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Research Article

# Developing STS skills for children through learning history and culture of Vietnamese kites

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**Abstract** This research is to develop a STS educational program through a learning project, which is an open project in which the participating children can freely create useful products in their own lives. Research objective: children apply their knowledge, skills, and experience in designing and making "Kite" which is a traditional toy in Vietnam. Research method: I used the case study method, with 5 children from 10 to 12 years old (grades 4, 5 and 6 in Vietnam), the project was carried out in 5 days. After completing the project, the research team used the questionnaire to find out the skills that the children used during the project implementation. In addition, interviews are also regularly used by the research team to assess each children's level of participation and the effectiveness of the project. Findings: children recognize the meaning and necessity of STS education as a problem-solving activity that leads to increased understanding of science subjects, enhanced application of interdisciplinary knowledge, and enhanced creativity by suggesting new ideas.

*Keywords*: Problem solving, STS education, Kite.

## 1. Introduction

STS is a term for the fields of Science, Technology and Social. The term is often used when referring to educational policies and curriculum selection in schools, in order to increase competitiveness in technology development. It plays an important role in workforce development, national security, and immigration policy.

Currently, the context of the ongoing 4.0 industrial revolution with the speed up technological development has significantly influent on Education (N.H. Hau, T.T. Tinh and N.T. Van, 2020 [1]; T.T. Tinh, N.H. Hau, L.T. Hieu (2017) [2]).

STS education emphasizes the importance of education fostering creative problem-solving skills to become competitive in the global age and prepare for all future challenges (Baek et al., 2011 [3]; N.H. Hau, T.T. Tinh and N.T. Van, 2020 [1]; T.T. Tinh 2018-2019 [4]).

The Science, Technology education system is believed to be an effective solution to the problem of high-tech labor shortage. "Science, Technology education has made work in so many industries faster, more efficient and bolder at the lowest cost.

The foundation of education system is to make us more productive throughout the process, but it does little to develop our curiosity or imagination. It does not focus on promoting creativity. It also does not teach us about compassion or how to create and maintain deep emotional human relationships. Japan and Singapore are typical examples. They are seen as role models in the transmission and application of modern education in the country, but they also face the risk of a lack of creativity taking place around the world.

Benjamin T. Lester, Li Ma, Okhee Lee & Julie Lambert (2006) [5] said that children with adequate science knowledge tended to express activism more frequently, and that their expression of activism increased as they gained better science knowledge after the instruction.

Bouillion, L. M. and Gomez, L. M. (2001) [6] said that explores a form of "connected science" in which real world problems and school-community partnerships are used as contextual scaffolds for bridging children' community-based knowledge and school-based knowledge as a way to provide all children opportunities for meaningful and intellectually challenging science learning.

Bybee, R. 1993 [7]. said that science education reform is an ongoing process; Pedretti, E. 1999 [8]. said that it is important for young children to develop skills of natural inquiry, critical thinking, and decision making about science and technology and the links to the world they encounter at an early age in their education; P.P. Walsh and E. Murphy and D. Horan (2020) [9], said that, the transition path to inclusive and environmentally sustainable economic development must be Science, Technology and Innovation intensive.

Science, technology, engineering and math are important subjects and need to be taught with focus. However, they cannot take on the entire responsibility alone. To prepare future generations to lead the progressive world, we also need to focus on innovative ideas that empower each individual to innovate and progress.

Because STS education, they also usually persevere through failure, and otherwise experience the range of attributes associated with the creative process (Guyotte, Sochacka, Costantino, Kellam & Walther, 2015 [10]; Sawyer, 2012 [18]; N.H. Hau, T.T. Tinh and Nguyen Thuy Van, 2020 [1]).

