

# CREATIVE DESIGN THINKING APPROACH TO SUPPORT THE COMPLEX LEARNING ENVIRONMENT OF THE CLASSROOM FOR AUTISTIC CHILDREN AND THEIR TEACHERS

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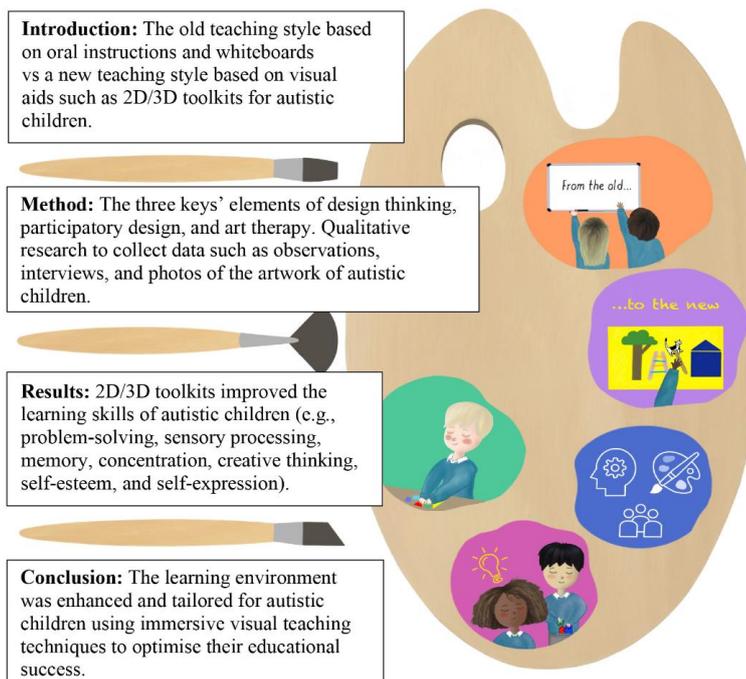
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## ABSTRACT

This study presents a case study of autistic children, their teachers, and teaching assistants at Marine Park primary school in the UK. There is a gap in social communication between teachers and autistic children, which can lead to frustration for the children and significantly hinder the learning process. This study applied qualitative research to collect and analyse data (such as observations, interviews, and photos of the artwork produced by the autistic children) in the complex classroom setting to improve the quality of practice, focusing on the adaptation of teaching styles to support needed of the pupils. The study integrated the three key research elements of design thinking, participatory design, and art therapy to develop innovative 2D/3D toolkits, which present and explain tasks in a manner that is more compatible with the learning style of autistic children. The toolkits aimed to break down lesson plans into more readily comprehensible components and translate tasks and worksheets into an immersive 2D/3D learning experience, employing a variety of visual aids. The toolkits employed appropriate imagery, textures, creative thinking, etc. to bring the lesson to life in a way which allows autistic children to actively engage with the material at hand, whilst also ensuring that the visual and tactile experience was not overwhelming to the pupils. The results of this study confirmed that this learning approach could improve memory, sensory processing, concentration, problem-solving skills, and well-being for autistic children.

*Keywords: social communication, well-being, sensory processing, problem-solving skills, memory, concentration, autistic children, teachers, design thinking, participatory design, and art therapy*

## VISUAL ABSTRACT



## 1 INTRODUCTION

Autism is a neurodevelopmental disability that manifests in a range of differences [1], in communication and social skills. Autism has a prevalence of over half a million people in the UK [2] and is also thought to affect approximately 1-2% of individuals around the globe [3]. Incidence rates of autism have been progressively increasing as awareness has increased. Autism is deemed to be a hidden disability indicating that the need for additional support is not instantly apparent. Various educational and emotional, interventions are currently available to support autistic individuals [2]. Research suggests that art and design creative activities can be an essential part of the intervention strategy.

There are several kinds of interventions with a range of different objectives. As there is no single solution to be offered by any one intervention to fit all children, the choice of the intervention strategy mainly relies on each child's specific requirements [2]. Educational interventions are vital for autistic children to help them develop knowledge and skills across an uneven profile of strengths and challenges, being especially able in some areas and having struggles in others. Hence, education is regarded as the most successful therapeutic approach for autistic children [6] and is realized as essential to improve the quality of life of autistic children [7].

