

Placement of a Bird Jigsaw Puzzle on a Creative Story Website to Enhance Learning Pleasure and Understanding of Animal Conservation

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Manuscript submitted December 12, 2018; accepted April 15, 2019.

doi: 10.17706/ijeeee.2020.10.1.69-76

Abstract: In order to establish the concept of animal conservation and learn about local animals under conservation, this study adopted flash program codes to make digital jigsaw puzzles of Fairy Pitta and placed them on a creative story website. The results show that the website with animation teaching materials was able to help students raise their understanding of animals under conservation in Taiwan and enhance their awareness of animal conservation. The digital jigsaw puzzles of Fairy Pitta followed the animation, thus increasing the enjoyment of the website, inspiring students' thinking agility, and improving intelligence and learning effectiveness. The creative story website with animation teaching materials on animal conservation can raise the understanding of animal conservation of browsers. Through games, the edutainment website can trigger follow-up practices, and so it is highly recognized by browsers. The results of this study were presented at a scientific exhibition.

Key words: Digital game, digital jigsaw puzzle, educational, Fairy Pitta, creative animated story website.

1. Introduction

Digital games can improve students' learning ability and interest toward learning and exert a subtle influence [1]. People acquire knowledge or information from digital games and transfer potential cognitive processes from game tasks [2].

This study combined a creative story website with Fairy Pitta with local characteristics to make digital jigsaw puzzles and turn them into vivid and lively digital teaching materials in order to change students' cognition of animal conservation. It aims to cultivate the abilities of observation, patience, and concentration, train a person's logical thinking order, and improve hand-eye coordination ability via the jigsaw puzzles.

2. Motivation and Purpose

Conservation topics are ubiquitous now, but not given enough due attention, leaving many wild animals to be unlawfully exploited and endangered and even eventually living in animal shelters [3]. Tourists' environmental quality and attitudes can positively influence their conservation behavior [4]. Therefore, it is helpful to improve the quality and attitude of animal conservation via education.

In today's information society, digital learning is not limited to time and space. Compared with traditional teaching, digital learning can better attract students' attention, enhance their learning motivation, promote

their problem-solving ability, and achieve better learning outcomes [5]. Therefore, this study turned the creative animated stories of Fairy Pitta with local characteristics into teaching materials for the website. Coupled with the digital jigsaw puzzles of Fairy Pitta, the stories were offered to teachers for teaching and to students for improving their hand-eye coordination ability and to raise awareness and understanding of animal conservation while playing the games.

After watching creative animation, the students played the digital jigsaw puzzles of Fairy Pitta. They were able to learn knowledge happily while having fun and increased their awareness of animal conservation, which is the goal of this study.

3. Literature Review

3.1. Animal Conservation and Placement and Marketing of Local Characteristics

Global warming has increased the risk of the disappearance of certain species. How to properly utilize sustainable wildlife resources has thus become a vital environmental topic today [3]. Taiwan's urbanization has dramatically advanced, making it necessary to understand the mechanism of bird evolution in the urban ecosystem and to conserve animals [6]. Researchers have converted photos and videos on exotic birds taken by Yen-ming Liu, an ecological photographer, into an online photo and video library for the public [7]. By leveraging on ecological photos and videos, the public can understand more about birds, which not only improving their understanding of ecological conservation in Taiwan, but also achieving the purpose of conservation and helps promote education.

Previous study has combined QR codes of cultural and historical sites with local characteristics, so as to activate sightseeing, promote interaction among residents, and make sightseeing a digital experience when understanding culture [8]. In Japan, the government actively assists local special industries, by enhancing the added value and expanding the sales channels of local specialties and by vigorously driving the e-commerce of the local specialties [9]. Previous studies have integrated e-books, interactive picture books, and cultures of aborigines with local characteristics to develop electronic picture books that are rich in cultural connotations so as to attract primary students and to raise their learning motivation and interest in learning [10]. This study regarded Fairy Pitta as the protagonist of the digital games and integrated local characteristics that have far-reaching educational significance, allowing the students to experience local ecology via the learning courses.

This study combined Fairy Pitta with its local characteristics with animation and digital jigsaw puzzles to allow the students to learn the significance of animal conservation via edutainment, to form positive behavior, and to protect animals.

3.2. Jigsaw Puzzles and Digital Games

Jigsaw puzzles are interesting and challenging, and the success at solving them can boost one's confidence, bring about a sense of accomplishment, and inspire subsequent challenges [11]. Jigsaw puzzles have been used to obscure physics and chemistry knowledge, proving that they can improve students' learning motivation and achievement, enhance confidence, and improve their willingness to learn [12]. A tangram is a symbol of educational games, which contains cultural connotation and knowledge [13]. While playing a tangram, one can internalize knowledge and become more skillful at the game.