The recent high-speed development of scientific technology has led to an increase in globalization, convergence, diversification and unpredictability. As a result, scientists of the future will need not only a strong background in education, but also the development of creative problem solving and global expertise fostered through the arts. The rationale behind developing a Project STS in Vietnam is based on the concept of integrated education. The STS project will help develop the ability to apply interdisciplinary knowledge and personal experience to problem solving, and increase the interest and understanding of science and technology in children. STS education is necessary to nurture the creative and convergent talent among today's youth, which will lead future developments in science and technology.

## 2. STS project implementation process

In my opinion, the fundamental elements of STS are creative and emotional design, providing a learning experience based on knowledge, processes and the convergence of fields related to technology, engineering, science, math and artistic emotion

In figure 1, the author proposes the process of implementing a STS project, in which, the problem from the context, creative design and emotion is clearly highlighted.

- The first stage: from the life situation, children recognize the problem that needs to be connected to their lives and relate it to the real world (Brown, Collins & Duguid, 1989 [11]; Lave & Wenger, 1991 [12]).

- The second stage: Transforming from a need for a product to a design idea, creative ideas for a design are proposed by children, in which the instructor/teacher encourages children to practice creatively with open designs. Children can collaborate.

- The third stage: Children apply their knowledge, skills, and experience to the production process. In the process of implementing the project, children expand the emotional domain, emphasizing the importance of art by experiencing and exploring a situation.
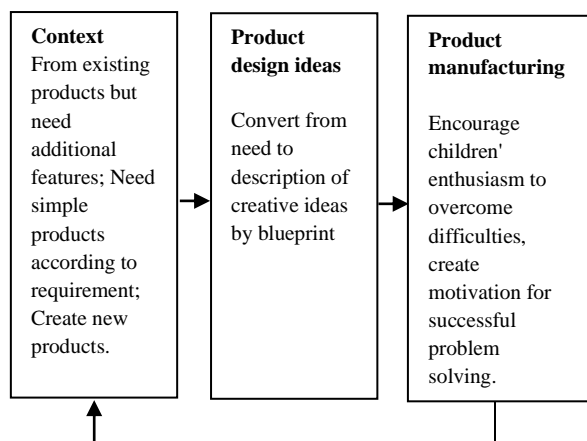
| Context | Product design ideas | Product manufacturing |
|---|---|---|
| From existing products but need additional features; Need simple products according to requirement; Create new products. | Convert from need to description of creative ideas by blueprint | Encourage children' enthusiasm to overcome difficulties, create motivation for successful problem solving. |

*Figure 1. STS project implementation process*

## 3. Research methods

### 3.1. Objectives of the study

This study seeks to develop a STS Project based on the theme of designing and manufacturing "Kite", which is a toy associated with each child's childhood in Vietnam. Apply it to a learning project, and determine the effectiveness of the program. Therefore, the main aim of this study is to:

1. Developing a STS project based on Vietnamese traditional culture as a form of learning and promoting Vietnamese traditional culture in general and the art of Kite making in particular.

2. Discover the effect of applying the STS project in the real context of the traditional Vietnamese Kite making.

### 3.2. Data collection and analysis

This study developed and identified the effectiveness of a STS Project that children could experience and implement on their own. The research team guided children through the following steps:

- Step 1: Create a group, including children and teachers, support experts
- Step 2: Discuss the topic of designing and making "Kite".
- Step 3: Learn cultural traditions related to the project's "Kite" product
- Step 4: Analyze the structure and operation of "Kite", propose tasks related to knowledge to apply during project implementation.
- Step 5: Design and make "Kite", and regularly consult teachers and experts who know about kites, helping to correct them in time.
- Step 6: Evaluate products, add new ideas

In this study, the expert team developing the STS Project includes:

03 PhDs from the schools Ho Chi Minh National Academy of Politics; National Academy of Education Management; Xuan Giang High School, Hanoi. In addition, we are supported by P.H.Bon, he is a Kite enthusiast for a long time, he is attached to Kite and has a lot of experience in "Kite" making.

