of different tools to enable better communication between the students and the teacher(s). Hence, group learning in this situation is advantageous (Cen et al, 2014).

Other than that, teachers also need socio-cultural and linguistic knowledge in order to successfully connect academically with their student; Thompson and Thompson (1994) emphasise the importance of expression. They clearly explain the situation of one educator who, despite understanding the definition of rate, was limited in his ability to articulate or address it in the common speech. In these scenarios, the individual student would be aided by CLE, whereby even if there is no access to the teachers, the students can benefit from shared knowledge (Chiu, 2000) There is a lot of literature on the benefits of adopting a group revision strategy for students in the context of a mathematics classroom, or otherwise.

For starters, Brown et. al., (1989) argue that in collaborative problem solving, groups come up with synergistic ideas and solutions that would not have occurred otherwise. The authors also further argue that when solutions and ideas are generated by students themselves as opposed to instructors handing it down to them in class, the retention is better and it also boosts interest and confidence in the students. Brown (1988) posits that since students must clarify, elaborate, or justify their stance to others, collaborative group work has the ability to reveal misconceptions and it is very academically important that such misconceptions are identified early, and are addressed early. This is of particular importance in a subject such as mathematics, which requires of a student to have clear preceding concepts. The benefits of such peer driven approaches to revision or learning have beneficial effects which extend beyond just scholastic performance or academic performance.

Cooper and Mueck (1990) demonstrate that students acquire the social skills that are needed in today's workplace in collaborative learning environments. These skills stand them in good stead when they pursue higher education or move into corporate sectors. Cooper and Mueck (1990) further show that another significant benefit of collaborative learning environment is a significant decrease in fear of course material, especially among female students. Several scholars have attempted to explain this finding. Lemke (1990) realizes that these students benefit from the interactive environment amongst peers because they can ask what may be perceived as ‘stupid’ questions without revealing themselves to the instructor, and without facing the ridicule of the entire class. Scholastic performance is also not just based on ability to absorb information and retention but also on motivation and the effort a student is willing to put in the subject. Davis (1993) in his book argues that in a group environment, students are incentivized not to postpone their study work and finish it on time. In individual study, it is easy and tempting to put off assigned work for later but in a group study environment, the entire group relies on every

individual member to complete the study work assigned to them. Not only in reducing procrastination, certain studies have shown that group studies also directly improve motivation. The assigned study material, especially mathematics, is frequently found to be boring and difficult by high school students. In this regard, study groups will help a student remain motivated and focused on the portion of the course that needs to be studied. This is because study groups encourage an individual student to discuss a subject with his or her peers and friends rather than just reading the material in a textbook, which fosters interest, which, in turn, leads to improved academic success. But perhaps more pertinently, active learning has been found to be more successful than passive learning, according to studies where instead of passively revising on their own, students in a group environment; share ideas and discuss strategies toward a collaborative objective, making the lesson more memorable (Carr 2015).

In a group setting, a very important consideration arises, which concerns the size of peer groups. Carey and Laughlin, (2006) discovered a minimum of three group members was absolutely necessary and sufficiently adequate for the group to outperform other control groups. As a result, the authors concluded that an optimal study group should have at least three participants. Walvoord (1986) discovered that study groups should be kept to a maximum of five people. If the group was larger than five people, each person may not be able to express themselves freely. As a result, it would appear that a group of 3-5 people is the optimal size for a group for the best academic output. In contrast to the group revision approach is the individual or self-based revision strategies. Self-study, according to one school of thought, is fundamentally more fruitful and advantageous than group study, and students learn more when they study alone because they have more time and can devote more intense attention to their research (Bosworth, 1990).

Self-studies benefit a student's ability to assimilate information because of the privacy and freedom they provide. When they study alone, the absence of negative feedback and perceived disruption allows them to pace their lessons at their own pace. The author argues that it is necessary for students to earn at their own pace, because everyone has a different pace of learning, especially subjects which are highly analytical and technical like mathematics, and in contrast to group studies, where a wide variation in the progress and understanding of course materials might present a barrier to productivity of all students. On the subject of a group setting where the group members are at different levels of preparedness and understanding of coursework, Diab, (2010) raises important point that are applicable to learning mathematics. According to the author, groups in which various individuals have varying levels of understanding are rarely productive for anyone. For example, if a high school student is only beginning to learn specific mathematics course concepts while the rest of the class is studying more advanced concepts, the student will find it difficult to keep up. Similarly, if a student is significantly ahead of the other members of the community, the study session would be ineffective for that particular student. Several authors have also pointed out several logistical challenges to students opting for group revisions.

