Measures to Organize Steam Education Activities for Children with Autism in Vietnam

Hoang Thi Nho1*, Pham Thi Thanh Thuy2, Nguyen Thi Anh Thu3

1University of Education – Vietnam National University, Hà Nội, Vietnam
2Faculty of Special Education, Hanoi National University of Education, 136 Xuân Thụ, Dịch Vọng Hậu, Cầu Giấy, Hà Nội, Vietnam

Abstract: This study assessed the expressive language development of M.T, a 5-year-old child with Autism Spectrum Disorder (ASD), following a STEAM educational intervention conducted in April 2023. Using a structured plan aimed at enhancing expressive language, the project involved activities like “Making Scented Jars” and “Making a Bird’s Nest.” M. showed marked improvements, scoring 36 points in the post-intervention assessment, a 10-point increase from the baseline, placing him in the "Fair" category (Level 3). Key progress areas included the ability to present using visual aids and answer open-ended “Why?” questions. Initially unable to present and displaying negative reactions, M. gradually understood presentation structures and organized content more logically. He began to use simple negative sentences and sequence words effectively in storytelling. Additional gains were observed in daily use of names, actions, qualities, and polite expressions, indicating broader communicative improvement. Feedback from teachers and parents highlighted increased attention, interest, and confidence in STEAM activities. M.’s ability to engage in storytelling and role-playing significantly enhanced his classroom participation and reduced the need for external support. These findings underscore the potential of tailored STEAM activities to foster language development in children with ASD.

Keywords: Autism Spectrum Disorder (ASD); Expressive language development; STEAM education; Intervention activities.

I. INTRODUCTION

Autism Spectrum Disorder (ASD) is a complex neurodevelopmental disorder that affects a child's ability to communicate, socialize, and behave. In Vietnam, the increasing number of children diagnosed with autism underscores the urgent need for specialized educational strategies to support their holistic development. STEAM education, integrating Science, Technology, Engineering, Arts, and Mathematics, has been proven to be an effective educational approach, offering benefits not only in enhancing logical and creative thinking but also in improving social and communication skills. However, organizing and applying STEAM education activities for children with autism requires specific and nuanced adjustments to cater to their unique needs.

This study focuses on analyzing and proposing effective measures for organizing STEAM education activities tailored for children with autism in Vietnam. The goal is to develop an integrated educational model that supports comprehensive development and fosters a friendly and inclusive learning environment. By doing so, the study aims to enhance the quality of education for children with autism and contribute to positive changes in societal perceptions and educational approaches toward children with special needs.

II. LITERATURE REVIEW

One of the core impairments of autism spectrum disorders is the deficiency in language ability, especially in expressive language ability. Expressive language delays affect children's ability to meaningfully share desires and preferences with social partners; reduce opportunities to interact with peers (Wetherby & Woods, 2006), and increase dependence on parents/caregivers across the lifespan, which is a source of stress for many families (Hayes & Watson, 2013).

There is a lot of evidence demonstrating the effectiveness of STEAM education for children with autism worldwide. Through STEAM education, students with autism can improve their ability to organize plans,
choose their goals, create action plans, self-assess, and adjust goals based on progress (Peterson & French, 2008; Argan et al., 2006)). In addition, they can improve their ability to solve addition, subtraction, or multiplication problems, tell the time on a visual clock, and determine the value of coins (Diamond et al., 2013). In Vietnam, there have also been studies on the impact of STEAM education on children with autism. Regarding language development for children with autism through STEAM educational activities, there has been research on vocabulary development for children with autism 3-4 years old in specialized environments through STEAM activities.

The study Application of STEAM Education Methods in Teaching Children with Autism in Vietnam by Phạm Hồng Quang, Lê Thị Ngọc Hà, and Nguyễn Thị Thu Hương (2021) focuses on applying STEAM educational methods in teaching children with autism in Vietnam. The authors conducted surveys and experiments with various STEAM activities at special education centers. The results indicate that this method improves logical thinking, creativity, and communication skills of children with autism.

