SCIFARI: Exploring the Effectiveness of Team Teaching in Science on Middle School Students

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Abstract

In the Middle School Science department at Mallya Aditi International School, Bangalore, India, a team of teachers designs and delivers course content to enhance learning experiences. The pedagogy of the Middle School departments includes deliberations among the team regarding lessons, hands-on activities, experiential learning opportunities and evaluation processes before and during implementation. This has been a positive experience for teachers who came in from conventional teaching models, with high student teacher ratio and limited support for students. We believe this practice has benefitted students. However, we were curious to understand how Science team teaching was perceived by our students in the academic year 2022-23 (post 2 years of virtual learning during the pandemic). 133 of our Middle School learners completed an anonymous survey to describe the effectiveness of science team teaching. Students' responses were recorded quantitatively and qualitatively. Largely, the emergent themes were a positive attitude towards team teaching (122 responses). the opportunity to clarify doubts individually (95), an appreciation of different teaching styles (71) and engagement in well-organised collaborative learning activities (125). Nonetheless, 17 students feel intimidated and overwhelmed in relating to multiple teachers, and 39 students reported being constantly observed, but acknowledged improved class management. We concluded team teaching can enhance learning by lowering students' emotional barrier to communicate freely, meeting individual needs in the classroom, and catering to different learning styles. Combining our study of student perspectives and our teacher experiences, we have compiled suggestions for teachers looking to implement team teaching successfully in their classrooms.

Keywords: Team Teaching, Science Pedagogy, Student Perceptions, Resolving Conceptual Doubts, Supportive Learning Environment



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Introduction

In the ever-evolving world of education, innovative approaches to teaching have gathered significant attention. Among these approaches, team teaching stands out as a method that involves the collaborative efforts of multiple educators working together within a single classroom. This change from the traditional model, where a single teacher addresses a diverse group of students, has generated interest due to its potential to revolutionise the learning experience.

Team teaching comes in various models, each offering distinct advantages. One such definition, as quoted by Johnson and Lobb (1959), characterises team teaching as "a group of two or more persons assigned to the same students at the same time for instructional purposes in a particular subject or subjects." Helms et al. (2005) reported that students who were lacking communication abilities such as "interpersonal, oral, and written skills," contending that these students benefit from team-teaching methods as a way of addressing these problems.

Vogler and Long (2003) presented diverse models of team teaching such as faculty from various departments presenting cross-disciplinary classes, several faculty who are teaching a particular section teaching one course together or each member of a team of faculty teaching one area of a specific course.

Another model, as proposed by Cunningham (1960), introduces the 'Associate type' of team teaching. In this arrangement, there is no designated leader; rather, leadership emerges from interactions among individuals and within given situations.

However, the implementation of team teaching has faced challenges, ranging from a shortage of teachers to issues stemming from defunding. Despite these obstacles, the merits of team teaching have compelled educators to explore its potential benefits further. To this end, our research delves into the realm of team teaching, with a specific focus on its applicability within the middle school context.

Recognizing the need to explore this method from a fresh perspective, our study centres on the perceptions of one of the most important stakeholders: the students themselves. By engaging directly with students, our aim is to uncover insightful perspectives that impact team teaching on their learning journey. Through this exploration, we seek to provide valuable insights that shed light on the advantages of team teaching as perceived by middle school students.

In the following pages, we will present a comprehensive analysis of the benefits that team teaching brings to middle school students. Our discussion will encompass how this approach enhances comprehension of intricate concepts, amplifies engagement within the classroom, cultivates a nurturing learning environment, and facilitates the integration of diverse teaching methodologies. Drawing from the results of an anonymous survey conducted among middle school students, we reveal a compelling narrative that underscores improved learning outcomes and enriched educational experiences.

This study not only contributes to the body of research on effective teaching practices but also serves educators and educational institutions striving to optimise their pedagogical strategies. By embracing the voices of our students, we empower ourselves to construct

classrooms that genuinely resonate with their needs and hopes. In this academic paper, we invite you to begin a journey that sheds light on the symbiotic relationship between team teaching and student advancement. Join us as we navigate the details of collaborative education, utilising its advantages to transform them into real educational success.

