

The perspectives of teachers on the importance of structuring the physical learning environment on development of social interaction among autistic learners in Vihiga County, Kenya

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ABSTRACT

Treatment and Education of Autistic and Communication Handicapped Children (TEACCH) approach has been widely adopted as one of the promising interventions for remediating learning problems encountered by children with Autistic Spectrum Disorders (ASD). There are limited empirical studies that have investigated the innovativeness of TEACCH as one of the intervention strategies for remediating deficits in social interaction among learners with ASDs in Vihiga in particular and Kenya in general. Teachers' voices and views on the potential of TEACCH in promoting social interaction are relatively inadequate. The purpose of this study was to assess the perspectives of teachers on the importance of structuring the physical learning environment on development of social interaction among learners with ASD in Vihiga County, Kenya. The study was guided by Development Theory. The study adopted descriptive survey research design. The study population comprised 229 respondents consisting of 21 head teachers, 65 teachers, 23 support staff members and 120 learners with Autistic Spectrum Disorder from all the twenty-four special schools within Vihiga County. The study used fishers' formula to obtain a sample size of 144 participants consisting of 13 head teachers, 41 teachers, 14 support staff members and 76 learners with ASD. Stratified random sampling was applied to select 144 respondents. Qualitative and quantitative data was collected using questionnaires, observation checklist and interview schedules. Factor analysis was used to test for validity. Tools were presented to experts in the department of educational psychology who judged their validity and they were refined based on experts' comments. Reliability of the instruments was established through test-retest coefficient for Cronbach's alpha. Physical restructuring and social interaction had a Cronbach's alpha value of 0.871 and 0.842 respectively which were all above 0.7. Data was analysed both qualitatively and quantitatively. Descriptive results revealed common challenges such as inadequate classrooms, poor desk arrangements and unclear instructions. The study concludes that well-structured physical environments play a significant role in enhancing social interaction among learners with ASD. It is recommended that schools improve classroom infrastructure to support learners' social development.

Key words: Perspectives of teachers, physical learning environment, social interaction, learners with ASD, Vihiga County, Kenya

I. INTRODUCTION

Autism Spectrum Disorder (ASD) is a developmental disorder that impacts individuals in specific ways, causing difficulties in the areas of communication, social encounters and the behaviors that they display. The severity of the symptoms associated with ASD impact an individual holistically throughout their development. The different severity of the characteristics of ASD in each individual is what makes ASD a spectrum (Holingue et al., 2018).

Autism is a disorder that impacts every aspect of the lives of those individuals with ASD. Prior to the DSM for autism, a diagnosis for autism required the manifestation of six of twelve symptoms for the individual. Those twelve symptoms were divided into three different categories: social interaction, communication and the presence of repetitive and restricted behaviors of those individuals with autism (Lord et al., 2020). Following the DSM for autism, however, those three categories have collapsed into two main categories for autism: the lack of social and communication skills of those individuals with autism, and the restricted behaviors of those individuals (Chambers et al., 2017). ASD students demonstrate qualitative impairments in their relationships with others.

The deficits in social interactions create difficulties for those students to understand the social interactions with others with ASD and to respond appropriately to those social interactions. In addition, ASD students struggle in the development of relationships and social interactions with others, leading to limited friendship networks among students with ASD. Furthermore, those without friendships often avoid interacting with others with ASD altogether (Linstead et al., 2017).

Autistic individuals often experience challenges with understanding and utilizing non-verbal communication, challenges with speech, issues with intonation and voice control, abnormal echolalic speech, speech that is repetitive and idiosyncratic with limited vocabulary, challenges with language comprehension, a tendency to become perseverant in some topics of discussion and general difficulties with utilizing language in social situations (pragmatics) (Gakii, 2024).

Recent reports indicate that in the United States alone, there are 560,000 children aged between 0 and 21 years with autism spectrum disorder (ASD). Given that the approximate ratio of children diagnosed with autism spectrum disorder (ASD) is 1 in every 150, this number is likely to increase. The widening of the diagnostic criteria and better evaluations impacts changes in the number of children diagnosed with autistic spectrum disorder. McCrossin, (2025) estimate that individuals with autism spectrum disorders (ASD) have high functioning IQs in the range of 48-52%, leaving 38% of this population undiagnosed. Academic goals can be met as early intervention programs are developed that positively change the trajectory of children with an autism spectrum disorder. Therefore, an exact demographic study of children with autism has yet to be done.

In Nigeria, as the number of school-aged children with ASD increases, the emphasis on academic achievement also increases. Reports indicate that 27% of autistic children spend less than 21% of their day in a general education classroom. Moreover, 21.5% of autistic students are expected to attend college, while 51.5% obtain a regular high school diploma and 17.6% drop out of high school (Kehinde et al., 2023). Thus, there is a growing need for programs aimed at assisting autistic children to tutor on par with their neuro-typical peers, as there has been an increase in children diagnosed with autism, as well as an increase in children expected to meet typical educational demands.

According to the South Africa Psychiatric Association, children with autism spectrum disorders (ASD) face an additional set of challenges due to their social and learning deficits. These difficulties are likely to complicate the demands of the curriculum. In spite of these challenges, the children are frequently placed in mainstream classrooms. In light of the increase of children diagnosed with ASD in recent years, the projection concerning the increase of children with special educational needs in mainstream schools is especially concerning (Chambers et al., 2017). While a number of children and youth on the ASD spectrum have been found to attain average or above average intellectual functioning, they may continue to have difficulty demonstrating the expected outcomes of the typical classroom, and may require additional support or adaptations in order to successfully complete the assigned tasks.

