

## BUILDING 3D MODELS OF HUMAN AND HEALTH TOPIC TO SUPPORT TEACHING IN THE NATURAL AND SOCIAL SUBJECTS AND SCIENCE SUBJECTS

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Received December 3, 2024. Revised April 18, 2025. Accepted May 5, 2025.

**Abstract.** In teaching the Human and Health topic of the two subjects above, with abstract knowledge, when teaching, teachers use a combination of 3D models to help students have the opportunity to access learning content easily. Based on the principles and process of 3D model design, the research has designed specific 3D models for each grade level in the Human and Health topic from grades 1 to 5. Experimental results of using 3D tooth models as a means of teaching practice activities in the lesson plan for Nature and Society subject in class 1/3 of V.T.S primary school, Ho Chi Minh City Minh has promoted students' positivity and met the development of inquiry capacity; ability to apply according to the requirements of the Human and Health topic.

**Keywords:** 3D model, Human and Health topic, Natural and Social subjects, Science subjects, primary school, Ho Chi Minh city.

## 1. Introduction

According to Jessica (2023), the demand for visual teaching tools (i.e., models) is on the rise due to their effectiveness in helping students engage with and explore the world around them [1]. Supporting this view, Permana and Utomo (2021) found that 3D models are particularly beneficial in science education for several reasons: (1) they offer students a more intuitive understanding of complex scientific concepts; (2) they effectively capture attention and generate interest by visually representing abstract content; and (3) stereoscopic 3D technology can enhance learning and memory retention, especially in relation to scientific topics [2]. Similarly, Nguyen M.T., Tran L., and Nguyen T.B.P. (2022) emphasized that well-designed teaching materials aid students in comprehending concepts and laws, while also contributing to the development of essential knowledge, skills, techniques, and attitudes [3]. In particular, the model has brought certain effectiveness to students in the process of learning subjects. According to My L (2019), using models will encourage innovation in learning methods in a positive, proactive, creative direction and improve the quality of education. Examples of the effectiveness of using models in teaching have been proven such as “Multi-purpose 3D paintings” of the 2nd grade students and “Vietnam sea and island model” of the 3rd grade teachers through the movement of making teaching aids in primary schools [4].

In the curricular of Natural and Social subjects and Science subjects (2018) form and develop students' scientific capacity, including the following components: scientific awareness, understanding the surrounding natural and social environment, applying knowledge and learned skills. According to the curriculum of these subjects, the purpose of teaching equipment is to illustrate knowledge, create interest in learning for students, learn, discover and train thinking and practice [5, 6]. Teaching content on the Human and Health topic in Natural and Social subjects, Science subjects of external and internal organs of the body. However, the teaching aids in this topic are mainly pictures, leading to difficulties for teachers in the process of educating students to discover the nature of structure, function and operating process of organs in the body. Therefore, it is very difficult for students to absorb knowledge content and form self-care and protection skills. Therefore, with abstract knowledge content, when teaching, teachers should use a combination of 3D models to help students have the opportunity to get closer to knowledge about the structure and operation of external organs in the human body [7]. In addition, teachers can apply the teaching orientation of exploration and discovery through 3D model learning so that students not only form and develop specific scientific competencies, but also develop quality capacity and general capacity according to program requirements. However, in reality, designing 3D models is used for the process of teaching the Human and Health topic in the Natural and Social subjects and Science subjects for primary students according to the 2018 General Education Program in Vietnam has not yet been systematically studied. Therefore, this research builds the 3D model of in the Human and Health topic to support teaching in the Natural and Social subjects and Science subjects. The research results aim to provide learning resources in the direction of designing and using 3D models in teaching and accessible resources for teachers and students.

## **2. Content**

### **2.1. Some concepts**

#### **2.1.1. Model**

A model is a visual representation of some aspect of the real world to describe and concretize abstract theories of an object. In addition, the model also describes the essential characteristics and relationships of a complex reality through intentional reduction [8].

#### **2.1.2. 3D model**

According to Hansen Steven (2018), a 3D model is a three-dimensional visual representation of an object [9]. According to G. Mathews, a 3D model is a product that simulates real objects outside reality by using a set of points in space to reconstruct the surfaces of objects in three-dimensional space; Helps viewers observe objects from all different angles [10]. 3D models can be built by hand, by computer algorithms or by scanning techniques. Based on related research, we use the concept of 3D models as realistic and vivid images in 3-dimensional space created from tools and software that designers can create. characters, objects and simulate space in a creative and sophisticated way.

#### **2.1.3. Principles of model design**

*a) Ensure goals and requirements are achieved, closely follow subject content and educational activities according to the 2018 General Education Program.*

The models are designed closely to the goals and requirements to achieve the content of the Human and Health topics, in the Natural and Social subject, Science subject at the formation and comprehensive development of capacity, qualities for students.

