

The Effect of Olfactory Support in Educational Multimedia Contents

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Abstract—A majority of existing multimedia contents is composed of visual and auditory data. Humans are able to better understand and recognize information through the five senses. Accordingly, this thesis has devised educational multimedia contents supporting the olfactory sense for enhanced learning effects. The contents comprised of plants that can be found in everyday surroundings from elementary school textbooks. A contents production scenario was composed for the students to effectively study the names, types, properties, growth environment and effects of aromatic plants. The contents were delivered through multimedia elements, such as text, images, audio, animation and mutual interaction, and aroma was added using a fragrance dispersing device. The learning effects were analyzed after directly applying the developed contents to elementary school classes. The results of the analysis displayed that contents supporting the olfactory sense increased the understanding of classes compared to data-focused 2D contents.

Keywords—Olfactory, Educational Multimedia Contents

I. INTRODUCTION

GENERALLY, the senses that humans experience can be categorized into visual, auditory, tactile, taste, and olfactory senses. People mutually interact with the external environment and recognize objects through the five senses so as to obtain information. Many recent studies on realistic contents using the five senses have been carried out, accordingly. With respect to tactile and olfactory senses, although these senses are not frequently used, they can provide very strong memory and impression mechanisms, and can provide extreme enhancement of existing senses[1]. In the educational field, various digital contents are being developed to overcome the restrictions of literary textbooks and for customized professors and learning for each student. Most of the educational contents developed thus far are visual contents combining 2D-based animation, video, and text. If olfactory information is added, learning effects, concentration, and interest will all increase. Thus, this thesis has devised educational multimedia contents supporting olfactory senses,

directly applied the contents to classes, and analyzed the effect thereof.

Educational contents were produced along the theme of ‘plants in everyday surroundings’ requiring olfactory support from elementary school textbooks. A scenario was drafted to analyze the educational contents to be studied and to competently express the educational contents in the plants in everyday surroundings unit. Scenario contents were developed after producing images, audio information, text, auditory information, and animation to be included in the contents. Elementary school students were divided into two groups, wherein one group attended a class composed of visual contents, and the other group attended a class composed of contents including olfactory information. After the class, the concentration, interest and understanding of the class were evaluated. The results of the evaluations demonstrated that contents including olfactory information greatly helped with the academic understanding compared to 2D visual contents.

II. OLFATORY INFORMATION PROCESSING

Olfactory senses have been recognized as a form of media, akin to the visual sense. Thus, studies to apply olfactory senses have been conducted. In 2011, a device information datasheet was composed for the mutual cooperation between contents and an olfactory sense recognition device, and the Korean standards for a mutual cooperation reference model between contents and the olfactory sense recognition device was enacted. In 2012, the Korean standardization of an electronics-based service reference model for virtual reality was conducted[2].

In view of ‘TV that cannot be distinguished from reality’, one of the 10 phenomena predicted by SISCO, the reinforcement of contents and UX (User Experience) that increases concentration by diversifying the method of mutual action with user contents through the development of olfactory and tactile sense realization functions with the realization of realistic TV using tactile and olfactory senses in addition to 3D functions is the primary content[3].

In a paper related to the effect of the presence of aromatic plants in classrooms on elementary, middle, and high school students’ concentration during class, a total of 680 students including 180 students of S elementary school, 250 students of D middle school, 250 students of S e-business high school located in Seoul were divided into three different classrooms, i.e., control group (no plant), aromatic oriental lily group

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(Siberian), non-aromatic plant group (yellow group), for three weeks, to research any changes in concentration and emotional response based on each age group. The results of the research displayed that concentration increased by an average of 4.27 points in elementary school students, 2.9 points in middle school students, and 2.94 points in high school students for the students in the classroom with aromatic flowering plants, which displayed a significantly great effect in elementary school students[4].

In previous studies, the standardization of aroma media and development of realistic media have been effectively pursued. However, there is a clear lack of comprehensive study results on educational media that include aroma. Accordingly, this study intended to plan educational contents that include aroma and to analyze the educational value, thereof.

III. DESIGN OF OLFACTORY SUPPORTED MULTIMEDIA CONTENTS

3.1 Multimedia Elements Composing Contents

The educational contents produced in this thesis relate to plants in everyday surroundings among elementary school textbooks. The contents was composed with contents on the names, properties and growth environments of aromatic plants, and the effect of these aromatic plants on our body. Various media elements were composed to analyze the contents of the textbooks and to enhance learning effects. Table 1 displays various media elements used in the production of multimedia contents including olfactory features.