In Kenya, children with ASD have difficulty communicating and interacting with others in a socially appropriate manner. Between 30 and 50% of children diagnosed with Autism Spectrum Disorder (ASD) begin their education with very limited communication (Fuller & Kaiser, 2020). A large percentage of these children struggle to both understand and use spoken language (Fuller & Kaiser, 2020). Because children with ASD are unable to perceive and understand social cues, they continuously struggle with being in social environments. In addition, children with ASD are often socially awkward, which leads to their peers isolating and bullying them. This causes these children to frequently suffer negative emotional consequences. This social inexperience leads to additional anxiety as well as emotional adversity to children with ASD who are considered to be on the higher functions of the ASD spectrum (Francis et al., 2019).

The documented prevalence of autism in Kenya is estimated to be 4% though proper records are absent to support the stated figure. However, the actual cause of autism is unknown. Due to lack of adequate learning facilities, many children with this disorder are hidden away at home. For many years, Kenya has not put in place any education initiatives for people with autism. (Kadzo, 2017). The opening of an autism unit at the City Primary School, Ngara, Nairobi, in September 2003, with a donation of special catering equipment from the Safaricom Foundation, changed the trend observed in the previous years. Since then, Buruburu, Kasarani, Mathare Special and Ruthimitu School have also opened units, but it is still not enough, and the ones available still do not mainstream the autistic learners into inclusive education (Kadzo, 2017).

The diagnosis of Autism Spectrum Disorder within the Kenyan learning process is still within its development phase. Both formal and informal processes are used to diagnose learners with ASD. An ideal method for diagnosing learners with ASD within Kenya would be through the efforts of a multidisciplinary team of educators, psychologists and special education officers within the Educational Assessment and Resource Centre (EARC). However, this process is rarely completed within Kenya, especially within rural communities like Vihiga County. Thus, teachers within these schools are required to diagnose students with ASD, which requires observation of the effects of their behavior on the learners. Though these observations can help direct students to assessments to diagnose for ASD, the delays in such diagnoses are common due to the lack of available resources within these schools to complete such an assessment. Such a limit in diagnosing learners with ASD can act as an obstacle to the implementation of interventions like the TEACCH approach, which aims to recognize the needs of each learner (Kadzo, 2017).

The focus on the physical structuring of environments for children with autism involves the design of their environment, such as their classroom or playroom. Many children with autism struggle to differentiate between activities or to understand how the activities may relate to one another. Creating designated areas for activities like music, work, play and meals can help these children to understand the different activities that they are to perform (Lal & Shahane,

2011). As a result of incorporating these activities, the children with autism have a better understanding of their environments and of the relationship between various events in those environments (Lal & Shahane, 2011).

Social engagement for children with autism involves a comprehension of certain social norms. Social processing for these children includes the observation of others, the interpretation of those observations, problem solving in relation to those observations and the performance of actions that are deemed appropriate following this observation (Fuller & Kaiser, 2020). Overall, the ability to relate to others on a deeper level requires the development of numerous skills, the majority of which are developed during adolescence and adulthood. However, the development of the skills that allow for deeper relationships with others are skills that, when acquired, allow for the gaining of new knowledge and the diversification of a child's interests (Fuller & Kaiser, 2020).

The development of social skills causes a decline of repetitive behavior (Chambers et al., 2017). Less repetitive behavior can result in more participation in functional tasks, which helps one learn. There is a strong connection between the effects of social skill development and learning; this is most likely to result in an improvement to the learner's social skills and learning (Towson et al., 2017). The social skills of learners diagnosed with ASD influence the way they relate to and negotiate with their peers. An improvement in negotiation skills can lead to better peer relationships, which helps improve the emotional state and confidence of the learners, which also helps improve learning and academic performance (Francis et al., 2019).

In a study conducted by Khasakhala et al., (2014) on the correlates of behavior management strategies of learners with autistic spectrum disorders in primary schools in Western Kenya, the support offered by parents of students with ASDs was appreciated by a considerable number of teachers and teacher aides in coping with ASDs. This indicates the necessity of school-centered strategies that ensure assessments demonstrate an understanding of a child's development and the child's responses to a collection of actions that are well thought out and documented and that take into consideration the parents' preferences, feelings and knowledge.

The importance of physical structuring of the learning environment cannot be overstated because these are the specific dimensions that center on the primary concerns of learners struggling with ASD and their inability to self-regulate, socially interact and communicate. It is essential to consider the perceptions and practices of teaching staff on these dimensions because they are the main practitioners of the most beneficial teaching and learning practices, including TEACCH, for learners with ASD in their classrooms (Tiasari et al., 2020). If they do not appreciate the significance of these practices at all or do not understand them, students with ASD will experience increased social isolation, disengagement and inability to achieve learning outcomes. This is likely to culminate in increased school dropout, escalating behavioral problems and the loss of essential developmental milestones that are crucial for these learners. Hence, teachers' perceptions are the most important for the inclusion of children with ASD to strengthen their social and academic dimensions. Thus, the most valid and pressing need is to examine these teachers' perceptions.