Research Objective and Methodology

Our school's history of team teaching can be traced back to the 1980s when a group of visionary educators recognized the potential benefits of collaborative teaching. With a steadfast commitment to innovation, team teaching has gradually evolved into a well-established and widely adopted practice across our educational institution.

As devoted educators, we have personally borne witness to the remarkable effectiveness and multifaceted advantages of the team teaching model. Supported by extensive academic research, team teaching has been shown to greatly benefit teachers by enhancing classroom management, deepening subject understanding, providing individualised support, fostering collaborative learning opportunities, and encouraging the implementation of diverse teaching approaches.

"Team teaching assumes that the 'whole' of the participants, working together, will make a greater contribution than the 'sum' of the participants working alone" (Davis, 1966,p. 2).

However, while there is robust evidence supporting the benefits of team teaching from a teacher's perspective, there has been a notable lack of comprehensive information regarding how students perceive team teaching instructional approach.

To address the lack of comprehensive information regarding how students perceive team teaching, we conducted a survey to gain invaluable insights into their experiences. Our endeavour involved the implementation of an anonymous survey among 133 middle school students, specifically targeting those in grades 6, 7, and 8.

The survey's design was meticulously crafted to delve into various dimensions of team teaching from the students' unique perspectives. We sought to provide a comprehensive understanding of their thoughts and feelings about this instructional approach. To achieve this, the students were encouraged to participate candidly, expressing their honest opinions and experiences.

The survey comprised a series of thoughtfully crafted questions that enabled students to rate their classroom experiences with multiple teachers on a carefully calibrated spectrum, ranging from 'strongly agree' to 'strongly disagree.' This rating system allowed for nuanced responses, offering students the flexibility to express the extent to which they agreed or disagreed with each statement.

The questionnaire explored several key aspects of team teaching, aiming to gauge its impact on the students' learning journey. In particular, we sought to understand whether team teaching facilitated a more comfortable and conducive environment for students to ask questions and seek clarification. We were eager to discover if the collaborative teaching approach contributed to their better comprehension of challenging concepts and if it aided them in making meaningful connections between different subject areas.

To gain a comprehensive understanding of their experiences beyond mere quantitative data, we also incorporated open-ended questions into the survey. These open-ended questions allowed students the freedom to share their personal experiences, provide additional insights, offer suggestions, and voice any concerns they might have had regarding team teaching.

With the data collected, we adopted a comprehensive analysis, combining both quantitative and qualitative methodologies. The quantitative aspect allowed us to discern statistical trends and gain an overall overview of the students' responses. At the same time, the qualitative analysis involved a meticulous examination of the open-ended responses, skillfully coding them to uncover emergent themes and gain profound insights into the students' specific experiences, thoughts, and opinions.

The implementation of the survey provided us with a diverse range of perspectives and reflections from the students, ensuring a well-rounded assessment of their experiences with team teaching. Through their participation and candid responses, we aimed to uncover valuable insights that would enable us to further enhance and refine our team teaching practices to better cater to the students' needs and create an even more enriching learning environment.

Upon examining the survey outcomes, a myriad of themes emerged, showcasing the students' genuine appreciation for the team teaching model:

- 1) Enhanced Learning Environment: Students conveyed their delight in the positive and collaborative classroom atmosphere, which significantly contributed to an engaging and enjoyable learning environment.
- 2) Amplified Understanding: Many students expressed how team teaching facilitated their comprehension of complex concepts through the diverse explanations and perspectives offered by multiple teachers.
- 3) Personalised Support: The students found solace in knowing they could approach different teachers, each with their unique strengths, for personalised support and guidance.
- 4) Cultivation of Collaboration and Interaction: The team teaching setup fostered greater student-to-student and teacher-to-student interaction, leading to increased participation in group activities and meaningful academic discussions.
- 5) Embrace of Varied Teaching Styles: The students appreciated the diversity in teaching approaches, catering to their individual learning preferences and ensuring a well-rounded educational experience.
- 6) Building Positive Teacher Relationships: Witnessing educators collaborating harmoniously, students felt a strong sense of rapport with their teachers, contributing to a positive and nurturing learning environment.