For Dr. T.T. Tinh and Dr. L.H. Quang, the two PhDs have done a lot of research on innovation in teaching methods, with researches on experiential learning, developing children' ability to model math, and research on integrated education. In which, there is an assessment of the process of solving tasks of the STS project as well as the evaluation of the project's products; learning through projects. Moreover, in 2018-2019, both were key members in a code B2018-HVQ-06 project "Developing STEAM educational capacity for high school teachers" sponsored by the Ministry of Education and Training, Vietnam [4]. Therefore, these two members have a lot of experience in developing a STS project.

Dr. L.H. Quang is currently teaching Mathematics at Xuan Giang High School, Soc Son District, Hanoi, Vietnam. He often uses modern teaching methods to increase student learning outcomes. Soc Son district is famous for the festival of "Kite flying contest", so he is very knowledgeable about the culture of his homeland associated with "Kite".

To develop and apply the STS Project, the group of members, teachers, and experts conducted regular discussions, as well as participated in the program validation process. The helping team includes P.H.Bon who has a love for "Kites", knows how to make "Kites". In addition, another member, T.V.Tho, has a deep understanding of ethnic musical instruments, and electronic engineering, will help as an expert in activities related to engineering, technology and tweak the sound (if available in the project). Reviews of these experts are conducted on a regular basis, improving the efficiency of the project and helping to ensure the development of a high-quality project. This procedure allows experts to assess the accuracy of the research process and research results because it ensures reliability between studies. The development program took place in 5 days.

After implementing the project, the research team conducted interviews with all 5 children, the interviews were recorded. Thanks to that, we make comments on the project's results, as well as the effectiveness of STS education methods through creative practice activities.

## 4. Research contents

### 4.1. Activities of the "Kite" making project

The topic is to produce an application in life, showing the cultural beauty of many Vietnamese people. The research team determined to make "Kite", the references for the project members was mainly found on the internet, directly refer to Kite products that have samples and are flown by players in the sky.

Tracy L. Coskie and M. Michelle Hornof (2006) [13] said that, children are delighted by the playful activity of making and fl ying kites, They encourages teachers to harness this excitement and connect it to investigations relating to wind, technology, and the design of experiments.

The process of forming autonomous learning in education is often complex, in which the influences of socio-cultural factors on education in general and children' learning in particular are considerable (C.T. Nguyen 2011) [14].

According to (C.T. Nguyen 2011 [14]; Hanrahan 1998; Sinclair 2007 [17] and Lamb 2009 [16]), the learning environment including traditional-cultural aspects crucially impacts on children' learning, especially on autonomy in learning.

Taking context in Vietnam this paper attempts to depict and examine Vietnamese culture that may constrain or facilitate children to learn autonomously (C.T. Nguyen 2011) [14].

Specifically, the project implementation phases are as follows:

+ In the first stage, from a real-world context, children focus on learning about the tradition of kite flying, the festival of kites in Vietnamese culture; Each group will write an essay related to Kite

+ The second stage: describing the kite design through its structural analysis;

+ The third stage: implementing production through design and creative ideas and artistic feelings, this phase focuses on making the kite and using it… During the project implementation, we use the calculator to learn more about the design, calculate the quantity of materials to be prepared.

+ The fourth stage: evaluating project results.

Out of 5 children proposed to design two different types of kites.

+ Group 1: T.T.Duong, P.V.M. Ngoc and Sehma chose to make a "Flat Kite".

+ Group 2: L.H.Dang and T.G.Han chose to make a "Kite Boat"

During the implementation process, the children were regularly consulted by members of the research team and outsiders who were knowledgeable about Kite, to ensure smooth project implementation.