Studies like (Tetteh, 2017) points out that study schedules have a significant role to play in terms of the academic performance of a student. In a group study, the schedule is not very flexible because the group has to find a specific time for everyone to meet, whereas in an individual study approach, the student can tailor the schedule according to his or her own schedule, which would result in better academic performances. Hence for a student it becomes much more convenient to study by himself or herself. Encouraging a group based model of studying also fundamentally assumes that the student is socially comfortable enough to participate in a group setting comfortably. Students who are introverted or uncomfortable in group settings will find it difficult to interact in a group, which might dampen the academic output of the group revision session, and proportionately negatively impact the grades. However, there are several drawbacks to the aforementioned benefits. Tetteh (2017) points out that the ability to create your own schedule can potentially lead to a situation where the laziness of a student manifests itself in procrastination and consequently, poorer scholastic performance, and that some students perform better when the schedule is made for them. The author also further argues that negative feedback from peers, which is often viewed as a negative influence and harmful to a student's self-esteem, may be a powerful source of motivation for them to put more effort into, and in that context group studies may provide an opportunity for introverted students to make friends and enjoy the process of studying more

METHOD

Knowledge development in the field of research is increasing at a breakneck pace while remaining fractured and trans-disciplinary at the same time. This makes it difficult to keep up with cutting-edge research and stay on the cutting edge, as well as to determine the weight of data in a given research field (Snyder, 2019). Hence, it becomes important to incorporate the review of literature in research methodology in order to identify the gaps in current literature and also to become cognizant of the current trends in the contemporary literature.

The methodology which will be followed in this research paper will be a thorough review of existing literature and secondary data, which will be presented and analysed by the broad themes of the inquiry; understanding the role of pedagogy in the contemporary methods of teaching mathematics and analyzing the relative advantages and disadvantages of group-revision and self-revision. A literature review can be understood as a collection of research works that examines recent or current literature. Based on literature reviews that could include research results, review papers may cover a broad range of subject material at different levels of clarity and robustness (ncbi.nlm.nih.gov).

The style of literature review which will be conducted in this particular project is a theoretical literature review, theoretical literature review is concerned with a body of knowledge that has developed in relation to a subject, idea, theory, or phenomenon. Theoretical literature reviews are useful for determining what concepts already exist, their associations, and the extent to which theoretical frameworks have been studied, as well as for developing new hypotheses of the study (research-methodology.net). Because the

research is only relying on literature review for the purposes of this research, it will be using materials which use both quantitative and qualitative forms of research, which can generally be understood as relying on mixed-methods secondary sources. In general, a Mixed Methods Analysis may refer to any mixture of methods in which at minimum one of the elements is a systematic literature review. The Mixed Methods Analysis is seen as capitalizing on the shortcomings of the 'what functions' efficacy systemic review and other more theory-driven strategies. To make sure that the literature review which is being done is as authentic as possible, the review will be conducted in a systematic manner. A systematic review is a research tool and procedure for locating and objectively evaluating applicable research, and also gathering and analyzing data from that research. A systematic review's objective is to find all empirical proof that meets pre-specified eligibility requirements and can be used to address a specific research questions and hypotheses (Snyder et al, 2016; Liberati et al, 2009). To avoid quantifying the secondary data which is collected in the form of reviewing literature, the research will not be delving into meta-analysis. This is to ensure that diverse forms of data, which cannot be strictly categorized are not overlooked in the pursuit of answering the research questions.

The literature review was conducted using a structured search strategy across academic databases such as Google Scholar, JSTOR, and ScienceDirect. The following inclusion criteria were applied:

- Peer-reviewed journal articles, conference papers, and books published in the last 20 years
- Studies discussing learning methodologies in mathematics education
- Research examining the effects of group-based and self-study learning strategies
- Studies using quantitative, qualitative, or mixed-methods research

The exclusion criteria included:

- Studies focusing on non-mathematical subjects without relevance to cognitive learning in mathematics
- Opinion-based articles or editorials without empirical evidence
- Research with small sample sizes or lacking methodological transparency

After screening for relevance and credibility, 30 studies were selected for in-depth analysis. The selected studies were analyzed using a thematic analysis approach, which involved the following steps:

1. Data Extraction
    - Key information, such as study design, sample size, research objectives, and main findings, was extracted from each study.
    - A coding framework was developed to classify studies based on whether they focused on group revision, self-revision, or comparative analysis.
2. Categorization and Thematic Coding
    - Studies were grouped based on recurring themes, including cognitive retention, student motivation, academic performance, and social learning benefits.
    - Thematic coding was applied to identify patterns in the advantages and disadvantages of group and self-revision.