1.1 Statement of the Problem

The growing incidence of children diagnosed with ASD is met with challenges from the education system in Kenya. While inclusive education is on the rise, there is a lack of training or approaches to assisting these children with their communication and socialization skills among the majority of educators in Kenya. There is a disconnect between knowing about the needs of special education students and having the knowledge of how to teach remedial education to these students. The Treatment and Education of Autistic and Communication Handicapped Children (TEACCH) were developed to improve the communication and social and flexible skills of children with ASD with evidence backing the methodology. The approach includes the arrangement of the learning environment for the students with ASD to encourage their self-sufficiency which subsequently allows them to develop their social skills, gross and fine motor skills, self-care skills and participate in various activities within their educational and social environments. Such an approach is currently a rarity in Kenya, and even if implemented within Vihiga County, is still lacking compared to the real TEACCH approach. For instance, teachers in Vihiga County use general special education teaching approaches that do not incorporate the TEACCH approach. As a result, these children with ASD struggle with communication, interaction and emotional regulation skills which adversely impact their social interactions and academic performance. Data collected from learners in Vihiga County with ASD symptoms indicates that 41.4% of these students drop out of primary schools altogether with 22.6% of these students performing poorly in school as only 26% of these students perform to the school average (Sadia et al., 2023). These statistics indicate the lack of social and adaptive skills that these students manifest which could be positively influenced by the use of the TEACCH approach to teach them how to manage their disorders. If not addressed, children with ASD in Vihiga County will continue to drop out of school at high rates, score low marks in their education, lack social interactions with others and be unable to live and work independently after they reach adulthood. The use of the TEACCH methodology for the improvement of the social interactions of children with ASD has been studied to some extent in various counties in Kenya. However, for Vihiga County, there is a virtual nonexistence of the implementation and use of this methodology in their schools. Teachers in these schools do not have any knowledge or understanding of the TEACCH approach as indicated by the lack of

organized areas in classrooms. Therefore, the main aim of this study is to investigate the influence of the TEACCH methodology on the social interactions of children with Autism spectrum disorder in Vihiga County, Kenya.

1.2 Research Objective

To assess the perspectives of teachers on the importance of structuring the physical learning environment on development of social interaction among learners with ASD in Vihiga County, Kenya

1.3 Research Question

How does the physical structuring of the learning environment influence social interaction among children with autism spectrum disorder in Vihiga County, Kenya?

II. LITERATURE REVIEW

2.1 Theoretical Review

The study employed Developmental Theory. The theory is also called Theory of Mind and it explains how individuals develop an understanding of the thoughts, beliefs, emotions and intentions of others. Learners with Autism Spectrum Disorder (ASD) often experience a delay in the way they develop and perceive ideas towards situations (Baron-Cohen, 1997). The limitations of individuals with ASD in relation to Theory of Mind also limit their abilities to engage in social interactions with others (National Autism Center, 2021).

From the perspective of Theory of Mind, schools and the classrooms in particular may have a critical role in facilitating the development of Theory of Mind in learners with ASD. Learners with ASD often require external cues to understand the social behaviors of others due to the difficulties inherent in their minds to understand others' thoughts and emotions. Therefore, incorporating theories of physical environments into the classroom, such as the TEACCH method, may help those learners with ASD to better understand others within the school structures and classroom. For instance, arranging the desks in a structured way in the classroom will help the learner with ASD to better find their peers, interact with them and develop a Theory of Mind regarding others and social interactions. Additionally, creating areas within the classroom for specific tasks will help those learners with ASD to understand the intentions of others and to develop their Theory of Mind skills.

However, learners with ASD do not all develop their Theory of Mind at the same rate. Thus, the structuring of the physical environments in the classroom may require some adjustments to ensure that the learners with ASD are experiencing success in implementing these physical modifications to the classrooms. Overall, then, the Developmental Theory can help explain how physical arrangements in the classroom could impact social interactions among learners with ASD. Classrooms that are arranged in ways that make social interactions difficult may limit the social interactions among those learners, while properly-structured classrooms may lead to the development of Theory of Mind and subsequent social interactions among those learners with ASD.

2.2 Empirical Review

The structuring of the physical space within the learning environment for learners with Autism Spectrum Disorder involves the design of the classrooms in ways that minimize sensory overload for the learners and maximize their engagement with the learning environment. This includes the creation of clear boundaries within the classrooms, the use of visual schedules, the organization of the seating arrangements within the classrooms for the learners and the minimization of potential distractions within those classrooms. The use of these types of structured environments for learners with ASD helps the learners to feel secure within their classrooms and to reduce their feelings of anxiety. According to the Developmental Theory, learners with Autism Spectrum Disorder often struggle with understanding social cues and behaviors of others. Consequently, structured environments for classrooms provide visual cues for learners to understand social interactions with others within the classroom. Zhao and Chen (2018) noted in their research that structured environments improve the social interactions of learners with Autism Spectrum Disorder.

The TEACCH approach to education for learners with Autism Spectrum Disorder includes the structuring of the learning environment for these learners. Sanz et al. (2018) conducted a study of parents and teachers of children with Autism in Spain who used the TEACH program within their classrooms. The researchers discovered that the introduction of physical structure into schools for learners with ASD improved the communication and social interactions of those learners. Virués-Ortega (2010) also discovered through a review of various studies of learners with ASD that structured teaching methods lead to improvements in the adaptive behaviors of these learners. Additionally, Hume et al. (2021) discovered that teaching methods that are structured lead to improvements in the social interactions of learners with ASD when implemented into the classrooms of these learners. These studies all indicate that the structuring of the classrooms of learners with ASD may help the learners to develop their social interaction skills.

Zhao and Chen (2018) also conducted a quasi-experimental study involving children with ASD in China. The study used a 12-week physical activity program for the children with ASD, and the results demonstrated improvement in the children's communication, cooperation, self-control and social interaction skills. The study concluded that structured programs positively influence the social development of learners with ASD. However, the study did not investigate the effectiveness of TEACCH interventions in classroom settings in Kenya.

Despite the benefits of structured teaching for children with ASD, the implementation of these strategies presents challenges in low-resource settings. For instance, studies have demonstrated the lack of training of teachers in strategies for ASD interventions, such as TEACCH. Additionally, overcrowded classrooms with limited resources make it difficult for teachers to implement these teaching strategies effectively. Thus, children with ASD in these classrooms may not benefit from these teaching strategies.