- **Group 1 activities (T.T. Duong, P.V.M. Ngoc and Sehma)**

After learning about how to produce a "Flat Kite", the three friends gave the materials with following sizes and quantities:
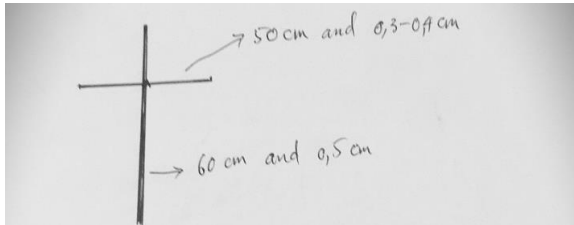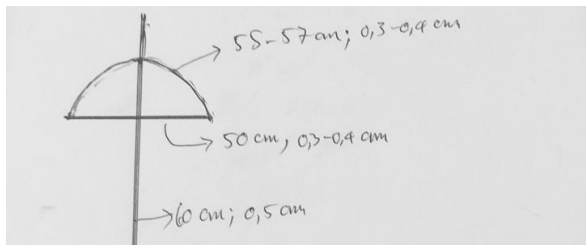


**Figure 1.** First Flat Kite model
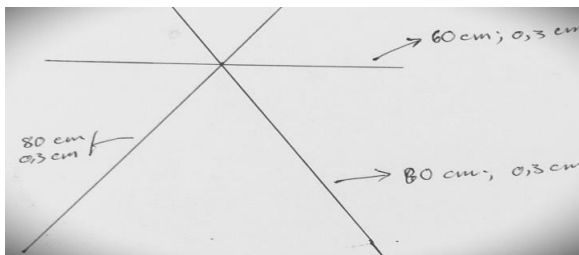


**Figure 2.** Second Flat Kite model



**Figure 3.** Third Flat Kite model

**Step 1:** Describe the Kite design on the drawing (use A4 or A3 size paper to draw the design on it) (Figure 1-2-3).

**Step 2:** Determine the materials needed for production (Figure 4-5)

+ Plastic garbage bags, durable paper or thin cloth
+ Two 60cm and 50cm wooden or bamboo sticks
+ Cotton rope at least 30m long
+ Newspaper or colored paper (for kite tail cutting)
+ Glue, Tape
+ Ruler
+ Scissors
+ Colored pencils/markers/crayons (optional)



**Figure 4.** The materials needed for production

     

**Figure 5.** Bamboo tubes     **Figure 6.** Flat Kite Production

**Step 3:** Making a Kite Frame

We need two or three main bamboo sticks to make a frame (assembled in figure 1, 2 and 3), learn the length ratio of the two sticks 5/6 (Figure 6). Stretch the string from the ends of the bamboo sticks of the T shape (Figure 1-2-3), pull the string taut but not too tight to prevent the stick from bending. The string will help the kite frame keep its shape when flying in the sky.

**Step 4:** Measure and cut the kite sail

We can use plastic bags, paper or cloth with a width of 1m to make kite sail. The large white garbage bag is the best choice because it is durable and easy to decorate. White decorative paper or newspaper, or fabric can also be used to make kite sail if paper or plastic bags are not available, but thick and stiff fabric should be used to avoid tearing.

Place the kite frame on the center of the kite sail material on the floor. Use a ruler to draw the outline of the kite. Cut the kite sail 5cm wider than the line.

**Step 5:** Glue the kite sail with the frame and add the kite tail

Wrap the edge of the kite sail over the frame, apply glue and press down. Apply a thin layer of glue to the frame and press the edge of the kite sail onto the frame to hold it in place.

The kite tail is cut with newspaper or colored paper with a width of about 3-5cm, the tail can be 1.5m-3m long (short pieces of paper can be joined into a long kite tail).

Attaching strings: The kite string is actually consulted and advised by experts, the kite string is selected as a small, tough string that is compatible with the kite size.

Decorating the Kite: Sehama is in charge of painting decorations on the kite sail; T.T.Duong and P.V.M.Ngoc are in charge of designing vivid kite tails.

**Step 6:** Fly the kite and keep tweaking

T.T.Duong and P.V.M.Ngoc took the kite away, Sehma held the control line to bring the kite up. After 2 times of flying, the kite has been re-aligned and the tail has been adjusted. As a result, the kite was released in the sky and was stable, without being exchanged.