Data Analysis

The following findings present a comprehensive analysis of the data gathered from the survey conducted. As this survey was designed to elicit valuable insights and perceptions from a diverse group of students, by employing both quantitative and qualitative research methods, we sought to gain a holistic understanding of the student's perspective of team teaching and uncover nuanced patterns and individual perspectives.

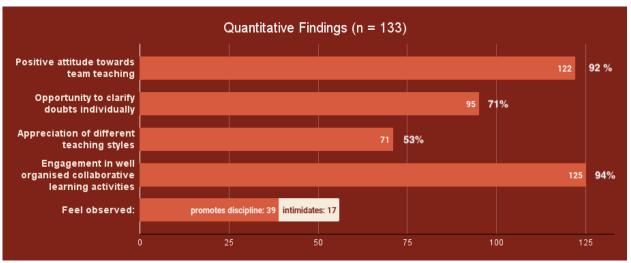


Fig 1: Qualitative findings of the survey

Fig 1 represents the qualitative findings of our survey. It is clearly evident from the graph that 92 percent of the surveyed students exhibited a positive attitude towards team teaching. These students perceived this practice as a favourable approach to teaching. 71 percent of the students considered team teaching as a valuable opportunity to clarify doubts as it helps them gain a better understanding of a concept. 53 percent students emerged as open-minded and understanding that each teacher has their unique strengths and approaches to teaching. These students appreciate the expertise of each teacher and acknowledge the diverse perspectives they bring to the classroom. The forefront of the findings – 94 percent of the students agreed that collaborative activities are well-organised when multiple teachers conduct them as opposed to a single teacher. Activities provide an excellent opportunity for all students to actively participate, observe and reflect, although sometimes it can present challenges that lead to chaos. However, team teaching facilitates the implementation of small workstations, enabling the majority of students to stay engaged, giving them less scope to get distracted. The study by Wellington (1998), identifies three main domains that justify the implementation of practical work or hands-on activities in education: the cognitive, affective, and skills and processes domains. Within the cognitive domain, practical work serves as a powerful tool to illustrate, verify, and affirm theoretical content. By engaging in hands-on activities, students can 'visualise' scientific laws and theories, leading to an enhanced understanding of scientific concepts and promoting their overall conceptual development. Transitioning to the affective domain, Wellington argues that the motivating and exciting nature of practical work can ignite students' interest in science. This heightened interest not only contributes to better lesson retention but also cultivates improved memorization abilities. Lastly, practical work resides within the skills and processes domain, offering the potential to develop transferable skills essential for future scientists as well as students pursuing diverse career paths. Wellington emphasises skills such as observation, measurement, prediction, and inference that are honed through active participation in hands-on activities. Despite the potential challenges that practical work might pose, such as occasional chaos, collaborative teaching techniques, including team teaching and small workstations, can effectively manage these issues, ensuring a focused and engaging learning environment for all students. While the results of this study aligned with the perceptions of the teachers, it is worth noting that 56 percent of students held a different perspective regarding team teaching. Among them, 36 responses were positive to the feeling of being observed, whereas a noteworthy 17 responses indicated the feeling of being intimidated by the presence of many teachers in the classroom.

With the qualitative findings of our survey, we sought to capture the unique insights, benefits and challenges students associate with team teaching. The qualitative responses were gathered, systematically analysed and carefully organised. For this analysis, we identified eleven keywords from the responses given for open-ended questions. Thematic analysis was employed to identify patterns, concepts and meanings within the data to be able to build meaningful codes.

The coding process revealed several prominent themes that emerged from the analysis, encapsulating the students' perspectives on team teaching.