Riccio (2011) conducted a study on autism in Kenya involving the parents and teachers of learners with ASD. The study established that the use of TEACCH strategies for the physical structuring of classrooms improved the academic performance and classroom participation of learners with ASD. However, the study did not investigate the impact of the physical structuring strategies on the social interaction of learners with ASD. Despite the existence of policies that mandate the inclusion of learners with disabilities in Kenya's schools, many schools lack the trained teachers and resources necessary to implement TEACCH strategies with learners with ASD. Thus, the influence of TEACCH strategies for physical structuring of classrooms on the social interaction of learners with ASD in Vihiga County remains insufficiently explored.

Existing literature demonstrates the positive influence that the uses of structured learning environments have on learners with ASD in relation to their communication, participation and adaptive behavior skills. However, limited studies have explored the impact of physical structuring of classrooms on social interaction of learners with ASD in Kenya, specifically in Vihiga County. Therefore, there is need for a study that investigates the influence of physical structuring of the learning environment on the social interaction skills of learners with ASD in Vihiga County, Kenya.

III. METHODOLOGY

3.1 Research Design

In this study, the descriptive survey research design with qualitative and quantitative methods was employed to investigate the perspectives and practices of teachers in relation to social interaction among learners that have autism and communication handicap in Vihiga County, Kenya. This research design was appropriate for answering the research question as it allows the researcher to collect data in their existing environment and to explain the current situation in their area of study and acquire quantifiable data to analyze (Thomas & Lawal, 2020).

For the qualitative portion of the study, interview schedules were used to collect data about the experiences of the teachers and how they are implementing the strategies from TEACCH. For the quantitative portion of the study, a questionnaire was used to collect the perceptions of teachers regarding social interactions among students with autism and communication handicap. Using both qualitative and quantitative methods allowed the researcher to gather a more comprehensive study of the topic, as these methods provided both insights into numerical data trends and additional in-depth information regarding the topic of study (Siedlecki, 2020).

3.2 Study area

The research was conducted in the western parts of Kenya, specifically in Vihiga County. The county covers a square area of around 563 square kilometers, and consists of five constituencies within the area: Emuhaya, Hamisi, Luanda, Sabatia and Vihiga. The county is one of the most populated counties within Kenya, and the population is predominantly of rural dwellers. The majority of the county's residents are of the Luhya people, whose population are mostly young and include a high number of school-going children.

Vihiga County is faced with a variety of socio-economic problems. For instance, the majority of the county's population lives in poverty, and the county relies upon small scale farming as its main form of economic activity. Additionally, the level of literacy throughout the area is moderate, and most of the county's residents are not provided with access to information regarding developmental disorders like ASD.

Despite the county's population, Vihiga County does have a relatively high number of primary schools, as well as 23 special schools and one special unit that provides education to those of special needs, including those with ASD. However, the special schools in Vihiga County lack specific teaching and learning facilities for students with ASD, lack specialized educational materials for those students, and have relatively high ratios of teachers to students. Furthermore, there are not enough teachers within these schools that have special training in how to teach students with special needs or ASD.

The concept of disability in Vihiga County is somewhat different from the rest of the country in relation to the beliefs and attitudes of the people towards those with ASD. For instance, many of the people in Vihiga County are

unaware of the reasons for ASD, and have certain beliefs regarding its causes that differ from the accepted knowledge of the medical community. Such beliefs have led to the stigmatization of those with ASD within the county, and have resulted in the lack of provision of assistance to these students. Thus, these attitudes play a significant role in the use of strategies like TEACCH within the area.

The researchers concentrated upon the 23 special schools and the one special unit for students with ASD within Vihiga County. These schools and units can provide the background knowledge necessary to understand the implementation of TEACCH within the schools, as well as the effect that TEACCH can have upon the social interactions of students with ASD.

3.3 Target Population

The research study involved 229 participants that were recruited from 23 special schools and from one special unit within Vihiga County. The participants included 21 head teachers, 65 teachers, 23 support staff members and 120 learners with autism spectrum disorder (ASD). These groups were recruited as they are the groups of individuals that are either directly or indirectly involved in the care and support of these learners with ASD. The head teachers, teachers and support staff members are involved in the daily care of these learners. This is as illustrated within table 1 below.

Table 1
Target Population

Category	Target Population	Sampled Population
Head teachers	21	13
Teachers who handle learners with ASD	65	41
Support staff (matrons)	23	14
Learners with Autistic Spectrum Disorder	120	76
Total	229	144

3.4 Sample Size and Sampling Procedures

This study used fishers' formula that was adopted by (Kothari, 2014). The method is most appropriate in determining the sample size where the targeted population is less than one thousand hence will be employed in this study. Proportionate stratified random sampling was employed by the study in determining the sample size of each category of respondents.

The formula is given by $n_0 = \frac{Z^2 P(1-P)}{I^2}$ (3.1)

Where;

n - Desired sample size

Z – The normal standard deviation at the confidence level of 95% equivalent to 1.96

P - Proportion of the population with the desired characteristics

This study will assume 50:50, a probability of 0.5

I^2 - Degree of precision which is 5%

As the percentage of the population that had the desired characteristics were not known, $P = 0.5$ was taken. This is the general assumption made by statisticians regarding the population's variability in cases where the actual variability of the population is not known to the researchers conducting the study. Therefore:

$$n_0 = \frac{1.96^2 \cdot 0.5(1-0.5)}{(0.05)^2}$$

$$n_0 = 384.16$$

However, since the target population was less than 1000, the sample size adjustment was done using the formula

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}} \dots \dots \dots (3.2)$$

$$n = \frac{384.16}{1 + \frac{(384.16 - 1)}{229}}$$

$$n = \frac{384.16}{1 + \frac{383.16}{229}}$$

$$n = \frac{384.16}{1 + 1.67319}$$

$$n = \frac{384.16}{2.67319}$$

$$n = 144$$

This sample size is 66% of the total population. Collis and Hussey (2014) argue that if well chosen, samples of above 10% of a population give good and reliable findings. The sample size was distributed proportionally into the four categories as follows;

$$\text{Head teachers} = \frac{21}{229} \times 144 = 13$$

$$\text{Teachers who handle learners with ASD} = \frac{65}{229} \times 144 = 41$$

$$\text{Support staff (matrons)} = \frac{23}{229} \times 144 = 14$$

$$\text{Learners with Autistic Spectrum Disorder} = \frac{120}{229} \times 144 = 76$$

Simple random sampling was also applied in every stratum to pick the respondents who met the selection criteria as they were mentioned in the lists compiled from the school records and selected randomly to ensure that every individual who was to participate had an equal probability of being chosen for the study through the use of random number techniques.

