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Improving Engagement through Enhanced Inclusive Practices to Teach Science for Secondary School Students with Autism

Chris Mathew[1,2]

[1]Faculty of Science, St Mary's Coptic Orthodox College, Coolaroo, Australia
[2]School of Education and Arts, Australian Catholic University, Fitzroy, Australia
Email: c.mathew@stmarys.vic.edu.au

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Abstract

Students with autism are often neglected in a classroom setting within schools. Thereby, this proposed study will focus on using cooperative learning and differentiated instruction strategies to help year level 7 to 9 students with autism to initiate better conversations and social interactions within a classroom, and further utilise science inquiry-based lessons and group-oriented tasks to better understand the contents.

Keywords

Autism, Student Engagement, Enhanced Inclusive Practices, Science Education, Secondary School

1. Introduction

Autism Spectrum Disorder (ASD) or Autism is an impairment of neurobiological development, affecting the communication, social interaction and flexibility of a person (Mandy et al., 2016). It affects 1 percent of the world's population and has been observed to have several behavioural and emotional setbacks while actively engaging in an activity (Lerner, White, & McPartland, 2012; Mandy et al., 2016). Furthermore, students with autism show poor non-verbal body language (eye contact, hand gestures and facial expressions) and improper cooperative learning (Boutot & Bryant, 2005). It is also observed that autistic children fail to recognise and maintain friendship (Banda, Hart, & Liu-Gitz, 2010; Boutot & Bryant, 2005; Humphrey & Symes, 2013). In Australia, it is estimated that 1 in 100 children are diagnosed with autism, where studies indicating a drastic rise in diagnosis over the last decade (Garrad, Rayner, & Pedersen, 2019). This show-

cases that students entering mainstream education have a higher probability of being diagnosed with autism (Carnahan & Williamson, 2013; Carnahan, Williamson, & Christman, 2011; Garrad et al., 2019).

Carnahan et al. (2011) state that autistic students have strong recognition of words but experience greater difficulty in comprehending the text. Furthermore, as students' journey through mainstream education systems, their ability to read and follow instructions diminishes (Carnahan & Williamson, 2013; Carnahan et al., 2011; Mandy et al., 2016). This initiates the inhibition of functionality in maintaining proper conversations or interactions, which is often cited as inappropriate behaviour in a classroom. Hence, the need for educators to understand the uniqueness of ASD is crucial in planning inclusive classroom activities to maximise student engagement. Thereby this research study focus on the importance of improving communication between teachers and autistic students in enhancing inclusive practices to increase students' participation when working in small groups and individually, and also to report if modifications of assessment or classwork is of significance in increasing student participation.

2. Problem Statement

In a classroom setting, educators administer a behaviour management plan for observed inappropriate behaviour. This includes sending the student to the principal's office to manage the issue or implementing detention protocols to replace bad behaviour with much more tolerable behaviour. However, this is considered as an ineffective communication strategy for autistic students because the occurrence of the inappropriate behaviour continues to disrupt the classroom (Kossyvaki, Jones, & Guldberg, 2012; Kaff, Zabel, & Milham, 2007). Therefore, educators need to implement adult interactive style intervention (AISI) to know and understand how autistic students learn, and to meet their psychosocial needs such as love, fidelity, competency, hope, will, purpose, care and wisdom (McLeod, 2018). AISI has been proven to be successful among autistic students aged from 4 to 6 years old (Kossyvaki et al., 2012). However, no empirical data indicate the use of AISI for the benefit of autistic students attending mainstream education at secondary school.

The participation of autistic students is critically low compared to other intellectually disabled students (Fleury et al., 2014; McMahon, Cihak, Wright, & Bell, 2015). The exact reason for their low participation is idiopathic. However, a contributing factor is the inconsistencies in delivering explicit instructions while teaching science (Fleury et al., 2014; Knight, Smith, Spooner, & Browder, 2012). As a result, autistic students disengage themselves from classroom activities such as answering questions, making presentations and participating in group-oriented tasks (Fleury et al., 2014; Knight et al., 2012; McMahon et al., 2015). Thereby, this proposed study will focus on using cooperative learning and differentiated instruction strategies to help year level 7 to 9 students (age between 13 - 15) with autism to initiate better conversations and social interactions within a classroom,

and further utilise science inquiry-based lessons and group-oriented tasks to better understand the contents.