## 2 PROBLEM STATEMENT

Autistic children often struggle with social communication, language difficulties, sensory issues, attention problems, executive functioning difficulties, and emotional dysregulation [8]. Such difficulties can result in a gap in communication between teachers and students and subsequent feelings of frustration for the children, which can significantly hinder the learning process. There is a growing challenge to meet the requirements of autistic children enrolled in schools as they have ongoing difficulties with some aspects of typical social interaction (e.g. maintaining eye contact, interpreting facial expressions and emotional signals), communication skills (verbal and non-verbal), and repetitive behaviours (e.g. hyper-fixation and a strong need for routine), as well as restricted and repetitive patterns of activities or interests since early childhood, and are often referred to art therapy sessions [9-10]. Such problems require careful attention and the development of a new design approach to support learning (the 2D/3D visual toolkit) in the classroom. Complementing the learning process with the design of creative activities (e.g. using art therapy to facilitate the development of problem-solving and decision-making skills) in the classroom provides an alternative medium of communication and expression for autistic children (especially useful for non-verbal students) and can help create an environment of controlled stimuli, helping to prevent the children from becoming overwhelmed. This study aims to assist teachers in modifying their traditional teaching style (as shown in Fig.1) to incorporate new design-based practices through the adoption of this toolkit, and thus help autistic children to understand and take part in classroom activities more easily (as shown in Fig.2).



Figure 1. The old teaching style is based on oral instructions & whiteboards



Figure 2. A new teaching style is based on visual aids such as 2D/3D toolkits

### **3 METHODOLOGY**

#### **3.1 Research Positioning**

This research is multi-disciplinary in nature and brings several fields together (e.g. design, art therapy, and education), creating a unified theoretical framework, to help adopt a design-led approach in the complex learning environment situation. This study:

1. Used design thinking and participatory design knowledge and theory to inform this research study's design [11-15].
2. Applied leading art therapy theories and practices to support the co-creative process [1, 10,16].
3. Adapted learning theories in education to establish an analytical tool to apply to the case study [17-19].

#### **3.2 Epistemological Positioning**

The theory and production of new knowledge, linked to methodology, validity, and scope, were crucial to conceptualising and operating this research study. As Merriam notes, "Research is, after all, producing knowledge about the world in our case, the world of educational practice" [20]. Constructivism epistemology oriented this qualitative research study in accordance to Merriam's epistemological view, arguing that "the key philosophical assumption upon which all types of qualitative research are based on the view that reality is constructed by individuals interacting with their social worlds" [20]. Hence, it is important to understand the meaning and knowledge constructed by people to build a coherent qualitative case study.

#### **3.3 Theoretical Framework**

The researcher focused on the exploration, description, and sometimes generation and construction of theories using qualitative data within a constructivist epistemological view (guided by Merriam's view, arguing that "reality is constructed by individuals interacting with their social worlds") [20]. The researcher's education (MA in design studies with dyslexic children) and work experience (20+ years as a designer and artist working in the educational sector) informed her standpoint based on the integration and application of multi-disciplinary fields (design, art therapy, and education) within a qualitative research framework with autistic children. This background and standpoint were fully described and acknowledged with this study's constructivist framework and aided the researcher in creating a theoretical framework (as shown in Fig.3), adapting a coherent design-led approach in the complex learning environment within classroom settings.