3.5 Data Collection Instruments

3.5.1 Questionnaires

The quantitative data collection process involved the use of questionnaires that were distributed to headteachers, teachers and support staff in Vihiga County. Questionnaires were considered the most relevant in the survey as they are cheap and appropriate in obtaining information from a considerable number of individuals (Mazhar et al., 2021). Questionnaires give the respondent ample time to frame an honest answer to the questions included in the questionnaires. This ensures that the data collected is reliable and objective.

The teachers who participated in the study gave answers to the questions based on their experiences with students with ASD in the classroom. This ensured that the data collected reflected the real world application of TEACCH strategies. Additionally, since the questions were close-ended, it was possible to collect measurable data that would be further assessed through descriptive and inferential statistics. The findings from the data were presented in the form of tables and graphs for ease of interpreting the data.

3.5.2 Interview schedules

Interview schedules were utilized to acquire the primary data regarding the impact of the TEACCH approach on the social interactions of autistic learners enrolled in educational institutions within Vihiga County, Kenya. To conduct interviews for this research, interactions with the head teachers of these educational institutions were necessary. These interviews were conducted with the intention of acquiring qualitative research information from those professionals who have daily interactions with these autistic learners and who could observe their social interactions within their educational institutions. Such interviews were conducted within the learning premise of these institutions to provide a convenient environment for the teachers to be interviewed.

The qualitative data obtained from these interviews were analyzed to extract themes and insights from the information provided by the teachers. These results were documented in a manner that recounts the observations made during the interviews of the social interactions of the autistic learners using quotations from the teachers.

3.5.3 Observation Checklist

An observation checklist served to systematically collect data regarding the social interactions of children with Autism Spectrum Disorder (ASD) in settings such as classrooms, playgrounds and therapy. The checklist focused on specific behaviors and interactions, such as starting a conversation, replying social cues, and even engaging in eye contact within a group setting. The staff members, usually teachers and researchers, used the checklist to assess during school and therapy hours the quality and frequency of the behaviors. This provided the staff members the opportunity to consistently and objectively assess social interactions in a broad period to create a complete image of the social skills possessed by the child and the social skills' development.

The observation checklist was most suitable for the study as it allows collection of data in real time and in a child's natural setting as the child continues with the activities of the day with the least amount of interruption, allowing the gathering of contextually valuable data. The gathered data was both qualitative and quantitative. This data allows the estimation of social skills of the children as well as the effectiveness of the TEACCH program.

3.6 Reliability of research instruments

Reliability is the degree to which the research instrument produced consistent and reliable results. The reliability of the research instrument was determined by using the Cronbach alpha coefficient to measure the internal consistency of the items in the questionnaire (Kothari, 2014). The Cronbach alpha coefficient ranges between 0 and 1 with a coefficient of 0.70 or higher being acceptable for the research study. The reliability of the instruments that were used in the study was tested using a pilot study that used a sample of 11 participants that were selected from the total study population (4 teachers and 7 learners with ASD). The results of this pilot study were used to calculate the Cronbach alpha coefficient for the various study variables. The results were presented in Table 2.

Table 2*Reliability of Research Instruments*

Variable	Cronbach alpha	Number of items	Result
Physical restructuring	0.871	6	Reliable
Social interaction	0.842	4	Reliable

The findings showed that the Cronbach alpha of physical structuring and social interaction were 0.871 and 0.842 respectively. These values are higher than the proposed value of 0.70 and indicate high degree of internal consistency among the items in each scale. This means that the instrument was valid and able to generate consistent results, which increased the credibility of the study findings of effects of physical restructuring on socializing among learners with ASD in Vihiga County in Kenya.

3.6.1 Validity of research instruments

Validity refers to the degree to which the research instrument is intended to measure. Validity was obtained through the review of research instruments by experts in the field. Five experts in the sphere of Special Needs Education and Educational Psychology reviewed the research instruments. These individuals included three university lecturers and two supervisors who conducted research in the Department of Educational Psychology at the university. Each of these scientists is well-experienced in the field of autism interventions and research.

The questionnaire was reviewed by these experts to assess the relevance and suitability of the questions to the aims of the study. The experts commented that some of the items in the questionnaire needed to be changed to make them more relevant and ensure that physical structuring and social interaction were expressed within the research instrument. Accordingly, some changes were made to the questionnaire to reflect these suggestions of the experts.

Furthermore, the content validity of the questionnaire improved as it was ensured that all areas of the study and its variables were addressed within the questionnaire. Face validity was ensured through making the items of the questionnaire visible and suitable to the respondents. Construct validity was determined through the items of the questionnaire correlating to the concepts of TEACCH and social interaction. Each of these steps was taken to ensure that the research instruments that were created were suitable for gathering the data that would be valuable to understand about TEACCH methods.

3.7 Data Analysis

The data that was collected was first cleaned, sorted and coded before being analyzed using Statistical Package of Social Sciences (SPSS) version 27 to determine its effect on social interaction among learners with ASD in Vihiga County. Quantitative data was measured through the calculation of descriptive statistics such as frequency, percentage, means and standard deviations to illustrate the responses provided by the participants to the questionnaires. These figures were represented in tables, graphs and charts for ease of understanding of the data.