- **Group 2 activities: L.H.Dang and T.G.Han**

To make "Kite boat", group 2 also performs the same steps as group 1, however, in this design there is a change. The shape of "Kite boat" is like a boat, so the frame design is different from the design of group 1. "Kite boat" does not use a flexible long tail, so in the production process of "Kite Boat", the balance of "Kite Boat" is always noticed by the members. In all Kite production activities, the team is always supported by experts, from the preparation of materials, processing the kite frame, assembling and creating the kite frame, cutting the kite sail, gluing the kite sail, tying the string, kite flute design, experimentation and fine-tuning. Specifically:

Materials: 1 sharp pair of scissors; 1 iron knife; 1 bamboo stick is about 1.4m long, the diameter of the bamboo body is 8-10cm thick. We take 1/8 of that bamboo; rope, 1 piece of plastic 2m long and 1.5m wide; a piece of bamboo about 20-25cm; an awl (used to punch holes).

The steps are summarized as follows

Children used a bamboo knife to cut into 8 pieces, then took out 2 sticks and sharpened them with a knife. After being sharpened to the corresponding small size, bend the two ends of the bamboo stick and adjust until it is balanced (Figure 5).

Choose a bamboo rod with a width of 10cm to make a kite handle, this stick should be flat (but not too thin otherwise the frame will be broken when bending). In addition, there are additional horizontal braces for the frame. Use a lanyard to create the shape of the kite frame (Figure 7).

Take a piece of plastic (or paper or cloth) and put it on the kite frame and then cut it (note to cut bigger than the kite frame). Then glue or sew the kite sail to the frame.



**Figure 7.** Kite boat Production

Tie the kite string, adjust the string after the experiment.

After completing Kite Boat, you L.H. Dang proposed the idea of adding a flute on the kite so that when flying in the sky, it will make a flute sound. To be able to get a kite-mounted FLUTE, L.H. Dang asked expert P.H.Bon and Dr. L.H. Quang to advise how to make a flute mounted on the kite boat. The process of making a flute that can be mounted on a kite boat takes a long time (Figure 8).
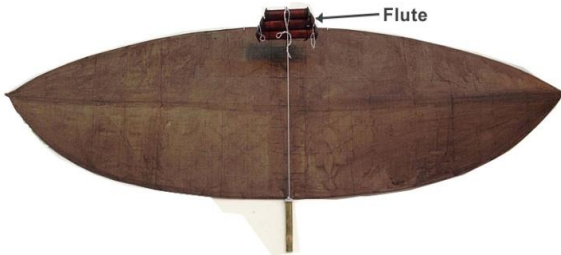


**Figure 8.** Kite boat

In addition, T.G. Han proposed to add LED lights on the kite so that when flying at night, the kite position can be seen and has beautiful colors, expert T.V.Tho assisted in the design and installation of led lights.

**Group 1's report about history and and culture of Vietnamese kites** (Figure 9)
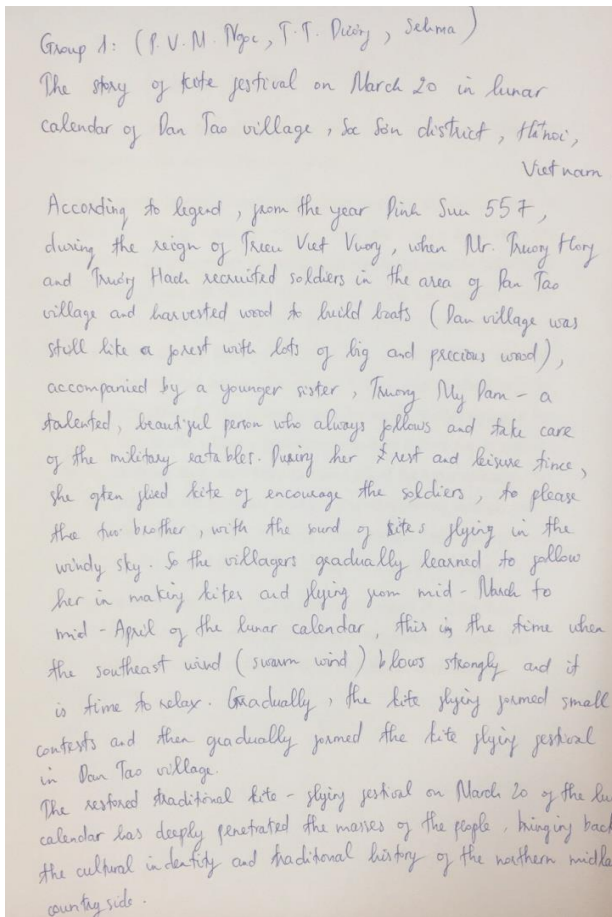