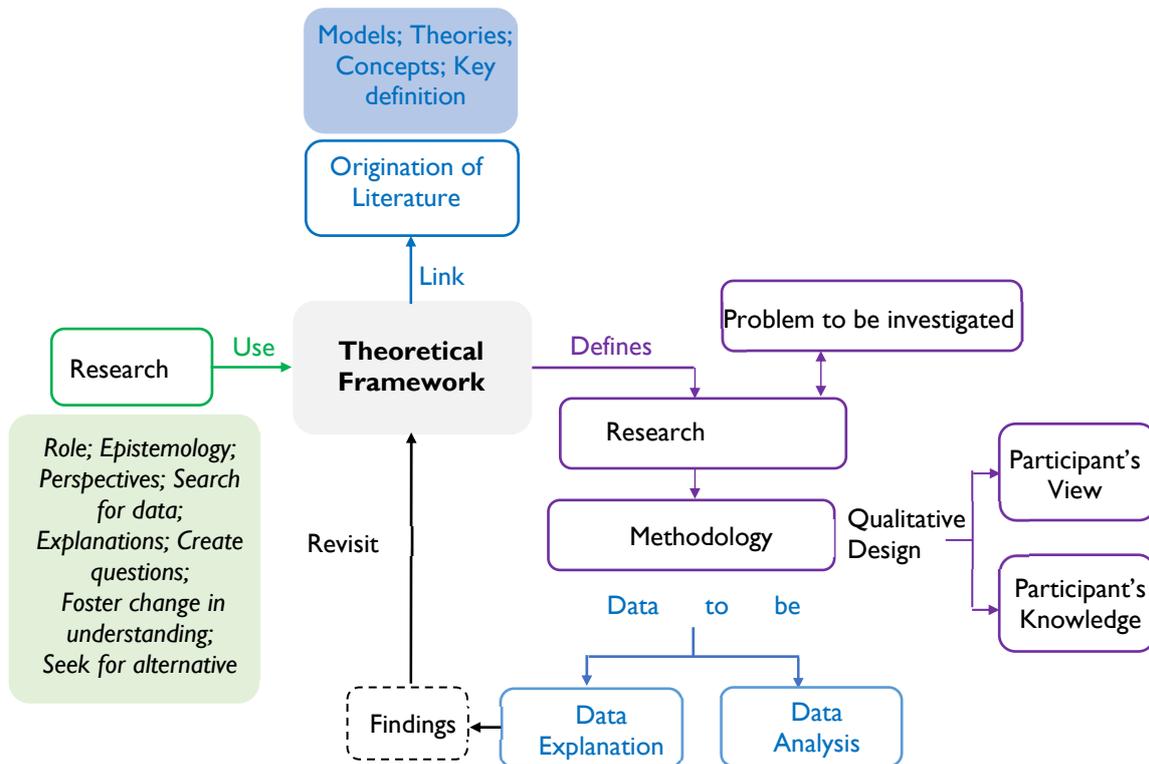


Figure 3. Theoretical framework in the qualitative research case study

### 3.4 Description of the research model

A comprehensive research model was established that integrates the design thinking approach as a mindset underlying the design philosophy, and participatory design process with art therapy within educational settings as shown in Fig. 4.

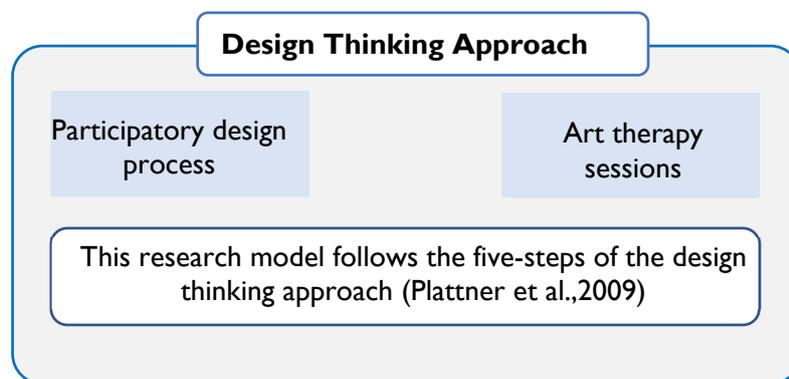


Figure 4. The research model approach and main principles

This research followed the five steps of the design thinking approach [21], including: 1) Emphasise (to watch, listen, observe and engage); 2) Define (statements of problem, views); 3) Ideate (to identify problems and to seek solutions); 4) Prototype (building, problem-solving, testing, monitoring and developing solutions); and 5) Test (enhancing prototypes, optimising solutions, and liaising with end-users).

### 3.5 Case Study

#### 3.5.1 Educational Context

This activity was undertaken at Marine Park Primary School, which included specialist autism classrooms. The school is located in South Shields, Northeast England, UK, and provides special classes for autistic children aged 3-11 years in different key stages. The school's related data is as follows: A large proportion of autistic children from minority ethnic groups (70%); Gender of entry: mixed; School

capacity: 238; Number of pupils: 198; Pupils with SEN support: 23.2%; English is not the first language: 59.1%; Ofsted rating: good. The head teacher was provided with relevant documents and letters describing the overall research.

