Procedure for developing and sharing educational materials on remote sensing

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Abstract: The authors are developing educational material package for remote sensing called RS-fun with Macromedia Flash software. In this study we propose a procedure for developing and sharing educational materials on remote sensing with other scientists and educators. The educational material developed in this framework will be open to public through web.
Keywords: Education, edutainment, e-Learning.

1. Introduction

Nowadays, various universities, research institutions etc. are developing educational materials on remote sensing. Many of them are open to public via Internet [1][2][3]. However, since most of them are developed independently, the concept, target users, and level of them are quite different from each other. The themes and items covered with each educational material are also limited. In order to share know how, experiences, and ideas of making good educational materials on remote sensing among international scientists and educators, setting up of some procedure or framework for cooperation is necessary. In this paper, a procedure for developing and sharing educational materials on remote sensing is proposed.

2. RS-fun

In 2004, the authors have started to develop an educational material package for remote sensing called RS-fun [4][5]. The main purpose of RS-fun was to allow users to understand the basic concept of remote sensing with some fun. In other word, when users are working with RS-fun, the users should feel like playing a game rather than studying.

2.1 Developing Concept

Target users of RS-fun are beginners of remote sensing, including high school or lower grade students who do not know much about remote sensing. In order to interest high school or lower grade school students, the authors decided to introduce the concept of “edutainment: education and entertainment” for developing a new educational material on the Internet.

2.2 System Configuration

RS-fun is a software package installed on a web server to allow users to access via Internet with web browsers. Macromedia Flash is used as the authoring tool to provide interactive operations with various visual effects to make users feel more like playing computer games. So users have to install free software Flash player to their browsers before using RS-fun. RS-fun mainly consists of three modules which are Q&A module, jigsaw puzzle module and Database module (see Figure 1).

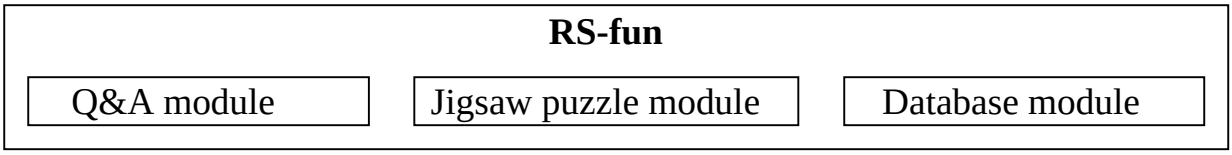


Figure 1 System Configuration of RS-fun

2.3 Q&A Module

2.3.1 Operation Procedure

Figure 2 shows the operation procedure of Q&A module. The Q&A module consists of a series of sessions. Each session deals with one particular topic on remote sensing such as “Spectral reflectance” or “False color composite”. At first, a user selects a session and starts reading the text explaining the topic of the session. Figure 3 shows an example. In this session, outline of electromagnetic spectrum bands from ultraviolet to microwave are explained. After reading the explanation, users have to do an exercise. In this case, users have to set the color bars in right order. By using the graphical/animated function of Macromedia Flash, the learning procedure with Q&A module becomes like playing a game. According to the user’s answer, the message “WRONG!” or “CORRECT!” would be displayed on the screen. If the answer was wrong, the user can try again if he/her wanted. Then user can move on to the next session.