**Figure 9.** Report Group 1

**Group 2's report about history and and culture of Vietnamese kites** (Figure 10-11)
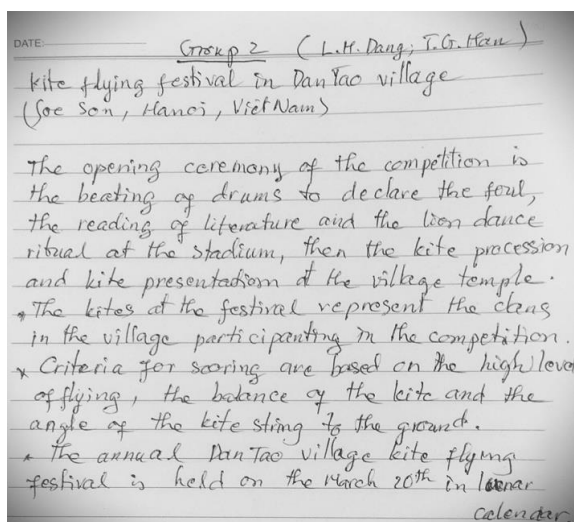
**Figure 10.** Report Group 2



**Figure 11.** Kite Festival in Dan Tao village

## 4.2. The skills children used when implement the project of making "Kite"

After the two groups of making "Kite" completed, the research team conducted an investigation to see what skills the children applied during the project implementation. STS skills are denoted by me as follows: Science Skills (S), Technology Skills (T), and Social Skills (S').

Investigate skills used by children:

+ Group 1 (T.T.Duong, P.V.M.Ngoc and Sehma) said that they used S skill with computer to learn about Kite; skills T with Math to calculate the required materials and use them; Skill T is their search for materials with unique properties to make kites; Skill Art is how they design kite frames, draw on kite shirts; skill S' about kite festival.

+ Group 2 (LHDang and TGHan) said that they used skill Art to research and create kite images, come up with ideas to make kites more beautiful, learn about traditional festivals about Kite; Math skill to calculate the required materials; Skills T are used in the process of making kite frames, designing flute and refining the flute's sound; S, Math skills are used to search for materials with specific properties, calculate the total amount of money needed if they have to buy materials that are not available; skill S' about kite festival.

We interviewed all 5 children participating in the Making Kite STS Project. The interview was noted in a notebook. Through interviews, we assessed children' awareness of the meaning of STS education.

The following content is from an interview with student T.T.Duong

Student T.T.Duong: "During the discussion about Kite model design, I discovered that there are many steps that I don't think about such as: choosing what kind of bamboo to make the Kite frame; what kind of paper should be used because when flying a kite it can rain, etc. I find that STS is necessary because it develops knowledge through problem solving."

The following is from an interview with children P.V.M.Ngoc and Sehma

PVMNgoc: I was able to easily understand the content that I didn't know how to do before. While working on the project, we asked and taught each other how to make a kite frame, how to choose paper or plastic to make kite sail. In addition, I think we learned something about trying to solve the problem in the Kite design discussion.