*b) Ensure systematicity*

The teaching process is a complete system consisting of many elements that are closely related, governed and regulated by each other. The teaching model is one of the components of

that process. Therefore, the model design needs to ensure consistency with other elements of the educational process such as teaching methods, teaching forms, etc., to maximize the effectiveness of the models.

*c) Ensure scientific quality*

Designing 3D models in the Human and Health topic must be consistent with the physiological and psychological characteristics of students. The details in the model must ensure accuracy, standards, clarity, and ease of understanding for students.

*d) Ensure intuitiveness and vividness*

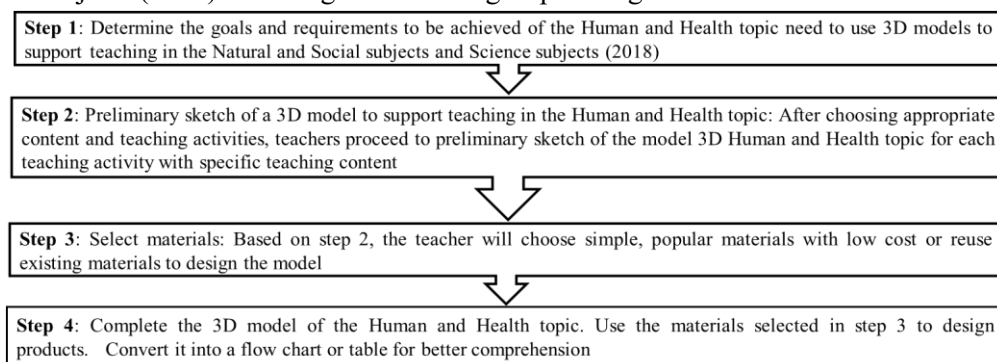
The designed model needs to ensure intuitiveness, vividness, diversity in form, genre, and content suitable for the psychology and physiology of all ages, attract concentration, create excitement for learning, and contribute to shaping learning. achieve and develop students' competences and qualities.

*e) Ensure feasibility*

Design models must be practical, close, create interest in learning, meaningful, and suitable to the cognitive level of primary students. Model design materials are simple, popular and easy to find, suitable for the reality of classrooms, schools and localities. The cost of inexpensive model design materials or the use of everyday recycled materials.

#### **2.1.4. The process of designing Human and Health topic materials in 3D models to support teaching in the Natural and Social subjects and Science subjects (2018)**

Based on the theoretical basis of designing People and Health-themed corpus in 3D models to support teaching in the Natural and Social subjects and Science subjects (2018), the study proposes a model design process. 3D supports teaching in the Natural and Social subjects and Science subjects (2018) including the following steps in Figure 1:



**Figure 1. The steps for designing the Human and Health topic materials in 3D models**

## **2.2. Research methods**

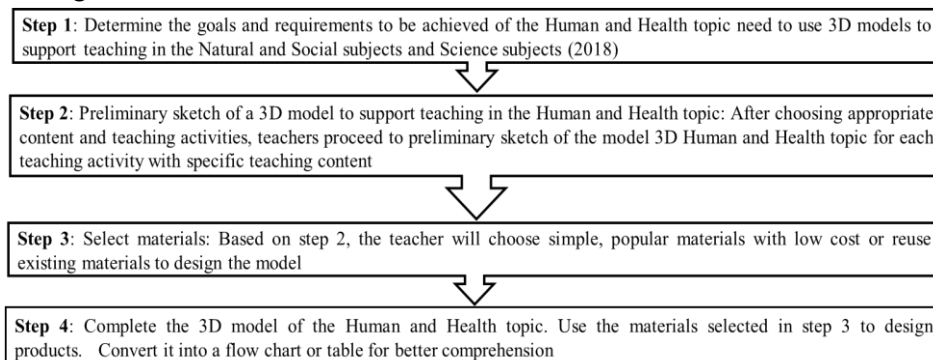
### **2.2.1. Theoretical research methods**

The method aims to research the theoretical basis for the research topic through collecting information from documents, books, scientific articles,... related to the design of the People and health corpus in 3D models. From there, researchers synthesize and systematize to build a theoretical basis for designing and using the People and Health corpus in a 3D model to support teaching in Natural and Social, and Science subjects.

### **2.2.2. Experimental method**

Survey students before and after the experiment through a questionnaire to compare the results to evaluate the effectiveness of the designed 3D model products, and to determine the level of effectiveness in practice. The results were measured by comparing the difference through a dependent t-test between the pre- and post-test results.