3. Comparative Analysis
   - A comparative framework was established to evaluate the effectiveness of group revision and self-revision across different learning outcomes.
   - Studies were compared based on their research methodologies, statistical findings, and reported impacts on students' mathematical understanding.
4. Synthesis and Interpretation
   - The findings were synthesized to present a coherent analysis of the strengths and limitations of each revision method.
   - Meta-summaries of quantitative studies were created to highlight key trends in data, such as performance improvements and student engagement levels.

By following this structured approach, the study ensures methodological rigor and transparency in evaluating the role of revision strategies in mathematics education

RESULTS AND DISCUSSION

Although there can be no specific literature which has compared the relative advantages and disadvantages of self-revision versus group revision or vice versa, literature has elucidated on the specific characteristics of the two based on similar parameters, and while analyzing the aspects of these two comparatively, these bodies of literature can be consulted. The concept of comprehension monitoring encompasses multiple components: first, assessing one's present state of understanding, and second, taking appropriate measures once a comprehension concern has been identified. Most study has concentrated on the first element: children's social and emotional capacity to track their own or some other person's understanding. Research has tried to understand how children evaluate their own understanding with respect to revision and according to those reports, elementary school students appeared to exaggerate how well they or another individual comprehended information that was actually vague (Dickson, 1981; Markman, 1977, 1979). Markman (1979), doing research on the method through which children perceive their confidence in a certain subject matter, asked students in third and sixth grades to read essays that contained conflicting information. She discovered that students in both grades frequently ignored the inconsistencies and reported that the essays were understandable.

The effect of a peer's review on the academic performance of a student has been a part of academic inquiry for the last decade. A lot of scientists in L2 writing have discussed the positive results of peer revision. Rollinson (2005) found that peer input was successful in university level EFL students in Spain, with 80 percent of peer feedback comments being considered legitimate and 65 percent being acted on. In 2004, Saito and Fujita looked into the feedback provided to EFL students at a Japanese university. Although it can be argued that these results are only limited to the discipline of learning languages, the results take into account learning and revision of a new concept, which can be applied to many disciplines. In the context of language learning, again, Srichanyachon (2011) discovers that self-revision seems to be the least effective approach for achieving efficient revisions. In comparison to peer revision results, it has a lower effect on students'

engagement and language abilities. The students understand the value of peer review. It allows students to see fresh concepts and become more motivated to better their writing, demonstrating its utility in a classroom environment.

If anyone is a procrastinator when it comes to learning, group revision can be a benefit since they will at least spend time practising with the group. Even so, a sense of responsibility to the community will encourage you to better prepare on your own. By discussing course material and engaging in learning events, one will actively learn the course material they are supposed to learn (linnbenton.edu). Roskosa and Rupniece (2016) examine this particular inquiry, but in the context of students who are learning about translation. According to Roskosa and Rupniece (2016), professionally structured group work is a very effective way to build students' translation skills because it allows them to popularise diversity – students learn from each other, consider their group mates' points of view, gain new knowledge, and thus improve the quality of translation. They give the lecturer a central role in the moderation of group revision, and understand them to have an important role in mitigating the differences between students in a particular study group. Since group work has both benefits and drawbacks, lecturers should ensure that the requisite prerequisites for productive group work are in place, and students should develop their skills and expertise in order to use group work in the process of translation in the most professional manner possible, addressing the disadvantages while focusing on the benefits

CONCLUSION

In this paper, we identified one of the most relevant questions in the dynamic field of mathematical pedagogy, which is whether group revision or self revision is a superior means of revision and which one consequently leads to better academic performances. In this paper we highlighted the relative advantages and disadvantages of both by means of analyzing existing literature. While self revision offers advantages such as studying at one’s own pace and flexible study scheduling, and is perhaps more suitable to students who are introverted or uncomfortable in group settings. Group revision on the other hand encourages not only finding solutions and clearing misconceptions amongst peers, but also makes learning enjoyable and has significant social benefits.

While most authors acknowledge that it ultimately it boils down to an individual student’s preference, the majority of authors agree in most settings, group revision is superior to individual revision and recommends that schools and/or educational institutions adopt group revisions as a matter of routine pedagogy

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