In another study by Trân Minh Phương (2022), the current state of STEAM education for children with autism in schools and special education centers in Vietnam is analyzed. The author proposes solutions to improve the organization of STEAM activities, including developing flexible lesson plans, training teachers, and increasing parental involvement.

Nguyễn Thị Hải Yến (2023) explored the potential for applying STEAM education in teaching children with autism in Vietnam. The paper analyzes challenges such as resource shortages, lack of specialized knowledge among teachers, and social awareness. Additionally, the author emphasizes the opportunities STEAM offers for the comprehensive development of children with autism.

The research by Nguyễn Thị Lan and Trân Văn An (2024) introduced a new STEAM educational program developed for children with autism at several special education centers in Vietnam. The study's findings show that the program not only enhances learning skills but also improves communication abilities and social integration of the children. Nguyễn Thị Ngọc Trâm (2023) evaluated the effectiveness of STEAM activities in educating children with autism through a case study, drawing lessons and recommendations for organizing STEAM education in other centers. Nguyễn Văn Quý (2022) presented Vietnam's perspective and approach to STEAM education for children with autism. The author discusses cultural, economic, and social factors influencing the implementation of STEAM activities for autistic children and offers specific proposals to enhance educational effectiveness.

In fact, research on organizing STEAM educational activities to develop expressive language for 5-6-year-old children with autism is not available on popular and official network information. Therefore, the authors choose to give measurements for organizing STEAM activities in developing expressive language for children with autism 5-6 years old and implemented these measures on two children with autism aged 5-6 years old to assess its effectiveness.

III. RESEARCH METHOD
Organizing STEAM Educational Activities to Develop Expressive Language for Children with ASD Aged 5–6 Years

The intervention was conducted with two children with Autism Spectrum Disorder (ASD), following an individualized approach with the following steps: Receiving the child's profile: Initial collection of personal, developmental, and educational information. Assessing the mathematical learning ability of children with ASD aged 5-6 years: Initial evaluation of their mathematical skills.

+ Evaluating the mathematical learning ability before the experiment: Assessment of baseline mathematical capabilities.

+ Proposing and implementing measures to organize STEAM educational activities to develop expressive language: Design and application of STEAM-based interventions.

+ Evaluating the outcomes of the STEAM educational measures: Post-intervention assessment of expressive language development.

Assessment Methods
+ Evaluating the child’s expressive language ability;

+ Evaluation forms: Utilizing tools for assessing expressive language in children aged 5-6 within the scope of the study.

+ Interviews: Gathering information from parents and teachers about the child's expressive language.

+ Observation: Using observation sheets during lessons and other activities at school to collect additional information.

+ Review of activity products: Collecting, photographing, or recording videos, tests, and other outputs of the child's activities.

+ Assessing the child’s learning outcomes before and after the experiment: The study uses methods including observation, interviews, analysis of activity products, and test assessments. Based on the preschool curriculum of the Ministry of Education and Training, and expected STEAM skills for children aged 5-6 (Phạm Thị Cúc M,
The study evaluated M and T's expressive language abilities before the experiment in mid-January 2023.

The evaluation team included the study's author (a special education teacher) and the homeroom teacher. Through observation of the learning process, teacher interviews, and assessment tests of pre-experimental mathematical learning abilities of M and T, the evaluation team found that M's total score was 26 points, placing them at Level 2.

For the use of different sentence types, M scored 2 points, indicating the need for continuous teacher support. M could only use affirmative sentences, which were 3–4 words long, but required a considerable amount of time (2–3 minutes) to plan these sentences. For negative sentences, M only used the single word "no" to refuse or object to something disliked, without forming a complete sentence. M was unable to ask any questions.