Digital games, due to their obvious interactive effects, have become an important teaching aid to improve learning outcomes. Special digital games can improve students' weakness in learning, stimulate their interest in learning, and exert a subtle influence [1]. Educational thinking games can guide students to think while playing and cultivate problem-solving ability. Hence, this study made Fairy Pitta digital jigsaw puzzles, with the goal of training students' logic and thinking abilities and raising their awareness and inclination

toward bird protection.

Digital games are now rather ubiquitous, from educational software to game-based learning activities to computer games, bringing about multiple opportunities and challenges [14]. People can learn from digital games, as they divert potential cognitive processes from game tasks, maintain the attention of learners when appropriately used, and greatly help students in remote areas [2]. Although digital games can encourage students to take the initiative to learn, affected by game design and the characteristics of learners, digital games may result in careless attitudes, circumvention from studying, and wrong attempts [15]. Digital games typically stress joyful learning, life experiences, and real-time and interactive feedback [16]. Digital games that have a positive effect on problem-solving, cognitive, and thinking abilities are suitable to serve as digital teaching materials.

Educational games can be virtual or physical and can develop students' problem-solving ability, problem analysis ability, and memory skills [17]. Educational games are often considered as an interesting and effective way to cultivate and train cognitive thinking [18]. Scientists have found that memory numerical games can enhance fluid intelligence and intelligence test scores, re-shape the human brain coupled with appropriate training, and help one to respond faster and more efficiently [19]. Game contests help raise students' interest, inspire intelligence, stimulate brainstorming, and improve problem-solving skills [20]. Therefore, this study produced digital jigsaw puzzles of Fairy Pitta, hoping to arouse students' interest in learning and to enhance their reaction ability and sensitivity.

4. Research Method

The success of completing a jigsaw puzzle can boost one's confidence, bring about a sense of accomplishment, and inspire subsequent challenges [11]. More and more people are learning from digital games and transferring potential cognitive processes from specific game tasks [2]. Digital games can improve students' weakness in learning, stimulate their interest in learning, and exert a subtle influence [1]. Numerical memory games, coupled with appropriate training, can re-shape the human brain and help one respond faster and more efficiently [19]. They can also inspire intelligence, stimulate brainstorming, and improve problem-solving skills [20].

This study selected Fairy Pitta as its theme, mainly because it is a Class 2 protected bird in the Wildlife Conservation Act of Taiwan. It is also designated by the International Union for Conservation of Nature and Natural Resources (IUCN) and Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) as an important species that urgently needs to be conserved [21].

This study discussed the design of creative stories on Fairy Pitta with primary school teachers, turned the stories into animation via Flash design, and posted them on a creative animated story website, as shown in Fig. 1.



Fig. 1. Website's home page with creative animated stories of Fairy Pitta.

This study turned Fairy Pitta animation into a teaching material on the website. Students can watch the animation to have a better understanding of Fairy Pitta. Teachers can help establish the concept of protection of Fairy Pitta by the students. After watching the animation, students can then happily play the digital jigsaw puzzles of Fairy Pitta, cultivate patience, and better achieve the purpose of this study's animal conservation.

Puzzle game: Puzzle games mainly test one's abilities at thinking, logic, and judgment. Jigsaw games are educational [22] and interesting [23]. Puzzle games also focus on brainstorming and improving a person's intelligence [24]. After watching the stories on Fairy Pitta, the students were expected to complete the jigsaw puzzles of Fairy Pitta, which are the same as that shown on the website. The students were expected to think, to realize a hands-on experience at skillfully assembling them, and to identify and solve problems.

Game rules: Sudoku was adopted to design the puzzle games. Fairy Pitta, the main character of the animation, was regarded as the theme of the puzzle games. The template picture was cut into pieces and randomly placed. Within the range of reading, another template with the same picture, but lower transparency, serves as a helping tip. A person passes one level after successfully assembling the random pieces into a complete picture of Fairy Pitta. The game tests the players' cognitive ability, color recognition, and spatial awareness.

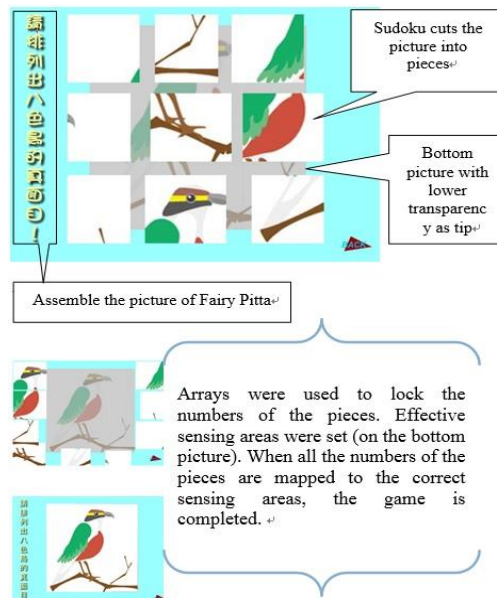
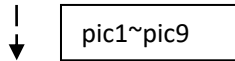


Fig. 2. Game interface of Sudoku.