3. Theoretical Framework

Although various studies focus on the problems faced by autistic students, not many highlight the difficulties associated with teaching them and how to initiate communication (Kossyvaki, Jones, & Guldberg, 2016). Interventions are made in accordance to adjust child-like behaviour rather than changing the patterns of adult behaviour or interaction (Kossyvaki et al., 2016). This led Prizant et al. (2006) to argue the importance of adult interaction with autistic students in enhancing their communication. Though there are several approaches used in favour of developing social communication in autistic students, classifications are not so easy due to many taxonomical concerns. However, the two main established categories are behavioural/naturalistic model and the developmental/relationship-based model (Kossyvaki et al., 2016). The developmental/relationship-based model stresses the importance of adult style in developing social communication skills, where an adult responds to a student's attempt to communication, even if it is unconventional. In contrast, behavioural/naturalistic model prioritises in teaching specific skills and maintaining adult style interactive intervention as a secondary method to initiate student conversation in prompting students to elaborate their response (Kossyvaki et al., 2016).

Despite the obvious differences among the two theoretical models, the fundamental approach is the same, the new skill is taught with clear antecedent stimuli, where adults are predictable in modelling the interaction and provide prompts by instigating systematic reinforcement (Kossyvaki et al., 2012, 2016; Knight et al., 2012). The environment is set in enabling student learning to have strong affluence on the interaction between educator and student, where educators are advised to follow the students' lead in interpreting all communicative attempts by adjusting the language and social demand in developing the students' confidence in initiating communication. In addition to the two theoretical theories, educators need to embrace the transactional model of students' development and disability. This is to let communication shape and influence students' progress in a continuous and dynamic style, and so if communication breaks down, educators bear the same responsibility as the students (Kossyvaki et al., 2012, 2016).

4. Literature Review

The need for implementing better communicative method between teachers and students is crucial in understanding and practising inclusiveness, as this would help in implementing effective teaching strategies such as differentiated instruction, scaffolding and cooperative learning in a science classroom (Ainscow, Howes, Farrell, & Frankham, 2003; Argyropoulos & Nikolaraizi, 2009; Cook, 2004; Howes, Frankham, Ainscow, & Farrell, 2004; Huebner, 2010; Juma, Leh-

tomäki, & Naukkarinen, 2017; Knight et al., 2012; Lewthwaite et al., 2015; Mathew, 2022; Messiou, 2018; Minds, 2014; Keeling, 2020; Slavin, 1988, 2014; Tragoulia & Strogilos, 2013). Mandy et al. (2016) express several considerable challenges encountered by autistic students while transitioning from primary school to secondary schools such as the increased risk of being bullied and teachers neglecting student needs by ignoring their low participation rate and intellectual capacity.

In a primary school setting, students are accustomed to a stable group of peers, where classes are managed by a single teacher, usually in the same room. However, a secondary school setting demand much more independent and academic integrity from students, where each subject is taught by a different teacher at a different classroom, requiring students to move around the school campus throughout the day. This can be cited as a major ecological shift because of the number of demands required by the student to facilitate various social, intellectual and organisational skills (Gillies, 2016; Slavin, 2014).

To better appreciate inclusiveness, Tragoulia and Strogilos (2013) suggest action research as means to explore the vast potentiality of inclusive practice, and the steps to conducting action research include planning, acting, observing and reflecting. In implementing action research, Ainscow et al. (2003) understood there were conflicts between values and goals, where the inclusive practice is not just a mere educational terminology rather a shift towards notions of empowerment, emancipation and equity. This led Cook (2004) to seek an alternative to existing inclusive practice by emphasising on pedagogical practice. In contrast, Howes et al. (2004) and Argyropoulos & Nikolaraizi (2009) argue the impact of classic pedagogies on personal and institutional values due to the factual focus given to educational access rather than acknowledging students of various cultures and disabilities.