Regarding retelling the content of a story in a certain sequence, M scored 2 points, again indicating the need for continuous teacher support. M required visual aids—two pictures from the story arranged in order—

### IV. RESEARCH RESULTS

#### 4.1. Groups of Measures

- **Group of Measures for "Developing Short-Term Plans to Organize STEAM Educational Activities to Enhance Expressive Language Skills for Children with Autism Spectrum Disorder Aged 5–6 Years":** This group focuses on creating and implementing short-term educational plans aimed at enhancing expressive language through STEAM activities.

  - Group of Measures for Adjusting the STEAM Classroom Environment to Be Rich in Language for Children with ASD Aged 5–6 Years: This involves modifying the classroom environment to provide a language-rich STEAM learning space suitable for children with ASD.

  - Group of Measures for Implementing STEAM Educational Activities to Develop Expressive Language for Children with Autism Spectrum Disorder Aged 5–6 Years: This group concentrates on organizing and executing STEAM activities that specifically target the development of expressive language skills in children with ASD.

#### 4.2. Experimental Application of Measures to Develop Expressive Language for Children with Autism Spectrum Disorder Aged 5–6 Years

**Pre-Experiment Evaluation Results of the Children:**

<table>
<thead>
<tr>
<th>No.</th>
<th>Ability</th>
<th>Score</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Speaking clearly</td>
<td>3 points</td>
<td>Receptive</td>
</tr>
<tr>
<td>2</td>
<td>Using nouns, verbs, adjectives, and expressive words in daily activities</td>
<td>2 points</td>
<td>Needs support</td>
</tr>
<tr>
<td>3</td>
<td>Using different types of sentences in communication</td>
<td>2 points</td>
<td>Needs support</td>
</tr>
<tr>
<td>4</td>
<td>Using speech to express emotions, needs, thoughts, and personal experiences</td>
<td>2 points</td>
<td>Needs support</td>
</tr>
<tr>
<td>5</td>
<td>Using speech to exchange and give directions to friends during activities</td>
<td>2 points</td>
<td>Needs support</td>
</tr>
<tr>
<td>6</td>
<td>Narrating an event or phenomenon so others can understand</td>
<td>2 points</td>
<td>Needs support</td>
</tr>
<tr>
<td>7</td>
<td>Retelling the content of a story in a specific sequence</td>
<td>2 points</td>
<td>Needs support</td>
</tr>
<tr>
<td>8</td>
<td>Initiating a conversation</td>
<td>2 points</td>
<td>Needs support</td>
</tr>
<tr>
<td>9</td>
<td>Adjusting voice according to the situation and communication needs</td>
<td>2 points</td>
<td>Needs support</td>
</tr>
<tr>
<td>10</td>
<td>Not interrupting or talking over others during a conversation</td>
<td>2 points</td>
<td>Needs support</td>
</tr>
<tr>
<td>11</td>
<td>Asking for clarification or showing gestures, facial expressions when not understanding others</td>
<td>1 point</td>
<td>Unable</td>
</tr>
<tr>
<td>12</td>
<td>Using polite words and greetings appropriate to the situation</td>
<td>1 point</td>
<td>Unable</td>
</tr>
<tr>
<td>13</td>
<td>Creating a narrative from pictures or objects</td>
<td>1 point</td>
<td>Unable</td>
</tr>
<tr>
<td>14</td>
<td>Presenting in front of the class with the help of pictures or objects</td>
<td>1 point</td>
<td>Unable</td>
</tr>
<tr>
<td>15</td>
<td>Answering open-ended questions: Why? How?</td>
<td>1 point</td>
<td>Unable</td>
</tr>
<tr>
<td></td>
<td><strong>Total Score</strong></td>
<td>26 points</td>
<td>Average</td>
</tr>
</tbody>
</table>

The study evaluated M and T's expressive language abilities before the experiment in mid-January 2023.
Plan for implementing STEAM educational activities to develop expressive language for children