TABLE I
VARIOUS MEDIA ELEMENTS INCLUDED IN REALISTIC CONTENTS

Educational Content	Elements of Multimedia Features
Features of plants, classification based on the breeding environment of the plants, images of aromatic plants	text, images
Vocal explanation of aromatic plants and background music upon producing the animation	sound
Movement of plants and characters	animation
Spray of the scent of herbs and key plants (lavender, rosemary and rose) using an aroma spraying device	scent
User interaction	mouse over, mouse click

Contents were devised so that the user is able to view the visual contents of the aromatic plants among plants in everyday surroundings, and smell the scent of these plants using a scent spraying device. To increase interest and concentration during class, an animation called 『On the Way to a Herb Farm』 was additionally produced using a storytelling method, along with text, images, and sound.

3.2 Content Design

Contents that included the use of scents as proposed by this thesis were devised as shown in Table 2.

TABLE II
SCENT SUPPORTED CONTENT PLANNING

Theme	Plants in everyday surroundings
Learning Objective	<ul style="list-style-type: none"> - Understanding of the names and features of various flowers - Categorization of plants according to breeding patterns - Understanding of cases where aromatic plants are used in our everyday lives
Content	<ul style="list-style-type: none"> - Learning of the meaning of flowers - Understanding the types and features of flowers - Categorization of annual flowers and perennial flowers - Understanding of how flowers are used in our everyday lives - Understanding of the types of herbs and plants and the effect of aromatic plants in our lives - Viewing of animation and smelling of aromatic plants using the scent spraying device
Evaluation	<ul style="list-style-type: none"> - Understanding of aromatic plants - Satisfaction of aroma supported contents

IV. REALIZATION RESULTS AND EXPERIMENT

To add the olfactory sense to educational contents, the program Scentee (developed by the Japanese corporation, ChatPerf. Inc.) was used. Scentee provides an Android application and can spray scents using a single scent cartridge. Scentee can be used by connecting it to the earphone jack of a smart phone. The scents used in this thesis - lavender, rosemary, and rose - were experimented. The screen explaining the lavender scent in the animation screen realized by this thesis is displayed in Fig. 1.



Fig. 1. Scene Explaining the Lavender Scent during the Animation

The animation has been devised to allow the teacher and the students to visit an arboretum, listen to the explanations of herbs, and to directly smell scents. Explanations of the herbs were provided as audio features. The scene of smelling the scents after listening to the explanations is as displayed in Fig. 2.

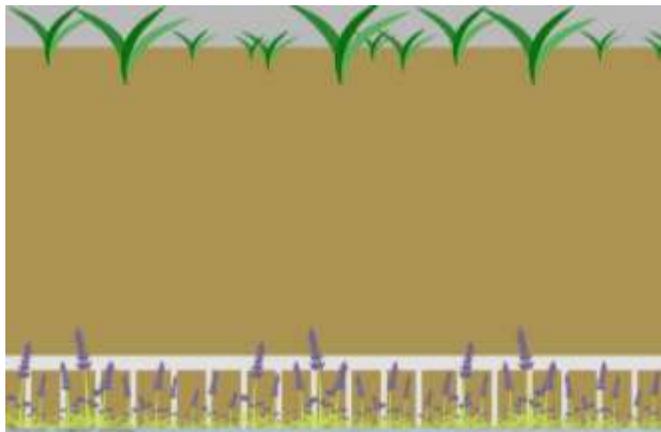


Fig. 2. Scene when Lavender Scent is Sprayed

An animation displaying the movement of the lavender flower lasts for approximately 20 seconds when the lavender scent is sprayed.

This thesis has researched the academic understanding of 100 grade 5 elementary school students after their classes. The experiment subjects were divided into two groups, where Group A were provided 2D educational contents, and Group B was provided a scent spraying device to accompany the 2D visual contents, for the students to directly smell the scent of aromatic plants. The students' understanding of the educational content was tested after the class. In the textbook content test, the students that were provided realistic educational contents with the olfactory feature added had 19%p more correct answers than the students that were provided 2D educational contents. Particularly in aromatic plant questions 3, the students that smelled the scent of the plants had 27%p more correct answers than the students that did not smell the scent of the aromatic plants.

V. CONCLUSION

Olfactory features were added to visual educational contents and applied to actual classes. It was demonstrated that the students in the group that were provided olfactory features in the educational contents had 19%p more correct answers than students that were only provided visual educational contents. Particularly, in aromatic plant question 3, the students that smelled the scent of the aromatic plants had 27%p more correct answers than the students that did not smell the scent of the aromatic plants. In overall view of the results, the students were able to feel and experience the educational content rather than simply learning by rote, to increase understanding when provided realistic education contents. It is expected that students' learning effects will be enhanced through the use of realistic educational contents in the digital textbooks to be applied in the near future.

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