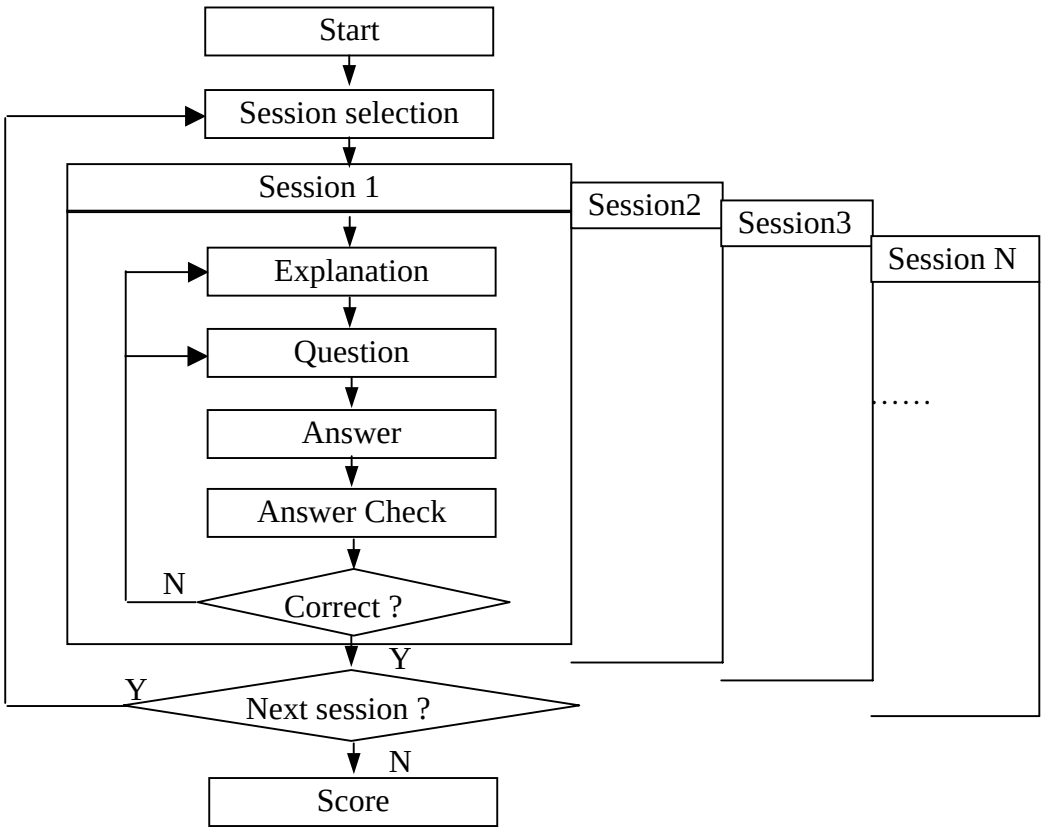
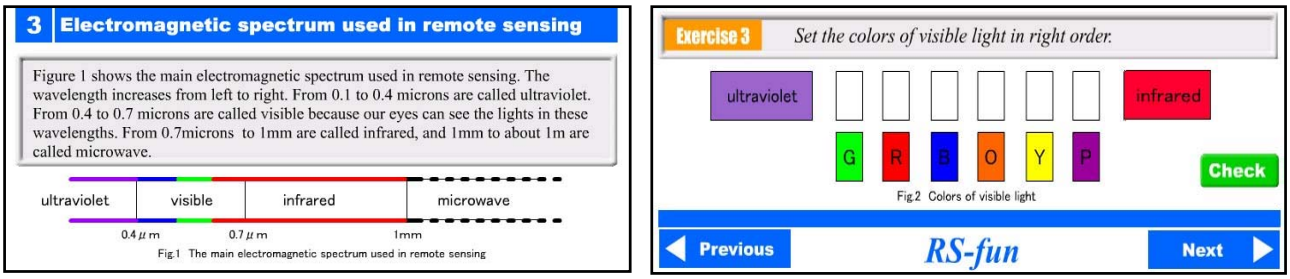