<table>
<thead>
<tr>
<th>Activity</th>
<th>Project</th>
<th>Duration</th>
<th>Location</th>
<th>Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1. Use negative sentences with 2 – 3 words</td>
<td>&quot;Making Scented Jars&quot; Project (3 sessions)</td>
<td>- Duration: 1 session/week, 4 sessions/week with teacher intervention</td>
<td>- Location: Classroom experiment corner</td>
<td>- Format: Group learning with preschool classmates</td>
</tr>
<tr>
<td>1.2. Present the group’s product to the class using a given structure with teacher support and visual aids; the presentation includes 3 – 4 sentences, each consisting of 3 – 4 words</td>
<td>&quot;Making a Bird's Nest&quot; Project (3 sessions)</td>
<td>- Duration: 2 sessions/week in preschool, 4 sessions/week with teacher intervention</td>
<td>- Location: Preschool classroom</td>
<td>- Format: Group learning with preschool classmates; 1:1 intervention with the teacher</td>
</tr>
<tr>
<td>1.3. Answer “Why” questions starting with “Because…” with teacher support</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4. Retell the story content in sequence using a 3-step picture</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.3. Measures for Organizing STEAM Educational Activities to Develop Expressive Language in Children

Activity 1: Organizing a project for children: “Making Scented Jars”. Duration: 3 sessions
Implementing a set of measures: “Developing a short-term plan for organizing STEAM educational activities to enhance expressive language abilities in children with Autism Spectrum Disorder (ASD) aged 5 – 6 years” to: Gather information about the children’s expressive language abilities and other developmental areas; Develop a STEAM educational activity plan suitable for the children’s abilities and needs: Divide the project into 3 smaller sessions, integrate conversation, questioning, and verbal support in activities to help children develop expressive language during the session.

Use environmental adjustment measures in the STEAM educational classroom to create a language-rich environment for children with ASD aged 5 – 6 years:

+ **Measure 1**: Decorate the classroom with real models of noses, facial parts, various perfumes, pictorial illustrations about scents, poems, and riddles about the nose and fragrances.
+ **Measure 2**: AAC without assistive technology: Teachers use gestures, physical supports, eye movements, body movements, etc., to assist and prompt children.

Regarding answering open-ended questions such as "Why?" and "How?", M had no ability to respond. M could only answer simple questions like "Who is this?" "What/which color is this?" and yes/no questions. M responded with 3 – 4 word sentences but required time to plan the answer. The response reflex to questions was not quick.

According to the homeroom teacher’s interview, M and T were familiar with these contents, but M was often unable to perform them due to a lack of focus and motivation. Therefore, the results accurately reflect M’s abilities.

Low-tech AAC assistive measures: Use activity charts to remind children of the process and steps for making scented jars and presenting their products; use visual rules to remind children of permissible and non-permissible behaviors during STEAM activities; use picture cards to help children express needs when lacking vocabulary or forgetting words/ideas they intend to express verbally; use real objects, models, photographs, drawings, symbolic images related to the nose, perfume bottles, scents, the process of making perfume, materials for decorating scented jars, drawing tools, paper, squeeze tubes, glass jars, scent boxes, essential oil bottles, adhesive tapes, glue, scissors, etc., to support children in enhancing their vocabulary. High-tech AAC assistive measures: Use computers and projectors to show videos, images, and interactive games related to the steps of making perfume and how different scents are combined.

Implementing measures for organizing STEAM educational activities to develop expressive language in children with ASD aged 5 – 6 years:

+ **Measure 1**: Adjust the activity process to be slower than usual to help children with ASD keep up with the activities;
Measure 2: Collaborate with parents for children to repeat this activity at home; Measure 3: Apply all techniques to develop expressive language abilities in children throughout the STEAM educational activities.

Activity 2: “Making a Bird’s Nest” Project
Implementing a set of measures: “Developing a short-term plan for organizing STEAM educational activities to enhance expressive language abilities in children with Autism Spectrum Disorder (ASD) aged 5 – 6 years” to: Gather information about the children’s expressive language abilities and other developmental areas; Develop a STEAM educational activity plan suitable for the children’s abilities and needs: Divide the project into 3 smaller sessions, integrating conversation, questioning, and verbal support in activities to help children develop expressive language during the sessions.