### **3.5.2 Research Sample**

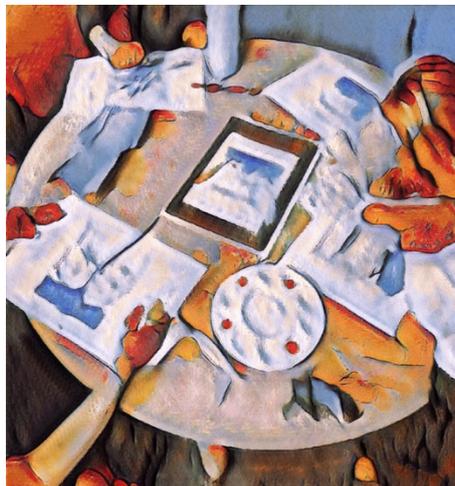
The number and size of the potential groups were typical class sizes of the designated classrooms in the selected school. Participants were autistic children in primary school, aged between 4-6 years old; boys and girls. There were around 2-4 children in the classroom setting, in addition to their class teachers and teaching assistants who were also involved.

### **3.5.3 Research Activities and Procedure**

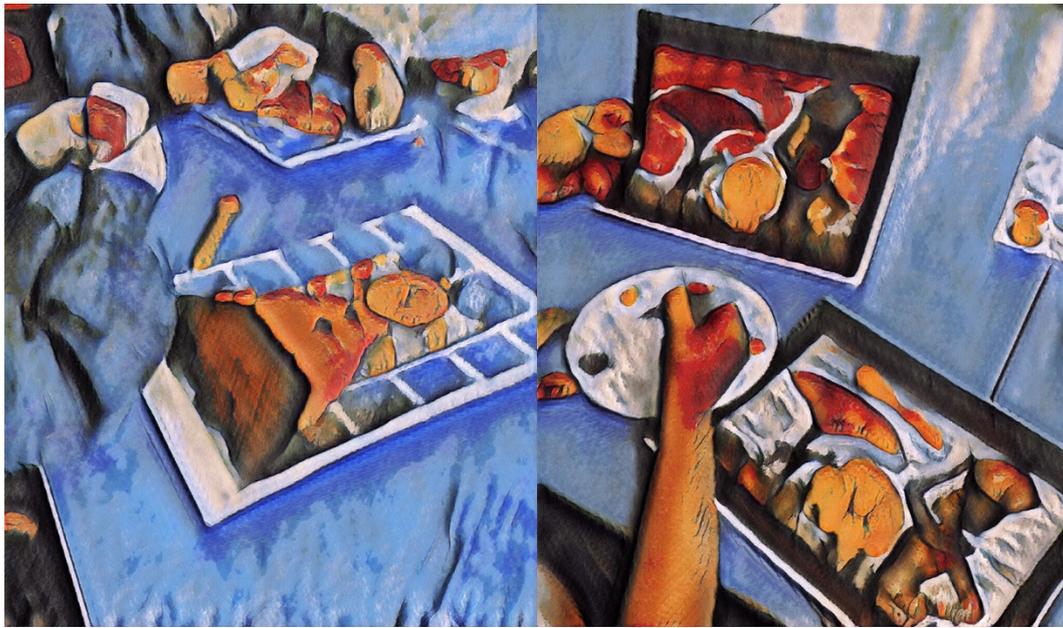
The research activities were designed with two integrated phases, including; i) Phase one: design practice activities in the school setting; and ii) Phase two: innovative 2D/3D toolkit designs for school implementation. Two cycles, namely Cycle 1 (Design process) - 22 weeks, and Cycle 2 (Optimisation) - 6 weeks, were carried out. Within the planned phases, the following procedure was followed: Observing (identify a concern); Reflecting (consider possible ways to address the concern); Planning (plan solutions to counteract the problem); and Acting (evaluate and reflect on what has happened, modify practice, and move in a new direction or return to observe, reflect, plan, and act cycle) [22-23].