Figure 2. Operation procedure of Q&A module



(a) Explanation **(b) Exercise**

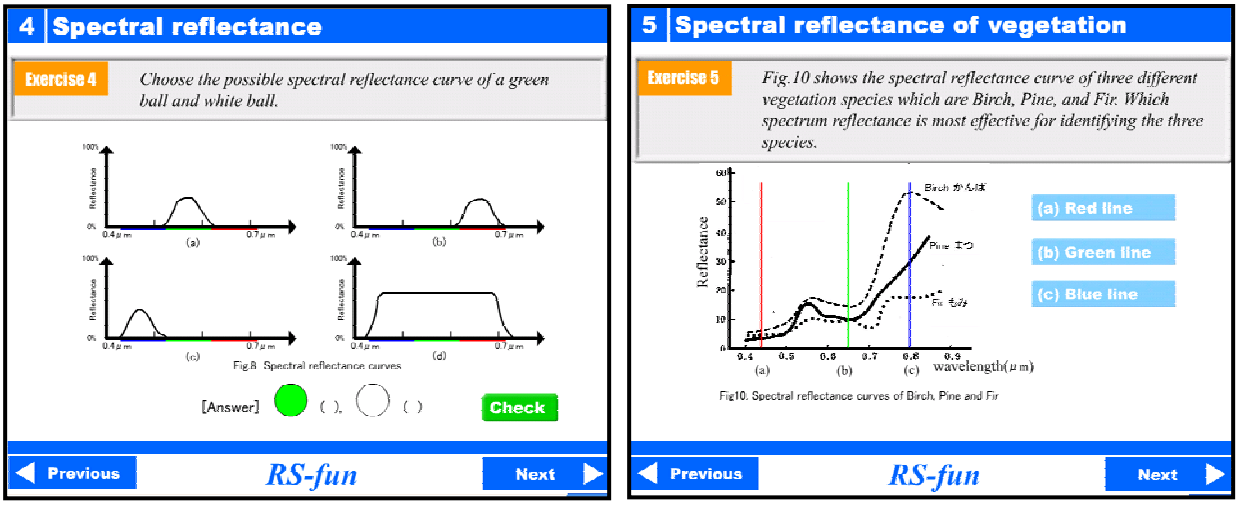
Figure 3 Examples of materials in Q&A module

2.3.2 Features

In order to make Q&A modules attractive to users, several unique features are considered when composing each material.

(1) Simplification and materialization

For explaining certain concept, simplification is quite useful. However, once the concept is understood, it is very important to learn more about the reality. Figure 4 shows such an example. The spectral reflectance curve of a color ball is simplified in the exercise (see Figure 4(a)). However, for further understanding, the real reflectance curves of three different vegetations are provided in the next step (see Figure 4(b)).

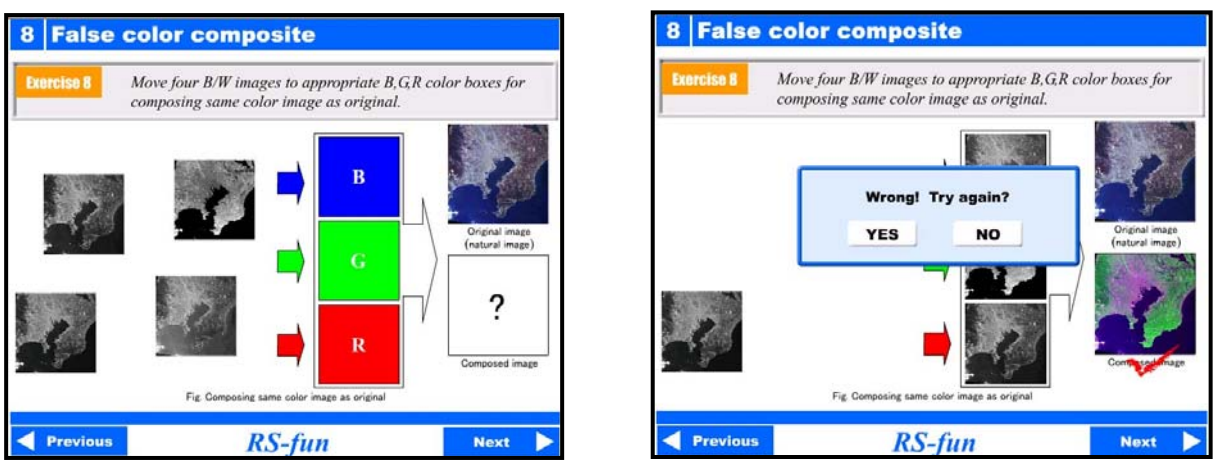


(a) Simplified spectral reflectance curve **(b) Real spectral reflectance curve**