Thematic analysis was used to analyze qualitative data from the interviews and classroom observations of teachers with ASD learners. Through repeatedly reading the transcripts of the interviews, themes were extracted regarding the experiences and perceptions of those teachers regarding TEACCH in their classrooms. These themes were coded and clustered into groups that were reflective of the objectives of the study: physical structuring, visual supports, individualized behavior plans and social interaction outcomes.

Due to the nature of this research study, a triangulation method was utilized to combine the qualitative and quantitative data. By presenting the quantitative data and qualitative themes in the study, both types of data allowed for the findings to be complimentary to one another. Each finding enriched the other findings within the study, leading to a comprehensive perspective on the impact of TEACCH on social interaction among learners with ASD.

IV. FINDINGS & DISCUSSION**4.1 Findings****4.4.1 Physical Structure approach and Social Interaction**

The researcher distributed 68 questionnaires to the respondents who were 13 head teachers, 41 teachers and 14 support staff. The remaining 76 out of the total sample size of 144 comprised Autistic learners who were not involved in filling the questionnaires because of the complex nature of their disability hence were observed. Out of these, 62 questionnaires were properly returned by the respondents, giving the study a response rate of 91.2%. This response rate was considered to be highly adequate for the study as the majority of the population of the target respondents participated in the distributed questionnaire. The high rate of returned questionnaires ensured that there was enough data to support the research findings. The data collected from this objective was analysed and presented in Table 3.

Table 3*Physical Structure approach and Social Interaction*

No.	Statement	Percentages and frequencies					TOTAL
		1 SD	2 D	3 N	4 A	5 SA	
1.	There are adequate classrooms in the school	17 (27.4%)	21 (33.9%)	5 (8.1%)	10 (16.1%)	9 (14.5%)	62
2.	The available classrooms are in proper learning condition	13 (17.7%)	13 (21.0%)	7 (11.3%)	18 (29.0%)	13 (21.0%)	62
3.	There is proper arrangement of desks in the classroom	17 (27.4%)	19 (30.6%)	8 (12.9%)	11 (17.7%)	7 (11.3%)	62
4.	Proper arrangement of desks improves the level of social interaction of autistic learners	10 (16.1%)	8 (12.9%)	6 (9.7%)	18 (29.0%)	20 (32.3%)	62
5.	Rows in the classroom are well laid out	19 (30.6%)	21 (33.9%)	5 (8.1%)	8 (12.9%)	9 (14.5%)	62
6.	Well-structured rows improves the level of social interaction of autistic learners in the classroom	9 (14.5%)	10 (16.1%)	8 (12.9%)	21 (33.9%)	14 (22.6%)	62

The participants were asked whether the school has sufficient classrooms. In response, 27.4% were strongly in disagreement, 33.9% were in disagreement, whereas 8.1% were neutral. On the other hand, 16.1% agreed and 14.5% were in strong agreement. Findings revealed that a majority of respondents disagreed that there were enough classrooms, indicating concern among teachers about the physical learning environment for children with ASD. The study highlighted that schools in Vihiga County may lack infrastructure for specialized activities like TEACCH, which require specific classroom setups to aid social growth. There is a notable discrepancy between the expectations of implementing TEACCH and the actual classroom environments, pointing to the need for schools to modify structures to better support learners with ASD.

This is aligned with the work of Sanz et al., (2018), who stated that children with ASD require appropriate physical settings that allow them to organize the settings to meet the objectives of the TEACCH program by facilitating the anxiety, predictability and social interactions of participants of the learning environment. One can argue that TEACCH is likely to produce little social improvement in learners with ASD where classrooms were poorly designed. This is similar to what the teachers from Vihiga County expressed, which calls for policies, infrastructure and the national adoption of TEACCH in Kenyan schools.

Respondents were asked on whether the available classrooms are in the proper learning condition. The findings showed that 17.7% strongly disagreed, 21.0% disagreed, 11.3% were neutral, 29.9% agreed and 21.0% strongly agreed. The results indicate that the majority agreed that the existing classrooms are in proper conditions for learning for learners with Autism Spectrum Disorder (ASD). This means that for most of the teachers, learning environments are adequately organized for even the most basic level of social interaction with other learners with ASD. This aligns with Zhao and Chen (2018), who showed that organized, low-stimulus classrooms enable ASD learners to become socially engaged and adapt to learning routines.

The study sought to find if there is proper arrangement of desks in the classroom. The results depicted that 58.0% disagreed and strongly disagreed, 12.9% remained neutral, 29.1% agreed and strongly agreed. The results indicate that a substantial number of the respondents were in disagreement with regard to the proper arrangement of desks within the classroom. This is an indicator that a significant number of the teachers would feel that the layout within their classrooms is not supportive of the highly structured and predictable environment necessary for learners with Autism Spectrum Disorder (ASD), as advocated for within the TEACCH framework.

The findings of this study can be supported by the Developmental Theory, which explains that learners with autism often experience difficulties in understanding the thoughts and intentions of other individuals in their environment. Because the majority of learners indicated that the desks in their classrooms were poorly arranged, those learners were potentially lacking in the skills necessary to interpret social interactions within their classrooms and navigate to engage with their peers. The above results were supported with information obtained from a head teacher in Vihiga county special school. HD1 stated that;

“At our school, we make sure that physical learning spaces for pupils with ASD are structured and have a predictable routine. Each classroom contains designated spaces for particular activities which include learning, playing, sensory tasks, and quiet moments. For distractions, barriers or dividers are used and for students to make sense of the classrooms, we put up labels signifying the different areas. Such an

environment promotes concentration and for our students, they feel less anxious.” (Head teacher, 24th July 2025).