The research has been conducted to develop lesson plans using 3D models in teaching. The experimental class has 36 students at V.T.S Primary School, Ho Chi Minh City. The experimental steps are as Figure 1:



**Figure 2. The experimental steps**

### 2.2.3. Mathematical statistical methods

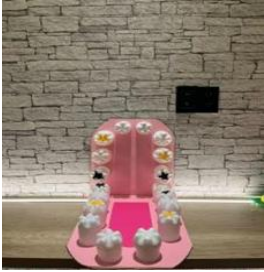

Using mathematical statistical methods to process data and results of pedagogical experiments to evaluate the effectiveness and feasibility of the research. The survey data before and after the experiment were processed with SPSS 25.0 software to compare the difference in average scores between before and after to experimental teaching. From there, draw conclusions compared to the initial hypothesis and evaluate the level of success of the research.




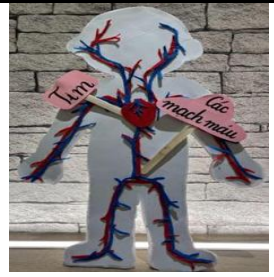


## 2.3. Findings



### 2.3.1. Design 3D models with the Human and Health topic

Research based on the principles and steps of building 3D models has designed a system of models used in teaching the Human and Health topic. Based on the requirements of the Human and Health topic from grades 1 to 5 and select the appropriate 3D model for design. After choosing the appropriate materials and completing the 3D models, there are suggestions for use for teachers. Some detailed products are presented in Table 1.

**Table 1. 3D model of the Human and Health topic**

Class	Model name	Requirements to be met	Material	Illustrative 3D model image	Suggested use
1	<b>Tooth</b>	Take steps to protect your teeth in everyday life	cardboard, lower body of water bottle, color, tape		The model is used in practice activities to specifically illustrate to students how to brush their teeth and each step.
2	<b>Hand</b>	Point and say the names of the main parts of the motor organs	cardboard, hard colored paper, straws, yarn, candy		This model is used in discovery activities to help students know the external and internal factors that make up the hand and how the hand works.

2	Lung	Point and name the main parts of the respiratory organs	colored paper, double-sided adhesive, cardboard, 4 straws and two balloons		This model is used in discovery activities for students to know how the lungs work: inhaling the lungs will expand, exhaling the lungs will collapse.
2	Urine excretion organ	Point and name the main parts of the urinary excretory organs	-Water bottle, felt paper, clay, cardboard, colored paper, 4 straws, candle glue, double-sided glue		This model is used in discovery activities so that students can identify the structure and operating mechanism of the urinary excretory system.
3	Digestive organs	Point and name the main parts of the digestive organs on the model	Cardboard, hard colored paper, self-drying clay, popsicle sticks, crayons, double-sided glue, candle glue		This model is used in discovery activities to help students directly observe the structure and functioning of the digestive organs inside the human body.
3	Circulatory organ	Point and name the main parts of the Circulatory organ on the model	Cardboard, hard colored paper, felt paper (blue, red), popsicle sticks, double-sided glue, candle glue		The model is used in discovery activities for students to directly observe the structure and operation of the circulatory system inside the human body.
4	Food is beneficial and harmful to health	State the reasons why it is necessary to use safe food	Roki paper, A0 white paper, colored paper, colored pens, cardboard, ice cream sticks		This model is used in discovery activities for students to observe directly to identify foods that are beneficial or harmful to the body.
4	Nutritional pyramid	Assess whether a meal is balanced and healthy based on the nutritional pyramid diagram and compare it with the actual meals of the day	Cardboard, self-drying clay, colored paper, hot glue, double-sided glue		This model is used in discovery activities to help students easily observe directly so they can come up with a balanced, healthy diet for the body.

5	Female genitalia	Distinguish the biological characteristics of women	Styrofoam, watercolor, glue		Using models in discovery activities helps students know the structure of the female reproductive system. Teachers can combine education with students on care and hygiene.
5	Male genitalia	Distinguish the biological characteristics of men	Styrofoam, watercolor, glue		Using models in discovery activities helps students know the structure of the male reproductive system. Teachers can combine education with students on care and hygiene.

### 2.3.2. Evaluate the effectiveness of the designed 3D model

#### a) Design illustrative lesson plans using 3D modeling materials

The research used designed materials to build a lesson plan: I keep my body clean in the Human and Health topic, Natural and Social subjects 1 (2018). The lesson plan is built according to the instructions of official dispatch 2345/BGDDT - GDTH and uses the designed 3D model in practice activities.