Measures to adjust the environment in the STEAM educational classroom to create a language-rich environment for children with ASD aged 5 – 6 years: + Measure 1: Decorate the classroom with models of bird nests and birds, drawings of bird nests, and poems and riddles about bird nests using images. Measure 2: AAC without assistive technology: Teachers use gestures, body language, physical supports, eye movements, etc., to assist and prompt children.

Low-tech AAC assistive measures: Use activity charts to remind children of the process, steps for making a bird’s nest, and presenting their products; use visual rules to remind children of permissible and non-permissible behaviors during STEAM activities; use picture cards to help children express needs when they lack vocabulary or forget words/ideas they intend to express verbally; use real objects, models, photographs, drawings, symbolic images related to bird nests and birds, materials for decorating bird nests such as: drawing tools, paper for designing, and materials for making bird nests like straw, felt, leaves, wood shavings, old mats, old baskets, etc., to support children in enhancing their vocabulary related to the theme of making bird nests.

+ High-tech AAC assistive measures: Use computers and projectors to show videos, images, and interactive games related to the steps of making bird nests.

Measures for implementing STEAM educational activities to develop expressive language in children with ASD aged 5 – 6 years: + Measure 1: Adjust the activity process to be slower than usual to help children with ASD keep up with the activities. Measure 2: Collaborate with parents to have children repeat this activity at home and suggest additional activities like “making a pet house” or “making a bird feeder” at home.

Measure 3: Apply all techniques to develop expressive language abilities for children throughout the STEAM educational activities.

The study evaluated M.’s expressive language abilities after the intervention in mid-April 2023. Feedback from the homeroom teacher and parents indicated significant progress compared to before the intervention. In the post-experiment assessment checklist, M. scored a total of 36 points (an increase of 10 points from the pre-experiment score), falling into Level 3 – Fair. The child’s expressive language abilities are specifically reflected as follows: With the educational goals set before the experiment, the child showed progress, particularly in two goals: presenting in front of the class with the support of pictures or objects and answering open-ended questions. Before the experiment, the child could not present in front of the class and even had very negative reactions when asked to present. However, after the experiment, the child understood the structure of a presentation and its components. Although the child still needed reminders from the teacher to recall the parts of the presentation when presenting directly to classmates, they grasped the idea of what parts are needed to describe an object or product, and how to organize the content logically. Regarding the goal of answering “Why?” questions, the child could find an answer to each question but needed prompts from the teacher to start with “Because...” and then would complete the answer independently.

Next, in using negative sentences, the child could use 2-3 word sentences to express refusal. The sentence structure used includes subject + “no,” or subject + “no” + verb. For 3-word sentences including subject + “no” + verb, the child still needed prompts to add the verb. With verbal cues, the child could complete their response. The verbs the child used more frequently were “take” and “play.” For the goal of retelling the content of a story in sequence using a 3-step picture, the child memorized the story after hearing it 4-5 times. Each story consisted of 3 parts corresponding to the 3 steps, each part being a 3-4 word sentence. The child could use sequence words correctly to describe the order of the story, such as “first,” “then,” and “finally.” However, the child was not naturally able to retell every story in sequence and only used sequence phrases naturally with stories they had heard and been asked to retell many times, especially when the story details followed a cause-effect pattern.