The statements demonstrate the most recent advocacy of strategic and flexible classroom environments for learners with Autism Spectrum Disorder ASD. In ASD training classroom design for organization and predictability is emphasized as a design strategy that can improve classroom environments for the different learners. The above discussion was supported with the information collected by the researcher during observation at special school in Vihiga; *“The researcher observed that majority of the classrooms had desks arranged in a crowded and irregular fashion. Many of the learners in these classrooms appeared to be somewhat distracted and uncomfortable due to the apparent lack of structure within the classrooms. Only a few classrooms had their desks arranged in a fashion that was organized to encourage both social and classroom interactions among the students.”* (Researcher, 25th July 2025)

The observation findings indicate that the physical arrangement of students in most classrooms was not conducive to the learning needs of students with ASD. The crowded and seemingly irregular placement of desks in most classrooms create difficulties for autistic students in movement in the classroom, interacting with other students, and in remaining free from distractions from other students with autism. The lack of an organized placement of desks in the classroom may lead to feelings of anxiety or inability of those students with ASD to participate in social interactions with other students in the classroom.

Another opinion of the participants was sought on whether proper arrangement of desks improves the level of social interaction of autistic learners. The responses indicated that 16.1% strongly disagreed, 12.9% disagreed, 9.7% remained neutral, 29.0% agreed and 32.3% strongly agreed. From these results, it was seen that many of the respondents perceived that the correct arrangement of desks increases the social interaction of the learners on the Autism Spectrum Disorder (ASD). This reflects the trend that more teachers are beginning to realize the value of the arrangement of physical space especially the desks and how that may enhance the social interaction of learners with ASD. Zhao and Chen (2018) who noted that the anxiety of learners with ASD was reduced and peer engagement was increased with organized and visually clear arrangements of classroom space have also documented this. Conversely, a considerable amount of instructors disagreed, which might suggest some deficiency in training or a lack of understanding on how the physical arrangement of a classroom influences the social development of ASD learners. The above results are consistent with the data from head teachers that were obtained during the interviews about the impacts of social interaction among students with ASD on structuring the physical learning environment. HT2 in a special school in Vihiga County stated that;

“Having a structure in a social space gives more confidence to the students or learners. Students are able to know what is expected and are able to stay focused and not get overwhelmed. So they are more likely to engage and participate with their peers in their social activities. Social educators have noticed that students are more likely to speak up and work together when they know a task is structured” (Head teacher, 24th July 2025).

The quotation emphasizes the powerful effect that well-structured physical learning settings can exert on the social interaction between learners with Autism Spectrum Disorder (ASD). In particular, the mention that learners feel more confident and less overwhelmed once they understand their environment and the expectations within it perfectly summarizes one of the most important principles on which TEACCH is founded: structure decreases anxiety and increases predictability, establishing a safe context for interaction. The discussion also aligns with the information obtained by the researcher during observation;

“The researcher observed that when the desks were well arranged in the classroom, the learners with ASD had opportunities to interact with other learners in the classroom. However, in classrooms with poorly arranged desks, the learners with ASD had limited opportunities to interact with other learners in the very classroom.” (Researcher, 25th July 2025)

The observation findings indicate that the arrangement of desks has a significant role in the social interaction of learners with ASD. The classrooms with a structured and defined layout for the learners encouraged social interactions between the learners as they could easily identify the personal space of the other learners and interact within their defined spaces. This layout also created a sense of security and reduced confusion for the learners with ASD.

Respondent were asked on whether rows in the classroom are well laid out. The findings indicated that 64.5% disagreed and strongly disagreed, 8.1% were neutral, 37.4% agreed and strongly agreed. The results show that a considerable number of respondents were in disagreement with the statement that classroom row arrangement is well done, and this is a clear indication that the majority of the educators polled are concerned with the current structure on offer for learners with Autism Spectrum Disorder (ASD). The fact that there is a general disagreement with respect to the statement on classroom row arrangement pointing out that the arrangement is poorly done can be taken to mean that the majority of the educators polled believe the current structure with respect to the arrangement of desks is sub-ideal for creating social interaction for learners with ASD.

The findings of this research study can be supported through the Developmental Theory. Students with ASD struggle to understand the theory of mind of others; they cannot easily understand the intention and thought of others. Furthermore, the findings of poorly-arranged rows for the majority of students indicate that it is difficult for these students to understand the thoughts of others within the classroom.

The study sought from the participants on whether well-structured rows improve the level of social interaction of autistic learners in the classroom. The finding showed that 14.5% strongly disagreed, 16.1% disagreed, 12.9% were neutral, 33.9% agreed and 22.6% strongly agreed. From the results, it can be observed that a large percentage of respondents agreed that well-organized rows within the classroom play a significant role within the context of improving social interaction between ASD learners. As such, this implies that the majority of teachers view the strategic placement of desks within the classroom as a central mechanism for creating a conducive environment for social interaction among learners. To this end, findings agree with Sadia et al. (2023) who opined that learners with ASD would find such well-organized rows created through the placement of desks within the classroom to be devoid of confusion and thus allow time for more proper interaction between learners.