Huebner (2010) and Mathew (2022) expresses that today's classrooms are filled with many culturally diverse students and thereby possess various cognitive skills, in which their background knowledge and learning pattern can also differ. Hence, making the curriculum content smaller and differentiating the lessons can further benefit the learning of all students (Gillies, 2016; Juma et al., 2017). Huebner (2010) suggests that differentiated instructions can help deliver effective teaching to the student's zone of proximal development, where students can express their knowledge without having external assistance. Differentiated instruction that caters students' strength can further develop logical reasoning and influence students to understand the subject contents more clearly. Lewthwaite et al. (2015) believe that differentiated instruction help with enhancing the existing relationship between teacher and student, which can reduce the gap to learning. The author also believes that students bring a set of beliefs and skills gained from their life-experiences and when teachers become the link between their thoughts and creativity can further help them transition into their classroom and learn efficiently (Mathew, 2022).

In contrast Slavin (2014) and Gillies (2016) explains that cooperative learning is a widely used and recognised pedagogical practice which enables much more socialization and learning among students of pre-school all the way through to tertiary studies. Gillies (2016) agree with Mandy et al. (2016) that students working in groups to achieve a common goal, completes the set task, and suggests that this pedagogical practice is much more effective than any interpersonal competition and individualistic efforts as there were no significant differences among them. The author also states that the results obtained consistent across all major subject areas including language, arts, reading, mathematics, science, social studies and physical education.

This urged Juma et al. (2017) observed and reflected on their pedagogical practices by analysing qualitative interviews, and this generated a better inclusive practice, but improving student engagement was of higher significance in closing the gap to learning. Furthermore, some barriers such as peer victimisation and high anxiety can be evident among autistic students. Thus, both clinical and indirect empirical data suggest that autistic students find it challenging to cope with the expectations, but there is limited evidence to make this statement. Hence, this proposed study demands action research to better understand inclusiveness using effective communications, and how this pertains to implement specific teaching strategies such as differentiated instruction and cooperative learning to improve engagement among autistic students in a mainstream secondary school setting while teaching science.

5. Statement of Aims

- To identify the key differences between differentiated instruction and cooperative learning and its benefit on student learning.
- To determine if cooperative learning theme can help autistic students learn effectively.

6. Research Questions

1) How can improved communication between teachers and students enhance inclusive practices?

2) How does arranging students to smaller groups, enable them to learn better?

3) Do students with autism learn better in a cooperative learning theme, if the set tasks and assessments are adjusted to suit their needs?

4) How does improving autistic student engagement benefit their learning?

7. Hypothesis

It is hypothesised that students with autism will be able to learn efficiently under a cooperative learning theme if the set tasks and/or assessments are moderated to suit their need while working in a small group. This will further improve their social interaction and comprehension skills in completing the set tasks and/or

assessments.

8. Methodology

This study is designed to take place during a 12-week placement to determine how the variations in teaching strategies can help students with autism in years 7 to 9 learn the subject content effectively by using teaching methods such as differentiated instruction and cooperative learning while improving their participation. The steps that formed this action research was planning, acting, observing and reflecting as described by Tragoulia and Strogilos (2013). The proposed study will analyse the data both quantitatively as a 2-cycle format, where data collection will be repeated twice.

9. Ethical Consideration

The proposed study will be introduced to the school, where the placement is scheduled. The school principal, supervising teacher and the science faculty members will be made aware of the project and also in seeking their assistance to know and understand how students learn. Their valuable suggestions will also be mandated for the collection of the data. Furthermore, parents of the autistic students will be contacted for their consent. While implementing cooperative learning theme, autistic students will be assigned to a group of students, who have similar interests. The group will also be notified of the moderation of set task and assessment made for the student with autism.