Additionally, there were two areas of progress beyond the initially set educational goals: using names, actions, qualities, and expressive words in daily activities; and using appropriate greetings and polite words in context. In the use of names, actions, qualities, and expressive words in daily activities, the child’s score increased from 2 points – needing support, to 3 points – receptive. In this area, M. could use action words more frequently in daily activities like “take,” “give,” and...
“play.” The child actively used names related to topics such as animals, fruits, vehicles, school supplies, household items, familiar toys, and weather phenomena in communication. However, for names related to weather phenomena, which were recently learned, the child still occasionally needed reminders. The child used names confidently in familiar contexts but was not proactive in new environments (new playground, new learning environment, with unfamiliar people) and tended to forget these names, likely due to a lack of confidence and shyness in new settings. For using appropriate greetings and polite words in context, the score increased from 1 point – not able, to 2 points – needing support. Through participating in activities like role-playing and presenting, the child needed to use greetings and polite words frequently to communicate with classmates and teachers. The child understood whom to use words like “yes,” “please,” “thank you” with. Before the intervention, the child often spoke without using polite words and rarely said these words. However, after the intervention, though still needing verbal prompts from the teacher, such as holding the mouth shape for “please” to remind, saying “please teacher....” “yes....” “yes please....” for the child to complete the polite phrase with adults. Though still needing verbal prompts and pointing to the communication target for the child to greet correctly, it was the first time the child reflexively greeted people around and used greetings appropriately.

Feedback from the homeroom teacher and parents indicated that M. had better attention, interest, and enjoyment in participating in STEAM educational activities, especially in activities like storytelling and role-playing compared to before the experiment. The child was more confident and, for the first time, could stand before the class and present a product description, though needing many reminders from the teacher. This was a significant improvement for the child's integration process, as previously the child did not dare to stand up before the class to speak, even having negative reactions like crying or throwing things to avoid the presentation task. The number of contents needing support from parents and teachers decreased compared to the time before the experiment.

The study proposes 3 groups of measures to develop expressive language for children with autism spectrum disorders 5-6 years old through organizing STEAM educational activities. Measure group 1 is a group of measures to develop short-term plans to organize STEAM educational activities, including sub-measures: 1) Assess children's initial abilities; 2) Plan to organize STEAM educational activities. Group of measures 2 is a group of measures to adjust the language-rich STEAM educational classroom environment, including sub-measures: 1) Arrange the organizational environment; 2) Use appropriate teaching materials. Group of measures 3 is a group of measures to deploy and organize activities, including sub-measures: 1) Adjusting the process of implementing activities; 2) Collaborate with parents; 3) Apply techniques to develop expressive language abilities for children with autism 5 - 6 years old. These 3 groups of measures were tested on 2 children with autism spectrum disorder 5 - 6 years old for 3 months. The author team has developed lesson plans that include the proposed groups of measures (each child carries out 2 STEAM projects, each project is divided into 3 lessons), and developed a plan to implement the lesson plans. (including educational goals, educational activities, duration, location, organizational form), conduct pre-experimental and post-experimental assessments.

After conducting experiments and from the experimental results, it has been shown that measures to organize STEAM educational activities to develop expressive language for 5-6-year-old children with autism not only bring positive effects in developing children's expressive language abilities but also create development in many other aspects. In particular, while organizing STEAM educational activities to develop expressive language for 5-6-year-old children with autism, it has been shown that an individual approach is suitable for children.

**CONCLUSION**

When developing expressive language skills for 5-6-year-old children with autism and organizing STEAM educational activities, teachers need to observe and learn about the strengths, weaknesses, needs, and abilities of each child to choose what to do. Adjust measures to organize activities to suit each child. Educational institutions need to create physical conditions for organizing STEAM educational activities to develop expressive language abilities for children with autism and strengthen guidance and training for teachers. In the future, research can suggest different measures and implement STEAM projects suitable to the organizational and cultural conditions of each country and region, helping children with autism to develop their best expressive language skills through participating in STEAM activities.

**REFERENCES**

- Nguyễn Thị Lan., & Trần Văn An. (2024). Phát triển chương trình STEAM cho trẻ tự kỷ: Hướng đi mới
trong giáo dục đặc biệt. Hội nghị Quốc tế về Giáo dục Đặc biệt và Hỗ trợ Tâm lý, 29-41.