### **3.5.4 Data Collection Methods**

Qualitative research [24] emphasises data collection, which is explanatory and comprised of observations, images, symbols, and words. A variety of data collection (triangulation sources) methods were selected to help the researcher directly answer the research questions and to assess the effectiveness of the developed theoretical framework throughout this study at various stages within the design process. The data were gathered in a coherent and integrated manner through different design thinking/participatory design creative sessions with the autistic children and their teachers and teaching assistants, including participant observation (e.g. field notes), structured interviews (e.g. closed-ended-questions), semi-structured interviews (e.g. open-ended questions; a set of topics to act as a guide to enable interview conversations), and photos of the autistic children's artwork (as shown in Figs. 5-6). Each session trialled different ideas, techniques, and visual materials to meet the needs of autistic children and their teachers.



*Figure 5. Using art therapy with (Reception class) during the creative design activities sessions*



*Figure 6. Using art therapy & problem solving-skills with (KS. 1) during the creative design activities sessions*

The researcher used three key research elements: 1) design thinking to enhance problem-solving skills, memory skills, concentration, sensory sensitivity, decision-making, visual attention, and think creatively and imaginatively; 2) participatory design to encourage engagement and work with stakeholders as co-designers; and 3) art therapy to improve self-esteem, self-acceptance, self-expression, and self-expression. After investigating other researchers in the same field of work, the researcher decided that using only one or two of the research elements (e.g. design thinking and participatory design) was not enough to encourage autistic children to fully engage in the workshop and enhanced their skill, as each child with autism spectrum disorder has different problems, needs, and interests. Thus, to create solutions for the problems faced by autistic children in the classroom setting whilst considering their needs and interests, the additional element of participatory design is required.

### **3.5.5 Data Analysis**

The researcher's methodological experiences in engaging autistic children in qualitative research [24] were adopted and she carried out questionnaires and interviews, which were transcribed and coded into main themes and sub-themes (thematic analysis). Throughout conversations with teachers and interactions with the autistic children, the researcher maintained an appropriate balance of being close enough to the children to obtain their confidence and facilitate good interaction with them, but not too close (e.g. to avoid social desirability prejudice). The researcher also followed her own friendly and open-minded approach in the interviews (e.g. being respectful and not intrusive).

## **4 RESULTS**

### **Implications of the Creative Design Process on Autistic Children and Their Teachers:**

The researcher carried out this study in Marine Park primary school to investigate the following research questions and find creative solutions:

1. Does an approach that integrates design thinking, art therapy, and educational theory deliver new forms of pedagogy when applied to the challenges of complex classroom situations?
2. What form of design practice aids do teachers establish that are suitable for the continual design and re-design of their classroom setting as a response to the complex needs of their pupils?

To investigate the research questions, the researcher conducted 28 creative design process sessions (cycles 1 and 2) with the stakeholders (e.g. autistic children, class teachers, and teaching assistants). The researcher used design thinking to develop prototype 2D/3D toolkits with the stakeholders (co-designers) through participatory design. Qualitative research was used to gather data (triangulation data such as observations, interviews, and the autistic children's artwork). Also, art therapy was used to enhance the autistic children's well-being.

With the 2D/3D toolkits, the traditional teaching style favoured in the classroom, based on oral instructions and the use of a whiteboard, was replaced by an effective visual teaching method tailored to the needs of the autistic children to support their development and educational success. Each toolkit included a particular set of materials and instructions to create an art piece (e.g. landscape paintings, collages, interactive scenarios). The materials were strategically selected to include different textures to accustom the children to interacting with various stimuli in a safe and controlled manner. The toolkits offered opportunities to piece together shapes, create stories, work with numbers to build scenes, etc., condensing conventional lessons into digestible pieces. The children were able to develop their problem-solving and decision-making skills, memory, concentration, creative and imaginative thinking, etc. by assembling the craft components to construct and navigate various tasks.