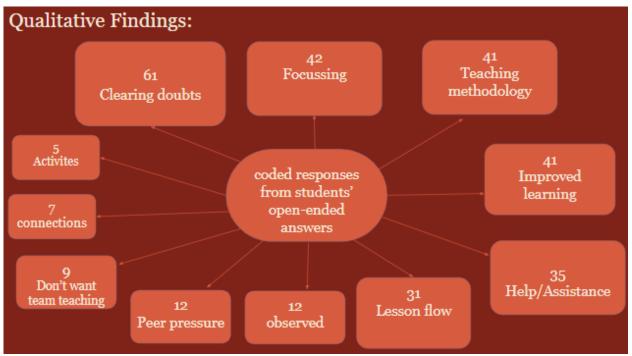


Fig 2: Qualitative findings with the coded keywords

It was clearly evident that there were remarkable similarities between the quantitative and qualitative findings. Many students emphasised the increased availability and support they received through team teaching. They reported feeling comfortable seeking assistance and clarification, without having to worry about peer reactions to their questions. They also mentioned benefits of receiving personalised attention and feedback, leading to improved learning. According to John Hattie and Helen Timperley (Hattie, J., & Timperley, H. (2007), feedback is information provided by an agent (e.g., teacher, peer, book, parent, experience) regarding aspects of one's performance or understanding. It occurs typically after instruction that seeks to provide knowledge and skills or to develop particular attitudes. In the view of Locke and Latham (1990), feedback plays a pivotal role in enabling individuals to establish realistic goals and monitor their progress towards these objectives. This ongoing assessment allows individuals to make necessary adjustments in terms of effort, direction, and even strategies to ensure goal attainment (p. 23). In our survey, students also recognised the importance of team dynamics between the teachers to maintain an organised and cohesive classroom environment which allowed them to focus better, by avoiding distractions. They appreciated the diverse teaching styles brought by teachers in a team-taught class. They acknowledged the benefits of different instructional techniques, engaging activities, catering to their individual learning preferences and needs. Students also highlighted their challenges with the team teaching model as presence of multiple teachers made them feel anxious and expressed their interest in other teaching models.

These findings have the potential to make a meaningful impact on how team teaching can be tailored to meet the unique needs of the student groups and encourage further exploration of this intriguing area of research.

Theme 1: Clearing Doubts

In examining the themes that emerged from student responses, our primary finding was that students are able to ask questions and clear any doubts they may have as they are learning when in a class taught by a team of teachers rather than a singular teacher. This response is highlighted in 121 of 133 likert scale responses and in 62 individual qualitative responses. The strength of agreement among the students across grades, classes and science classes allowed us to conclude that this theme was perhaps the most important and interesting finding of our survey.

Students marked their agreement to the statement "I get my doubts clarified/extra questions answered, without having to ask in front of the entire class and disturbing the flow of class discussion."

In their qualitative responses to open-ended questions they describe a class experience where one teacher is leading class discussion, lecturing or facilitating an activity while the others are moving around the room to support students and answer their questions. Students make specific reference to this arrangement allowing them to feel "more comfortable" in class, and "get help" when struggling. Students connected the experience of being able to clear doubts to three specific phenomena. 31 students said that they were able to ask questions in class while a teacher was lecturing or leading an activity without disrupting the rest of their classmates. 12 students said that they appreciated being able to ask questions without the scrutiny of their peers. 7 students said that the presence of teachers of other subject areas in the room facilitated their making connections between science subject areas.