Figure 4. Simplification and real data of spectral reflectance curve

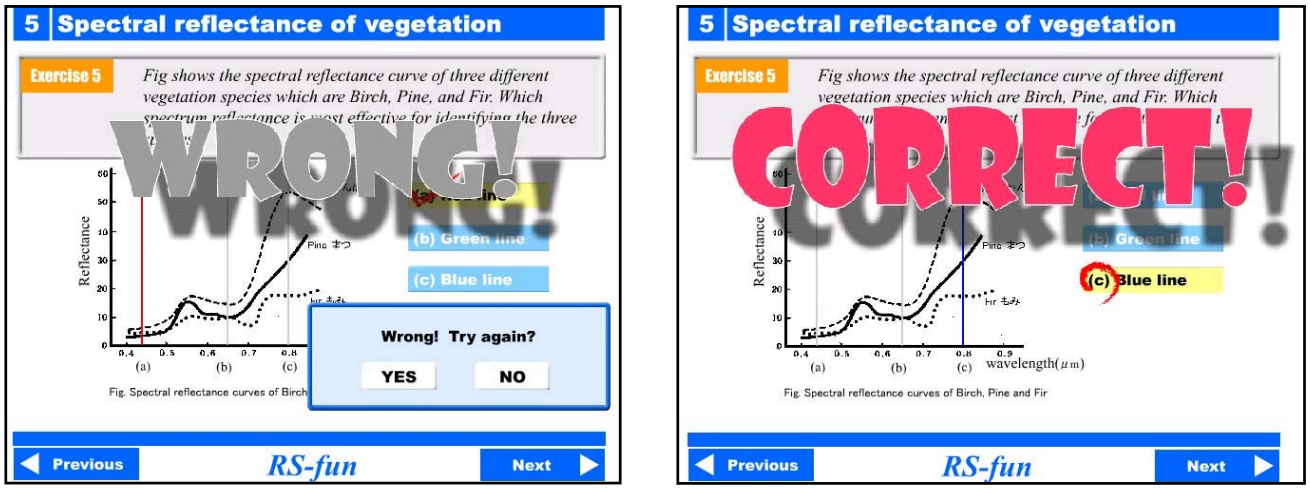
(2) Graphical Operation

The Graphical operation is another important features of RS-fun. Figure 5 shows one of those examples. The concept of false color composite is explained in this session. After learning the concept, users have to move the black & white satellite images to certain color box (see Figure 5). If each image is not set in right order, the composite color image does not become same with the original composite image. Because of the graphical operation, users are more likely to enjoy answering to each question.



(a) Question **(b) Answer**

Figure 5 An example of graphical operation of Q&A module



(a) Wrong **(b) Correct**

Figure 6. Message to the user's answer

According to the user's answer, the message "CORRECT!" or "WRONG!" pops up on the screen as shown on Fig. 6. This flashy action gives users strong motivation for answering correctly.

(3) Score

Each time user answers a right answer to each questions, one point is given to the user. When the user comes to the end of the sessions, the total score will be displayed on the screen (see Figure 7). Like a game, the score will be a good motivation for trying RS-fun again to improve his/her understanding of remote sensing.

Figure 7. Total score

2.4 Jigsaw Puzzle Module

The Jigsaw puzzle module contains a series of digital jigsaw puzzle of satellite images such as of Landsat/TM, JERS-1/SAR, Terra/MODIS, IKONOS. The jigsaw puzzles are not prepared only for fun but also to give good chance for the beginners to look satellite images in details.

2.4.1 Operation Procedure

Figure 8(a) shows the jigsaw puzzle of IKONOS image around the Tokyo Station. When a user starts to "play" the puzzle, the satellite image is divided in to 5 x 5pieces and shuffled. The user has to move each piece to right place to re-construct the original image (see Figure 8(b)). By pushing the NAVI button, the original image is displayed in light colors which help the user to find the right place to put each piece.