4.4.2 Social Interaction

Table 4
Social Interaction

No.	Statement	Percentages and frequencies					TOTAL
		1 SD	2 D	3 N	4 A	5 SA	
1.	There is improved communication among autistic learners	21 (33.9%)	20 (32.3%)	5 (8.1%)	9 (14.5%)	7 (11.2%)	62
2.	There is improved level of social interaction among learners with autism	18 (29.0%)	19 (30.6%)	6 (9.7%)	9 (14.5%)	10 (16.2%)	62
3.	TEACCH approach develops high skills of interaction among autistic children	11 (17.7%)	10 (16.1%)	5 (8.1%)	21 (33.9%)	15 (24.2%)	62
4.	Autistic learners demonstrate high self-control	21 (33.9%)	18 (29.0%)	5 (8.1%)	9 (14.5%)	9 (14.5%)	62

Respondents were asked on whether there is improved communication among autistic learners. The findings showed that 33.9% strongly disagreed, 32.3% disagreed, 8.1% remained neutral, 14.5% agreed and 11.2% strongly agreed. The results paint a worrying picture with regard to the current situation with respect to the development of communication skills among learners with ASD within Vihiga County as perceived by their teachers. The point is that a substantial number of respondents were in disagreement over the issue of whether there has been any improvement with regard to the development of communication skills among learners with ASD and this might mean that the current methods being implemented, including the application of TEACCH methods with respect to developing the said aspect among learners with ASD within the framework of developing behavior plans for them, might be ineffective and inefficient.

Participant's opinion was sought on whether there is improved level of social interaction among learners with autism. The results show that 59.6% strongly disagreed and disagreed, 9.7% remained neutral, 30.7% agreed and strongly agreed. This shows that a significant number of participants do not see any improved social interaction among learners with autism. This can be interpreted to mean that the current approaches being used, including TEACCH approaches, may not be having the desired effect on social interaction behavior among learners with autism. This may be due to a variety of systemic issues within the school setups and Vihiga County at large that may include a lack of training and exposure to such approaches like TEACCH among learners and teachers and a lack of well-defined guidelines on the approach's application. The discussion above was supported with the information obtained by the researcher during observation in a special school in Vihiga County;

"The researcher observed that the social interaction of the learners with ASD did not noticeably improve during the classroom activities using the TEACCH approach. While some learners with ASD interacted with other learners during these activities, the majority of those learners with ASD were found to be isolated from the other students in the classrooms. Furthermore, the lack of application of the TEACCH strategies during these activities suggests that the strategies were not effective in improving the social interaction of learners with ASD." (Researcher, 25th July 2025)

The observation of the learners with autism using the TEACCH approach indicates that this approach had no positive effect on the social interaction of these learners. While a few of these learners interacted with others during classroom activities, the majority of them were withdrawn and did not interact with others in the classroom.

The study sought to find if TEACCH approach develops high skills of interaction among autistic children. The results show that 17.7% strongly disagreed, 16.1% disagreed, 8.1% remained neutral, 33.9% agreed and 24.2% strongly

agreed. From this finding, a clear implication is that the majority of respondents were supportive of the TEACCH model being able to promote high interaction skills among autistic children. This implies that they perceive the potential of TEACCH to be beneficial in developing social and communicative skills among the learners. However, this near-consensus on the potential benefits suggests that its actual application and execution may be subject to variability and imperfections on the ground, such that a significant proportion is still skeptical about the disparities and inconsistencies in its application.

Respondents were asked if autistic learners demonstrate high self-control. The findings showed that 33.9% strongly disagreed, 29.0% disagreed, 8.1% remained neutral, 29.0% agreed and strongly agreed. The above finding shows that more than half of the respondents disagreed with the assertion that autistic learners exercise high levels of self-control, thus portraying a critical worry among teachers on the management skills exhibited by this particular category of learners. It therefore implies that while there exists means such as TEACCH whose application might be partially and selectively carried out among these learners, the achievement with respect to self-control is fairly discouraging in most educational setups. The discussion was supported by the information obtained by the researcher during observation in a special school in Vihiga County;

“The researcher observed that many of the learners with ASD exhibited difficulties in presenting self-control. Some of the learners with ASD displayed impulsive behaviors and restlessness. However, a few of the learners with ASD appeared to be calmer and to have more control over their behaviors within the classroom settings.” (Researcher, 25th July 2025)

The observation findings indicate that learners with ASD have challenges with their behavior. The learners often exhibit difficulties with impulsiveness, restlessness, and ignoring instructions - all of which makes it difficult for them to interact with their teachers or other students in the classroom. These behaviors indicate a lack of self-regulation skills, which are common among learners with ASD. However, the learners tend to be calmer and more focused when in classrooms with a routine and structured classroom activities. These findings indicate that utilizing structured classroom activities, such as TEACCH, may have a positive impact upon the behavior of learners with ASD as posited by Sanz-Cervera et al. (2018).

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

The results presented show that the teachers are aware of the significant role that the physical environment has on the socialization of the children with Autism in Vihiga County. The issues in the classrooms were found to be poor. The layout of the desks within these classrooms was also found to be a problem in the socialization of the students with autism. The findings from the research presented also corroborate the interviews and observations made of the classrooms that featured well-defined areas for the students, appropriate labelling of these areas, and minimizing distractions from the students' learning. The students in these well-organized learning environments had more interactions with their peers. However, these findings are weakened by the researcher's weaknesses, such as the use of self-reporting data from the students and the limited geographical focus of the research study to Vihiga County alone. Thus, though these findings do indicate a correlation between the physical environment of the classrooms and the social interactions of the students with autism, it cannot establish causality between these two variables.

5.2 Recommendations

Priority should be given to improving the organization of existing classrooms before attempting to build new classrooms. Although the findings indicated that inadequate classroom capacity and layout adversely impacts social interactions among students with Autism Spectrum Disorder (ASD), it may not be immediately practical to expand the infrastructure of classroom facilities in Vihiga County due to the available resources in the county. Therefore, efforts should first be directed towards reorganizing the classrooms with low-cost materials to improve the learning environments for students with ASD. In the future, however, both the Ministry of Education and the governmental authorities of the county should plan for the expansion and upgrading of classrooms to accommodate students with ASD. Additionally, teacher training institutions can prepare teachers through coursework or workshops on how to best organize their classrooms. Finally, the parents of students with ASD can also be involved in organizing their home environments to allow for the students to experience consistency between their environments at school and at home.

Declaration of Interest

The authors declare that they do not have any known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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