Chapter #20

DEVELOPMENT AND EFFECTIVENESS OF "CONTENT-FOCUSED ACCESSIBLE E-LEARNING MATERIALS" FOR ENGLISH LEARNING TARGETING VISUALLY IMPAIRED UNIVERSITY STUDENTS

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ABSTRACT
Visually impaired students need to have printed learning materials converted into media such as enlarged print and braille, and they need enhanced ICT environments such as sound and screen magnification. These modifications are known as "technical" accessibility to information. However, these enhanced learning materials are not always sufficient. This study presents pioneering attempts to modify printed learning materials into content-focused accessible e-learning materials that help visually impaired students to learn English independently. The original materials used in this study are self-learning exercise books for remedial English grammar study. The students used the modified e-learning materials and provided feedback from the following perspectives: 1) effectiveness of the materials, 2) suggestions for improving/revising materials, and 3) suggestions to further develop the materials for student autonomy. The study then analyzed students' grades before and after using the modified materials. Study results revealed that the modified materials were more effective, especially for students with severe visual impairment. This finding is significant as it provides new insights that will help facilitate visually impaired students' self-learning.

Keywords: visually impaired university students, content-focused accessible Materials, e-learning effectiveness of the materials.

1. INTRODUCTION

Students with visual impairment are not always able to effectively use printed books and learning software. The amount of learning materials incorporating braille characters is considerably less materials than printed materials. Moreover, magnification-capable learning materials and e-materials for students with visual impairment in higher education are not commercially available. Students with severe visual impairment must usually request the creation of braille materials and/or text data for their self-learning, but these can take some time to complete. As a result, many students may lose important opportunities for learning at a time when they are motivated and interested in engagement.

Several publishers are involved in producing online language learning materials. However, as Adobe Flash Player is usually the platform used for screen transitions, it is impossible to magnify screens using screen magnification software. In many cases the screen reader does not support the text-to-speech function. In essence, a self-learning environment for students with visual impairment has not yet been fully realized.

Generally, two methods are used for students with visual impairment to learn English: (i) media conversion to enlarged print or braille characters; and (ii) ICT environments that use text-to-speech or screen magnification software. However, in many cases, sufficient

progress cannot be made using these methods. Several studies have focused on the ICT environments applied to question formats for sighted students (Aoki, Kato, Kobayashi, & Kondo, 2003a, 2003b; Aoki, 2009), but these do not apply to visually impaired students.

There is a baseline requirement for students with visual impairment to attain basic university-level English skills. Focusing on the points mentioned above this study considers accessibility to information via media conversion of learning materials (e.g., enlarged print or braille characters) as well as ICT environments (e.g., text-to-speech and screen magnification software), technical accessibility to information. Cases where modification attempts are made to ensure that learning materials can be used by students with visual impairment are what this study terms "content-focused accessible e-learning materials." This study aimed to construct a comprehensive e-learning system, in which both technical and content-focused accessibility e-learning materials were added to self-learning exercise books for sighted students.

The goals of the study were to:

1. Create content that considers the characteristics and requirements of disability
2. Develop various materials for English self-learning systems for students with visual impairment and publish these widely within and beyond the National University Corporation of Tsukuba University of Technology (hereafter NTUT)
3. Implement a handicapped-accessible system that allows for character sizes, layout, and backgrounds changes for students with low vision
4. Establish the concurrent use of sound output and braille characters for students with severe visual impairment

2. BACKGROUND

The students at the Faculty of Health Science at NTUT have various kinds of visual impairment such as blindness, almost complete loss of sight, severe low vision, low vision, narrowed visual field, central scotoma, arcuate scotoma, night blindness, and light aversion. Some visual impairments are congenital and others are acquired. Some students who have congenital visual impairment are able to read braille even in English because they have undergone early training in braille reading skills. On the other hand, students with severe acquired visual impairment (e.g. blindness, almost complete loss of sight/severe low vision, etc.) have difficulty reading braille since they did not have enough time to be trained in the skill prior to entering university. Since mastering Japanese braille takes a long time, some students with visual impairment give up on mastering English braille, as it requires considerably more time and effort.

Students with visual impairment need various types of support such as braille, enlarged print, and digital data versions of learning materials, as well as the use of a loupe (a magnification apparatus for reading), and similar devices. However, prolonged use of this equipment can induce mental and physical exhaustion and even pain. In many cases, it is remarkably difficult for students with visual impairment to utilize technical accessibility to information in English learning, depending on the type of questions used in the study materials (e.g., multiple choice, fill-in-the-blanks). However, many students are required to have a basic knowledge of English in order to keep up with their required English classes. In addition, as some students aspire to enter graduate school, teacher-training courses at other universities, or take English certification examinations (STEP Test, TOEIC, etc.) for gaining employment, there is a substantial demand for the acquisition of at least basic English skills.

In this study, focusing on the background presented earlier, content-focused accessible e-learning materials were developed so that self-learning exercise books for sighted students could be modified for visually impaired students. An e-learning system that supports self-learning was constructed synergistically with technical accessibility to information. so that existing problems could be solved to a significant degree.