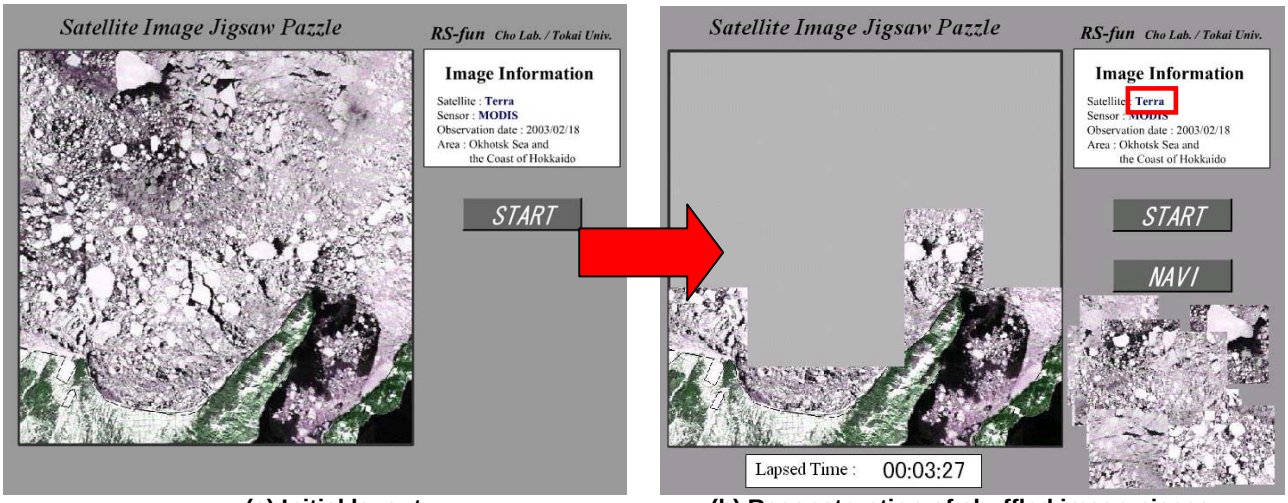
2.4.2 Features

(1) Timekeeping

In order to make user's satisfaction, the lapsed time is displayed in the bottom of the jigsaw puzzle(see Figure 8(b)). Since beginners such as high school students like to improve their time for completion, they try to recognize the detailed patterns of satellite images. Through several times of trials, users are likely to be used to satellite images with some enjoyment.

(2) Data base linkage

The jigsaw puzzle is not only for fun. When users click the name of the satellites and sensors placed next to the puzzle images, the detailed information will be displayed on the screen. These information help users to understand about the specifications of the satellite and the sensor of the image. For an example, if a user clicks "Terra" on the display(seeFigure 8(b)), general information on Terra satellite will be displayed as sown on Figure 9.



(a) Initial layout **(b) Reconstruction of shuffled image pieces**

Figure 8 The jigsaw puzzle of MODIS image of sea ice area

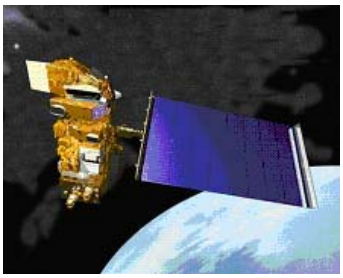
2.5 Database Module

Database module consists of various information on remote sensing. Important key words such as "electromagnetic wave", "satellite", "platform" in the Q&A module as well as in the jigsaw puzzle module are hyper linked to the database module, so the user can learn more details on certain subject. An example is shown on Figure 9.

Terra Satellite

[Outline]
Terra is the flagship satellite of NASA's Earth Observing System (EOS). Terra is carrying five remote sensors that, together, are measuring comprehensively the state of Earth's environment and ongoing changes in its climate system.

Launch Date: December 18, 1999
Orbit : Sun synchronous, Altitude:705km,
Equator crossing time: 10:30AM
Sensors: MODIS, ASTER, CERES, MOPITT, MISR
Planned life time: six years



< Related Links >

- NASA Terra Web site : http://terra.nasa.gov/
- MODIS reception at Tokai University : http://www.tric.u-tokai.ac.jp/rsite/r1/modis/modis.html

< Reference >

1)NASA : http://eos-am.gsfc.nasa.gov/instruments.html

Figure 9. Information on Terra satellite stored in the Database module

3. Procedure for sharing educational materials

So far, the concept of RS-fun is well accepted by the user community. However, RS-fun is still a small package for education. In order to share know how, experiences, and ideas of making good educational materials on remote sensing among international scientists and educators, setting up of some procedure or framework for cooperation is necessary. The authors would like to propose the following procedure for developing and sharing RS-fun with other scientists and educators.