Sehma said that thanks to the Kite production project, she has learned more about a folk game in Vietnam. In her homeland, Philippines also has this game, however, she has not had the opportunity to make Kite. Thanks to the project, she tried her creative ideas through the way she drew on the Kite.

L.H.Dang said that there are regular kite flying competitions at her living area, she has seen many types of kites, but before joining the project, she has never directly made kites. So, when she was called to participate in the project, she was very happy to join the kite production, she used her knowledge and understanding into the project implementation process.

The author discussed with Dr. L.H. Quang and Dr. T.T. Tinh. We believe that STS is necessary because it allows children to develop critical thinking skills through problem solving. These results correspond to the STS education goal that the Vietnamese education is aiming for, to help children develop STS skills, expand their knowledge by sharing their ideas to solve problems.

## 4.3. The usefulness of the STS Project

Interviewing 5 children doing the project, all children said that they are interested in the STS project because they can participate in problem solving, cooperation, and having fun during the implementation of the STS project, thereby gain new knowledge and learn new concepts. In particular, student L.H.Dang said that he used the STS project in his science project because it allowed him to participate in the whole problem-solving process. This shows that children are motivated by their interest in science, scientific effectiveness, and confidence in the STS project.

T.G.Han said that collaborative problem-solving is fun, and show that children can develop communication skills and appreciate skills through collaborative activities "practice" and "practice".

Student P.V.M.Ngoc: "We had a good time working on the project, we discussed, debated, tested ideas together. There were times when it failed but it didn't discourage us."

T.T.Duong and L.H.Dang said that the activities of the STS project were very strange and unfamiliar. At first, they thought that it would be difficult to make Kite because they had never participated in these activities before. However, with the encouragement of supporting members such as Dr. N.V.Luong, T.T.Tinh, L.H.Quang and Mr. L.H.Bon, thanks to that, they trusted and joined the project. During the implementation of the project, they always received regular advice from expert members.

## 5. Findings

Develop ingenuity and creativity: Children' ingenuity and creativity are stimulated, helping them invent innovative ideas and projects.

Teach children problem-solving skills by using critical thinking skills. When experiencing STS education method, children will learn how to analyze problems and plan to solve them.

Building endurance, in STS educational activities, children learn in a safe environment where they can freely fail and try again. The STS method of education emphasizes the value of failure as a valuable teaching tool, it teaches children to value failure, and accept it as an inevitable part of the learning process. This helps children practice confidence and perseverance, two indispensable virtues so that they can overcome difficulties later on. Difficulties and failures are an inevitable part of the road to success.

Encouraging experimentation, STS education aims to encourage children to experiment and safely take risks in learning activities.

Encouraging teamwork, the STS method of education can be applied to children of all levels. Children with different backgrounds can still work in the same team to solve problems, record data, write reports, give presentations, and more. As a result, children are able to cooperate with each other and develop together in an environment that

Encouraging the application of knowledge into practice, in STS education, children are taught skills that can be applied in real life, which motivates them to learn, because they know that these skills can be used immediately to make life better for children and their families. The ability to apply knowledge to practical tasks will be an effective tool for them in the future working environment.

Encouraging the use of technology, STS education teaches children the power of technology and inventions. Therefore, when children are exposed to a new technology, they will be ready to embrace it instead of hesitant or afraid. This will give them a great advantage in a global environment that is becoming increasingly technological.

To encourage adaptation, to be successful in life, children need the ability to apply what they learn to different situations.

## 5. Conclusion

The purpose of this study is to develop a STS Project in a real context and learn about a traditional Vietnamese folk toy "KITE" and make it. As shown in this study, children recognize STS learning projects as problem-solving activities using STS skills and integrated learning competencies. Moreover, from this project, children have a solid understanding of scientific principles as well as develop their creativity and exploit emotions by discovering the beauty of Vietnam traditional folklore through "kite"

However, this study has limitations, it is difficult to generalize the research results because the activity in this project was relatively small, with the performance of 5 children, therefore, any researches in the future must be a larger sample size to generalize the research results.

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