The 2D/3D toolkits offered new creative solutions to address existing problems in the classroom setting. The researcher paid particular attention to finding a creative solution for the issue of difficulties in social communication between autistic children and their teachers. For instance, autistic children often 1) struggle to understand oral instructions provided by teachers in the classroom setting. In this case, the researcher used visual as opposed to oral learning materials with the autistic children to help them to understand the topic at hand; 2) struggle to understand facial expressions and the feelings of others, disrupting proper communication with their peers and teachers. In this case, the researcher used art therapy to help autistic children to express their feelings, enhance their self-esteem, and help them to comprehend the feelings and expressions of others more easily (as shown in Fig. 8); 3) have a lack of attention, concentration, and memory skills as their teachers described. In this case, the researcher focused on enhancing such skills by using different colours, collage art, puzzles, etc. to engage the students in interesting ways; 4) struggle with knowing how to move through various stages of the project they are working on: starting, continuing, and finishing the work. In this case, the researcher used visual scheduling, using the traffic light system in a table divided into three sections: a) the red traffic sign (stop), take your time and start when you feel ready; b) the yellow traffic sign (steady), you can start to work now, and c) the green traffic sign (go), finish your work and receive your reward. Well done! And finally; 5) have anxiety and feel uncomfortable communicating with new people and changing routines. In this case, the researcher prepared various tools and coping mechanisms (e.g. the use of stress balls as shown in Fig.7) to help the autistic children to relax, worked with their teachers and teaching assistants in the classroom setting, and kept their routine as consistent as possible.



*Figure 7. Using the stress balls during the creative design session to help the autistic children to relax*



*Figure 8. Using art therapy during the creative design session to enhance the autistic children's well-being*

## 5 CONCLUSIONS

The following benefits of stakeholders and autistic children's participation have been identified:

1. **Learning Environment-** the positive impact on autistic children's learning and development skills, such as improved creative thinking, memory, problem-solving, decision-making, and concentration through creative design activities. They were taught new skills within each session and improved from low to medium to higher learning skills. During the sessions, they were taught to communicate with others, engage with different ways of thinking and problem-solving (as shown in Fig.11) and explore and experiment with new ideas based on visual communication.
2. **Well-being-** the positive impact on the autistic children's self-esteem, self-confidence, self-acceptance, and self-expression (as shown in Fig.9). The well-being of children with special educational needs in general, and autism in specific, significantly benefits from art therapy. Art therapy can reduce anxiety, improve low self-esteem, facilitate self-acceptance, and encourage self-expression by using drawing, painting, crafting, etc. instead of words.
3. **Social Skills-** the positive impact on the standard of communication between the autistic children and their teachers. The main problem this study aimed to address was difficulties in social communication between autistic children and their teachers in the classroom setting. The traditional oral teaching style used in the classroom with all of the children, including the autistic children, fails to sufficiently address the specific needs of autistic children. In place of this teaching strategy, the researcher used a visual strategy with the autistic children to teach them how to communicate with others, understand lessons more easily by using different materials such as 2D/3D toolkits, and help them to transition from different stages in the learning process more easily.
4. **Sensory processing-** the positive impact on autistic children regarding the tolerance of various sensory stimuli by using a variety of textures (e.g. hard textures like pink salt, soft textures like fleece, and fluid textures such as paint and glue) and providing opportunities for autistic children to try new techniques, ideas, and materials to enhance their sensory skills.
5. **Engagement-** the positive impact on autistic children and their teachers when engaging in creative design activities and working as co-designers, being provided with opportunities to co-design to create prototypes step-by-step based on their needs and interests.
6. **Benefits of Stakeholder Participation-** the stakeholders were provided with opportunities to exchange knowledge and information between the researcher, teachers, and teaching assistants (as shown in Fig. 10). By attending the creative design sessions, the teachers and teaching assistants were able to learn how to use 2D/3D toolkits, with or without the presence of the researcher, and can thus use these toolkits in the classroom to support the autistic children in their learning. The teachers and teaching assistants confirmed that the autistic children did not exhibit behavioural behaviour issues during the creative design activities, and the researcher focused on praising them with small toys and stickers to encourage their confidence. The researcher's time experiencing and engaging in the classroom setting allowed her to learn how the teachers and teaching assistants work with the autistic children one-on-one, what visual materials the school uses to support autistic children, and how they teach autistic children different topics (e.g. English, Maths, and Science).



Figure 9. Enhance autistic children's well-being such as self-esteem, self-confidence, self-expression, and self-acceptance



Figure 10. Exchange knowledge & information between stakeholders during the sessions



Figure 11. Enhance autistic children's problem-solving skills

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