The requirements of the lesson plan include: Identifying actions needed to maintain personal hygiene, following personal hygiene rules, and practicing proper tooth brushing techniques to maintain oral hygiene. In the opening activity, the teacher organizes a game activity to help stimulate students' existing knowledge about what to do to maintain personal hygiene; Activities to form new knowledge/discovery, teachers use fish tank techniques for students to discuss what to do to maintain personal hygiene. The 3D models are used in practice and application activities: Maintain proper oral hygiene (15 minutes) as follows: Students work in pairs, observing pictures 1 and 2 on page 100. Textbook, and tell your friend, "What happened to An?". (Picture 1: An has a toothache; Picture 2: Mom takes An to the dentist for a dental check-up); Students answer the question: "To avoid having a toothache like An, what do you need to do to maintain oral hygiene?" Then, the teacher uses a 3D model and lets students observe to determine which is the inside, outside, and top of the teeth; Students observe the teacher demonstrating the steps of brushing teeth on a 3D model; students perform step by step with the teacher. Each group of 4 students will work on one model; Then students practice independently. The teacher commented and concluded: to keep oral hygiene clean, you need to brush your teeth properly after every meal and before going to bed. In experimental activities, the research uses 10 models for students to practice in groups.

#### b) Experimental results

Experimental research in grade 1/3 with 36 students at V.T.S. Primary school, Ho Chi Minh City. Experimental time: March 2024. The test to assess input and output consists of 4 questions based on the manifestations of each specific scientific competency component of Natural and Social subjects 1 to collect data. In which, questions 1, 2, 3 are expressions of students' ability to learn about the steps of brushing teeth properly and question 4 is the ability to apply for students to explain the consequences of not brushing teeth properly. After collecting the results before and

after students participated in learning with the lesson plan using the designed tooth model, the study analyzed statistics with detailed results in Tables 2, 3, 4, 5.

**Table 2. Results of a student survey on the number of steps taken when brushing teeth**

Mean		N	Std. Deviation		Std. Error Mean
Before	2,280	36	0,0000		0,0000
After	2,090	36	0,8732		0,1411
Paired Differences					
Mean	Std. Deviation	Std. Error Mean	T	Df	Sig. (2-tailed)
0,2778	0,8732	0,1411	2,021	35	0,004

**Table 3. Results of student survey on step 1 of brushing teeth**

Mean		N	Std. Deviation		Std. Error Mean
Before	2,500	36	0,0000		0,0000
After	2,222	36	0,7968		0,1328
Paired Differences					
Mean	Std. Deviation	Std. Error Mean	T	df	Sig. (2-tailed)
0,2778	0,7968	0,1328	2,092	35	0,004

**Table 4. Results of a student survey about the last step of brushing teeth**

Mean		N	Std. Deviation	Std. Error Mean		
Before	2,361	36	0,5808	0,0968		
After	1,528	36	1,2360	0,2060		
Paired Differences						
Mean	Std. Deviation	Std. Error Mean		T	df	Sig. (2-tailed)
0,8333	0,4639	0,2440		3,416	35	0,002

**Table 5. Results of a survey of students about the consequences of not brushing their teeth**

Mean		N	Std. Deviation		Std. Error Mean
Before	2,431	36	0,4167		0,0694
After	1,458	36	1,2500		0,2083
Paired Differences					
Mean	Std. Deviation	Std. Error Mean	T	df	Sig. (2-tailed)
0,9722	1,2360	0,2060	4,719	35	0,000

The experimental results in Tables 2, 3, 4, 5 in all of the following questions are dependent on the paired-samples t-test results. sig = 0.000, 0.004; 0.002; 0.000; < 0.05. This result shows that there is a significant difference between before and after the experiment. When using 3D tooth models in teaching, students can observe the teacher modeling and discussing with group members, so they can easily distinguish the outer surface, chewing surface, upper jaw, and lower jaw. In addition to white teeth, the 3D tooth model is also colored and highlighted with black and yellow to represent yellow stains that lead to tooth decay. Through that realistic description, students can both visualize the parts of the teeth and be aware of the stains that lead to tooth decay so they can understand and remember knowledge better. Therefore, when using 3D tooth models, students can explore the structure of teeth and the problems that can occur with teeth if not cleaned



properly. This is the basis to help students develop the ability to understand the surrounding natural and social environment according to the requirements of the Natural and Social subject. At the same time, students also develop the ability to apply the knowledge and skills they have learned when brushing teeth on the model and combining it with brushing real teeth. At the same time, applying 3D models also enhances students' learning experience similar to the research results of Shudayfat and Alsalmi (2023) and process information better (Teplá, Teplý and Šmejkal, 2022).

### **3. Conclusions**

The research has provided 5 specific principles and 4 steps of 3D model design. The system of 3D models on the subject of Humans and Health has been designed closely to the requirements of the subject, choose recycled or very low cost materials. Experimental results of 3D models in teaching the Human and Health topic in grade 1 show that using this model ensures appropriateness, flexibility and effectiveness to help students form and develop their ability to learn and apply it according to the requirements of Natural and Social subject 1. The results of this research will be the basis for primary teachers to be able to design 3D models for topics with abstract content in teaching Natural and Social subjects and Science subjects that meet the goal of teaching and developing students' capacity. However, further experimental expansion is needed to evaluate the comprehensive performance of all the designed 3D models.

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