Since students are asking more questions and clearing more doubts within a team teaching model, we must explore possible benefits to students in the process of asking questions. Chin and Osborne (2008) highlighted three key benefits to students as they ask questions. They studied the role of student-questioning in the science classroom, and were able to document students' experiences of a learning opportunity that encourages questioning. They found that when students are developing their questions, they activate their prior knowledge. Students must connect knowledge they already have to the content being presented to them in the lesson to ask questions. Very often this process involves students being able to make connections between areas of the subject, different subject materials entirely and between their lives and the classroom. These connections are valuable as they centre the pedagogical principles of 'constructivism' (Dewey, 1966) which places student interests and needs at the center of their educational experiences. Chin and Osborne also found that the process of asking questions requires students to focus their attention on the primary themes being taught. Finally, in asking questions students are practising the beginning stages of critical scientific questioning. These phenomena evidence the strength of questioning in the classroom. As the teachers in a room both teaching and supporting classes, students' questions about the content being taught provide us very valuable data about the extent of student understanding, their application of learnt concepts and the connections they are making inside and beyond the classroom.

When students have asked a teacher a question, the teacher answers the question immediately-building up, and adding to students' content knowledge, and confidence in their knowledge and skills. All the sciences are interconnected, as are the topics within each of them. When a students' understanding of a topic is hampered by a miscommunication, a misunderstanding or a challenge faced by the student in the moment of learning, this seemingly small tear in the fabric of learning grows exponentially with the passage of time. Everytime the class makes reference to, relies on or connects new content to a missing piece of content from a students' understanding- that student's understanding of the subject, interest in it, and connection to the subject matter reduces.

The formative information collected during this process of being asked and answering questions is used by our team of teachers to inform the need for individualised student support through scaffolding and additional learning opportunities, and future lesson planning. Being in conversation with our students this closely allows us to receive constant feedback about their understanding and any challenges they might be facing. These conversations with our students allow us to forego the traditional exit and entry ticket system as well. We are able to check understanding, and also check-in with students who might be struggling to keep pace with the class. Teachers will also often use these fleeting opportunities to ask students how they're doing- emotionally, mentally and academically, building consistent and strong channels of communication between the team of teachers and each student.

Theme 2: "Feeling Watched"

Another interesting and prominent theme that demanded attention was the feeling of being watched in presence of multiple teachers in class. The mention of the feeling occurred both in qualitative and quantitative responses frequently.

The quantitative question, "I do not learn effectively in the presence of two or more teachers because," was responded to 56 times, with multiple choices available for participants to select from. Out of 56 responses 39 emphasised on the feeling of being watched in a team taught class and 17 of them clearly expressed their discomfort with this arrangement as they felt intimidated. Further using the open ended questions in the qualitative part of the survey, valuable insights were gained on dynamics of this feeling.

The qualitative findings revealed a diverse range of emotional responses among students regarding the feeling of being watched in the classroom. While 42 students reported that the perception of being observed by team teachers helped them stay focused and motivated, 12 expressed feelings of anxiety and self-consciousness in their descriptive response.

Those who perceived the presence of multiple teachers as supportive advocated its capacity to instil a sense of responsibility among students. The study discerned that within a team of teachers, students perceived a heightened level of accountability for their learning progress and contributions. The students' awareness of being observed by multiple teachers appeared to have a positive influence on their ability to engage effectively, prepare, complete and maintain the overall quality of the work assigned.

"I think that science is more engaged at more focused when a team of teachers is there. I feel like we also get more work done."

"It's very rare when there is only one teacher during science classes it's about the same but I don't think that we get as much work done."

They reported a compelling correlation between the presence of multiple teachers in the classroom and heightened student focus. The responses collected through the survey significantly indicated that the feeling of being observed contributed to improved student concentration during middle school science lessons. The presence of more than one educator appears to reduce the potential for student disengagement and encourages them to remain attentive throughout the class. The collaborative teaching approach facilitated by team teaching not only captured students' attention but also encouraged their active participation in discussions and activities.

"With a team of teachers, I am always more concentrated because I am being observed at all times and the entire class is also less distracted which helps make learning a little more efficient and productive. When there is only one teacher teaching a topic, it is often hard for them to teach and make sure the class isn't distracted at the same time and my focus also goes much lower."

They expressed that knowing someone was watching them led them to experience an additional level of pressure to their advantage. This made them pay closer attention to their actions, and stay on task. They also mentioned the utility of this feeling in reducing peer distraction and being mindful of their class behaviour. For some students individualised attention was reassuring and aided them in gaining more confidence in the ways they chose to complete the task.