3.1 Setting up of Teams

Three teams are planed to be set up for developing and sharing RS-fun. The three teams are Development Team(Team-D) , Scenario Team(Team-S), and Evaluation Team(Team-E). Team-D members have the ability to develop some sessions of Q&A modules of RS-fun by themselves using Macromedia Flash. Team-S members do not develop sessions by themselves, but produce scenarios and/or images to be used in making new sessions. Since good scenario is the key for making a good educational material, this team needs members from various application fields. Team-E members evaluate scenarios and produced materials, and make suggestions to Team-S or Team-D if necessary. Figure 10 shows the relationship of the three team and users.

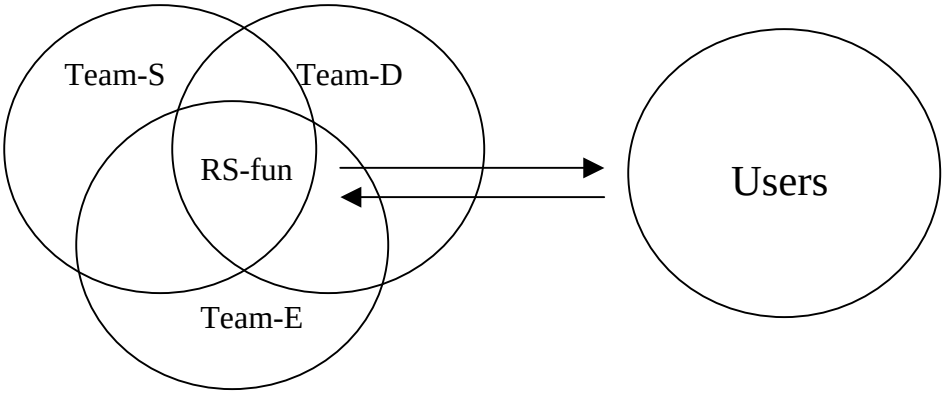


Figure 10. Relationships of Teams for RS-fun development

3.2 Development procedure

(1) Q&A module

Firstly, Team-S produces certain scenarios of new sessions. The scenarios are reviewed by Team-E, and some modification to the scenarios will be applied by Team-S or Team-E if necessary. The information on important keywords will also be collected. When scenarios are ready, Team-D starts to develop actual sessions. The developed sessions are reviewed by Team-E, and feedback goes to Team-D for improvement.

(2) Jigsaw puzzle module

Team-S collects certain remote sensing images and additional information on the images for jigsaw puzzle production. The information should include image explanation, map, name and specification of platform/sensor. Since the authors have developed software for making jigsaw puzzle, the making of jigsaw puzzle itself is quite simple and automatic. Team-D will make the jigsaw puzzle after receiving images and related information from Team-S.

(3) Database module

After accepting scenarios and information on jigsaw puzzle images from Team-S, Team-D starts to produce data base files in html format. Those files are linked from Q&A module and/or Jigsaw puzzle module.

3.3 Dissemination

After the evaluation by Team-E, the new materials are added to previous RS-fun on the web server to allow users to access via Internet. The initial version of RS-fun is accessible at the following site:http://www.yc.ycc.u-tokai.ac.jp/ns/cholab/RS-fun/index.html. The copy of the products will also be provided off line to the team members according to their request.

3.4 Copyright

All the contributors will be clearly indicated on the web site of RS-fun. In general, the copyrights of the materials remain to RS-fun team. However, for particular images or graphs etc., the copyright may remain to the person or organization who provided them.

4. Conclusion

The concept of the educational software package RS-fun was explained in details in this paper. The RS-fun allows beginners including high school or lower grade students to learn about remote sensing with some fun. In order to expand the role of RS-fun, a procedure for developing and sharing RS-fun with other scientists and educators are proposed. The authors are pleased to cooperate with those who are interested in developing, improving, and using RS-fun.

References

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