The following shows the main codes produced in Flash.

```

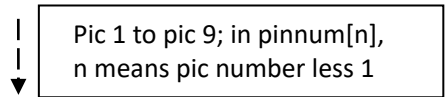
var test=0;
var pinnum:Array=new Array(9);
var nowin:Boolean=false;
end_mc.gotoAndStop(2);
var i;
for(i=0;i<9;i++){
    pinnum[i]=0;
}
stop();
pic1.addEventListener("mouseDown",mousedown);
    
```



```
pic9.addEventListener("mouseDown",mousedown);
backg_mc.addEventListener(MouseEvent.CLICK,check4);
function check4(MouseEvent){
    gotoAndPlay(1,"interactive game");
}
function mousedown(me:MouseEvent){
    me.currentTarget.startDrag(true);
}
pic1.addEventListener("mouseUp",mouseup);
```

```
pic9.addEventListener("mouseUp",mouseup);
function mouseup(me:MouseEvent){
    me.currentTarget.stopDrag();
    nowin=false;
    for(i=4;i<13;i++){
        if((me.currentTarget.x<=this.getChildAt(i).x+40)
            &&(me.currentTarget.x>=this.getChildAt(i).x-40)
            &&(me.currentTarget.y<=this.getChildAt(i).y+40)
            &&(me.currentTarget.y>=this.getChildAt(i).y-40))
```

```
{
    me.currentTarget.x =this.getChildAt(i).x;
    me.currentTarget.y =this.getChildAt(i).y;
    if((this.getChildAt(i).name=="b1_mc")&& (me.currentTarget.name=="pic1")) pinnum[0]=1;
    if((this.getChildAt(i).name=="b2_mc")&& (me.currentTarget.name=="pic2")) pinnum[1]=1;
```



```
        if((this.getChildAt(i).name=="b9_mc")&& (me.currentTarget.name=="pic9"))
pinnum[8]=1;    }
    }
    for(i=0;i<9;i++) {
        if(pinnum[i]==0){
            nowin=true;
        }
        //end_mc.gotoAndStop(1);
        //clearInterval(timeCount);
    }
    if(nowin==false){
        end_mc.gotoAndStop(1);
    }
}
```

Debug: During the game design, tests were conducted, modified, and adjusted repeatedly. After constant

changes in values achieved optimization of game smoothness, the game was tested to see if there were any errors. Common items requiring constant adjustment include the following.

- 1) Characters' speed of movement.
- 2) Objects' collision and triggering.
- 3) Setting of values in the events (e.g.: time limit, mouse event, game stop point, etc.).

Integrated release:

- 4) Demonstrated the design on the main home page: Used materials and font design on the home page in response to the theme of creative stories.
- 5) Webpage integrated release: Classified program codes, FLA files, sound effects, and animation into the same folder, constructed pages in an object-oriented manner, and integrated (html) output (as shown in Fig. 1).



Fig. 3. Image of pieces being assembled.



Fig. 4. Image of the completed picture (with the word "Congratulations!").

5. Conclusion and Suggestions

5.1. Conclusion

Jigsaw puzzles are interesting and challenging. The results of this study show that Fairy Pitta jigsaw puzzles provide rich, varied, and interesting knowledge. After playing the game, the students believed that it had the function of edutainment, rich colors, and well-matched sound and light effects. It thus attracted their attention and improved responsiveness and sensitivity.

When the students completed the puzzle, they would feel confidence and a sense of achievement.

The creative animated stories of Fairy Pitta of this study were also shown at a scientific exhibition and recognized by audiences. They were able to learn new knowledge from the digital game, and changed their cognition from the game tasks. Moreover, they were inspired to pay special attention to animal conservation via animation, while training their sensory abilities in the game. Lastly, the results of this study demonstrated that the website of creative animated stories adequately offers animation education of

wildlife conservation. The game was integrated to achieve edutainment and triggered follow-up practices.

5.2. Suggestions

This study suggested that follow-up research can focus on other protected animals, develop games of different types, raise the awareness of users on the topics requiring urgent attention, and encourage users to take action to protect animals. Games can stimulate students' interest in learning, exert a subtle influence, guide students to think while playing, and cultivate problem-solving ability.

This study adopted the theme of Fairy Pitta to produce animation and jigsaw puzzles. The goal is that future studies can also develop other games related to Taiwanese characteristics and set up more digital jigsaw puzzles with deeper and richer significance. Through the Internet, more games with rich contents and ways to play can be produced to attract the attention of users, help facilitate their learning, and achieve the purpose of edutainment.

6. Conclusion

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

Acknowledgment

The authors appreciate the comments of the review committee and also thank the teachers of Shuilin Township Primary School.

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