"With a single teacher you understand a little less because there is more talking but when there are two or more teachers you are under more pressure and feel like your always being watched so you do your work."

"I feel without a teacher I feel more free but when I do different things instead of doing the assigned work I also feel more confident when there is a teacher around me."

Sari,et.al. (2020) have shed significant light on the intricate relationship between students' learning concentration and their academic performance. The authors state that "Learning concentration is a concentration focus of thoughts and deeds on a certain object to reduce or set aside things that are not related to the object studied. The poor quality and learning achievement of students are mostly caused by the weak ability to concentrate while studying. The common problem of the students is having a branched mind while learning." These insights closely resonate with our own research findings, fortifying the notion that sustained attention within a team teaching model positively impacts learning outcomes. The corroborating findings of the mentioned paper provide a broader context to the significance of our study and emphasise the consistent influence of concentration on learning achievements.

In contrast, some students expressed feelings of being observed and scrutinised was intimidating and amplified their self-awareness. The feeling of self-consciousness hindered

their ability to freely express themselves and participate or contribute to discussions, as they felt their responses were being closely monitored. It was reported that these emotions led to increased anxiety levels among some students as the presence of multiple teachers was perceived as an added layer of evaluation, which influenced their behaviour and engagement. For some students this arrangement was a plausible source of confusion as well as distraction while learning. Moreover, students' comfort levels varied depending on their familiarity with the team teachers. Those who had established rapport with the instructors were generally less affected by the feeling of being watched.

"With a team of teachers I fell a bit anxious and nervous but the good side is that they give us each individual attention and I'm sure some people would not want teachers to see secret things they do during a class. I bet most of the people will like one teacher to teach because he won't give individual attention and they will not see some misbehaviours we do. So I think a team of teachers is beater even if some people feel like me."

The different feelings expressed by students highlight that the influence of being observed in team-taught classes is personal and changes depending on individual traits and learning styles. These results emphasise the significance of acknowledging and dealing with students' distinct emotional requirements within team teaching settings. This aims to establish a harmonious and encouraging environment that promotes both participation and mental wellness.

Building upon the discoveries of this study, several avenues emerge for potential future research endeavours. One such avenue involves delving into the correlation between the increased student engagement observed within the team teaching framework and the subsequent improvements in their overall learning outcomes. A prospective approach to this could encompass a longitudinal study, thus facilitating an exploration of the enduring impacts of team teaching on students' academic progress.

In an effort to alleviate feelings of unease, we embarked on the academic year by elucidating the concept of team teaching to our students, underscoring our primary intention of augmenting their support. This proactive measure offers an opportunity to scrutinise how students' learning predilections align with team teaching methodologies. This alignment can be further probed through the judicious application of well-structured surveys. Furthermore, an intriguing trajectory for future research lies in the exploration of the intricate interplay between students' emotions and their subsequent learning and academic performance. Research in this direction could encompass an in-depth investigation into how various emotional states, such as motivation, anxiety, or enthusiasm, influence students' learning outcomes. By employing a comprehensive research design that amalgamates quantitative assessments with qualitative insights, a nuanced understanding could be unravelled regarding the ways in which emotional experiences either catalyse or impede students' cognitive engagement, knowledge assimilation and effective learning.

Conclusions

In conclusion, the survey provided valuable insights into the students' experiences with team teaching, affirming its positive impact on their learning journey. The themes that emerged underscored the significance of team teaching in creating an engaging and enriching educational experience for our students. The comprehensive analysis of their perspectives has

empowered us as educators to further refine and enhance our team teaching practices, ensuring that we continue to meet the diverse needs of our students while nurturing their curiosity, creativity, and passion for lifelong learning. By embracing the principles of collaboration and innovation, we endeavour to cultivate an environment where students thrive academically, socially, and emotionally, preparing them to be informed, compassionate, and capable leaders of tomorrow's world.

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