10. Participant Selection and Recruitment

Upon contacting the school, the principal and faculty members, all year 7 to 9 students aged between 13 - 15 studying science will be the participants for the proposed study and only the data of autistic students will be recorded as the title suggests improving the participation of autistic students and if this pertains them to learn efficiently. The number of autistic students may vary but the expected minimum is 6 as illustrated in various research studies.

11. Method

11.1. Planning Phase

Most common concerns regarding autistic students will be gathered by utilising an individual education plan by considering possible strengths and interests. Student learning needs will be observed while teaching the subject content using a strategy known as differentiated instruction. This method of teaching is used as the control because it is the most widely used strategy in classrooms. Furthermore, the participation of autistic students will be observed to analyse the gaps to learning to avoid other derogatory issues concerning them to maximise their social interaction and comprehension skills, while facilitating classrooms as a haven for them to feel safe and valued while conversing with the teacher and other students.

11.2. Acting Phase

Cooperative learning theme is introduced to all students, where curriculum content is differentiated and organised into activities to structure as an 8-way intelligence (space & vision, naturalist, musical, logic & mathematics, existential, interpersonal, bodily-kinesthetic and intrapersonal) criteria to engage various domains of student thinking (using MI/Bloom planning matrix), so various Bloom's taxonomical concerns can be addressed. It is proposed that moderations of set tasks and/or assessments using a SMART outcome helps with differentiating the main task into smaller do-able subtasks to identify its benefits on student learning. Cooperative learning is one of the test factors in this study because it acts as the independent variable in testing student participation and how this pertains students to learn effectively. Furthermore, students are arranged into groups, because theory suggests assigning students into smaller groups will help them understand the subject content and also in completing the set tasks efficiently.

11.3. Observing Phase

Considering student participation as the priority, activities will be implemented under the cooperative learning theme, to test whether students with autism can learn better by assigning them into smaller groups. As this preferred teaching strategy is repeated, the frequency, count and effectiveness of the testing method in mandating inclusive practice can be determined to answer the four main research questions of this proposed study.

11.4. Reflecting Phase

While answering the four main questions, it is crucial to compare and contrast between teacher self-reflection and pedagogical practices in enhancing inclusive practice and how this pertains to improve participation among students with autism to reduce the gaps to learning.

12. Data Analysis

12.1. Data Collection

In this proposed study, data will be collected through topic tests, Kahoot quizzes and while students are participating in group-oriented tasks. The activities for conducting this project will be decided upon the unit outline set by the placement school because the Victorian curriculum for science in junior classes branches into four main streams such as Physical sciences, Chemical sciences, Biological sciences and Earth & Space sciences. The main objective of these four streams is to generate adequate scientific awareness and help students acquire the required knowledge to collaborate their ideas in understanding the topic contents, allowing them to make logical reasoning in solving the hypothetical scenario-based questions. In mandating these activities according to the four streams of science, students can gain science-inquiry skills that would help them

understand and achieve the lesson objective.

12.2. Statistics

Collected data will be analysed quantitatively and qualitatively. Numerical representation of the grade will be cross-referenced and categorised into the appropriate groups such as pre-test and post-test for each of the control and test variables, in this proposed study it will the teaching strategies such as differentiated instruction and cooperative learning. The analysis will consist of t-test and One-way ANOVA to be used with appropriate post hoc test including Bonferroni and Dunnets, for correction of multiple comparisons of the mean at 95% confidence level using Microsoft Excel and Graph Pad 7.0. To detect a minimum 50% shift in student participation, the standard deviation of 15 and $p < 0.05$; and 93% power is expected with n = 6. To detect the changes to student learning by moderating assessment tasks, a 30% standard deviation and $p < 0.05$, where 82% power is expected with n = 6. Finally, to detect the change in teaching variation for the appropriate strategy, a standard deviation of 1 (10%) and $p < 0.05$ with 88% power is expected with n = 6.

The quantitative data collected will be represented as a standard curve and qualitative data of student participation and satisfactory completion of set tasks/assessments will be represented in tabular format.

13. Discussion

Research rationale was formed for this proposed study through observations gathered while teaching science to students of year 9. The lessons were sequenced to teach parts of the human body by using various teaching strategies to understand the thought process behind formation of responses by students while they were working in small groups. This enabled to create and incorporate formative assessments, which are not graded because this is an unreliable tool due to considerations given to student attendance, participation and effort, which are not directly linked to student learning. However a gold or silver star was awarded to each student based on their performance. The size and colour of the star depends on their precise application of knowledge and key skills (Blakesley et al., 2019). Each student received feedback upon completion of tasks, so they can adjust their learning to meet their own expectational standard of learning, and it will help in collecting new and improved data to incorporate enhanced inclusive practices by implementing better teaching strategies (Brady & Kennedy, 2019; Francis et al., 2019; Lawrie et al., 2013; Lynch, 2015; Tanner, 2013; Thompson, 2020). Upon reflection, It is believed that cooperative learning pedagogical strategy can produce more significant improvement to students' participation in engaging with science content as they are focused in tasks involving conceptual understanding, problem solving, categorising and reasoning (Akin & Radford, 2018; Gillies, 2016; Kingsley, Townsend, Henderson-Wilson, & Bolam, 2013; McLeod, 2018; Milkova, 2020; Nelson, 2014; Slavin, 1988, 2014; Spencer, 2017;

Tangney, 2013; Wilson, 2018).

It was also observed that timely feedback generated better academic success among students. This may be suggestive of designed strategies captivating interest among students to learn the content and to understand their own learning patterns (Brady & Kennedy, 2019), and may also help teachers to collect data to support enacted teaching practices. McLeod (2018), Nelson (2014) and Spencer (2017) exclaim feedback need to be specific, so students are aware of teachers' expectations. In providing a generalised feedback students might not be able to check for improvements, and further implementation of strong virtues such as hope, will, purpose and competency while implementing each classroom task may help students to focus in task and also for teachers to approach the scenarios holistically (McLeod, 2018).

Milkova (2020) and Tangney (2013) indicate the importance of implementing student centred learning. Akin and Radford (2018), Tangney (2013) and Wilson (2018) iterate that effective teaching strategies can further build on student prior knowledge, generating purpose to active learning and sense making. Hence, it is hypothesised that cooperative learning strategy can help with improving participation among autistic students if they work in small groups and assessments are modified to suit their needs based on these observations.

14. Limitations/Delimitations

The major concern or limitation to this proposed study would be the reduced number of autistic students or none present in the designated year levels at the allocated school scheduled for placement. In contrast, if the parents of autistic students reject to consent their children to participate in this study would also be a significant limiting factor in obtaining the required data ethically and in submitting this study is another limiting factor due to many research studies requiring months to accumulate data for proper evaluation. Hence, the proposed study will need to be amended to focus on improving the participation of all students by enhancing inclusive practices and to evaluate its benefits on student learning, while teaching science in a secondary school.

15. Conclusion

Although the proposed study has not been established or attempted, teachers need to reflect on their pedagogical practices to enhance inclusive practice, so all students feel safe and valued. It is necessary to seek ways in implementing various teaching strategies such as cooperative learning theme in improving the participation of all students, especially the ones with a disability, because studying science is never easy as it is hard to comprehend the definitions and embedded messages within each topic but making the lessons engaging such as group-oriented tasks enable students to teach each other and understand the subject content much clearly, which helps them to achieve the set lesson objective and outcome to the best of their ability. Therefore, student participation may play a

crucial role in helping students close the gaps to their learning and it is evident to further extend this research to seek the answers in improving the existing inclusive practices to attain better student participation.

Conflicts of Interest

The author declares no conflict of interest regarding the publication of this paper.

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