3. PREVIOUS STUDIES

There are very few earlier Japanese studies of a similar nature that analyze or develop different kinds of support systems for visually impaired people. Some existing studies (Aoki et al., 2003a, 2003b; Aoki, 2009; Saito, 2009a, 2009b) examine support systems for visually impaired students that make use of ICT. However, these are all within the scope of technical accessibility to information, which by itself is insufficient for visually impaired students, as will be explained.

Aoki et al.'s work (2003a, 2003b) developed software called readKON in order to encourage low vision students with relatively low-level recognition of English words to be more skillful readers. The software development and subsequent research proposed a way to support visually impaired students to read more efficiently. It uses a system that helps them to first recognize one word, then two words, and gradually phrases. This system proved that technical support is useful for visually impaired students in reading English sentences. However, in reality, English self-learning exercise books contain various types of questions (e.g., multiple choice, fill-in-the-blanks, writing tasks). Simply improving reading skills is not sufficient for dealing with learning question types, and learning materials that prepare students for tests also comprise various types of questions.

Saito (2009a, 2009b) developed an effective, barrier-free English learning software program that offered various ways to enable both visually and auditory impaired students to study English. However, her study adopts a method of reordering paragraphs, which is quite difficult for blind students, as it requires them to remember long sentences. Furthermore, she proposes only two auditory methods for visually impaired students—the native-speaker mode and Japanese. For students with severe visual impairments (blindness, almost complete blindness, severe low vision), the native-speaker mode is not always necessary, especially when they are attempting to comprehend the content of English sentences or when they are learning grammar. There remains some doubt as to whether students can learn English effectively in this manner.

A few non-Japanese studies (Hunt, 2002[i]; Kashdan, Barnes & Walsh, 2005; Marek, 1999[ii]; Wiazowski, 2000[iii]) mention the relationship between learning English and visual impairment. However, there seems to be no reference in previous studies to the *content* of learning materials; all of them refer to technical devices for students with visual impairment. For example, Saito (2009a) points out that Hunt (2002) claimed that IT for learning English is necessary for visually impaired students; however, the communicative approach is better since audio information is more useful for these students. Visually impaired students cannot be exempt from evaluation of grammar, reading, and writing skills. In fact, there is greater reason to do so, as the possibilities for their participation in a globalized world increase as IT develops.

Thus, it is necessary to develop learning materials that are more accessible for students with various kinds of visual impairment that can be used as preparation for English tests.

4. METHODOLOGY

4.1. Creating computerized data of the learning materials

First, materials for self-learning were examined with respect to their effectiveness in fulfilling student needs. A Memorandum of Understanding for Licensing stating that these materials would only be used for the creation of computerized data of the learning materials at NTUT was executed with Pearson Kirihara K.K[iv].

Moodle was used as the e-learning platform. It is an online platform that has been used by many higher education institutions, including NTUT. Moodle allows for the creation of various question formats, such as multiple choice, writing tasks, and fill-in-the-blanks, as well as calculation practice tests. The platform is well known as the most easily customizable learning management system. Web pages were created with Moodle. Screen reader operation checks were performed with PC-Talker7.

First, printed learning materials were scanned to create computerized data. Falsely recognized characters with similar forms or shapes were checked and modified against the original printed materials (e.g., "…," and .",,"; "m" and "n"; "l" [lower case letter L] and "I" [capital letter I])." This ensured the accuracy of the text data. Second, data were categorized based on the type of question (i.e., fill-in-the-blanks, writing tasks, and multiple choice). The information was transcribed into Excel files based on the classification of question passage, choice of answer, correct answer, Japanese translation of question passage and choice of answer, and explanation in Japanese. The results were used as the basic data. Taking into account the cases where similar content would be created in future, relevant forms were determined, with consideration for the data types to be inserted in each column.

4.2. Batch conversion of computerized data into XML data format on Moodle

Next, the study developed a software operation on Moodle that allowed for the batch conversion of data from text into XML format. To identify the types of questions included in the Excel files, relevant information was extracted into formats classified in Moodle. This ensured that no erroneous conversion or omission of conversion would occur through manual operation, even if columns included identical types of questions, and this allowed for efficient conversion of files into XML data.

5. MODIFICATIONS

In this study, various methods were added to the technical accessibility to information (e.g., screen structure) and learning materials to ensure ease of use by students with visual impairment. The process for creating content-focused accessible e-learning materials is described below.

5.1. General Modifications

5.1.1. Students with severe visual impairments (blindness, almost complete blindness/severe low vision, extremely narrowed vision field)

As the system could not be designed for mouse users, the author set up buttons associated with sounds representing choices from the answers supplied. In addition, both sound and braille character outputs were used concurrently.

5.1.2. Students with other visual impairments (low vision, narrowed vision field, central scotoma, arcuate scotoma, night blindness, light aversion, and other types of visual impairment)

The materials allowed students to change print character size, layouts, background colors, character colors, and other screen features.

5.2. Modification of the learning materials

The process for modifying and enhancing the materials is described below.

5.2.1. Forest first access (6th Edition) (2010, Pearson Kirihara K.K.)

This textbook provides the foundation for basic English grammar for junior high school students. Questions are roughly divided into three types: (i) fill-in-the-blanks, (ii) multiple choice, and (iii) writing tasks. The modifications of the original content for each question type is described in detail below.

(i) Fill-in-the-blank Questions

■Original Question

"Fill in the blanks in English sentences with a suitable word from among the choices within the parentheses."

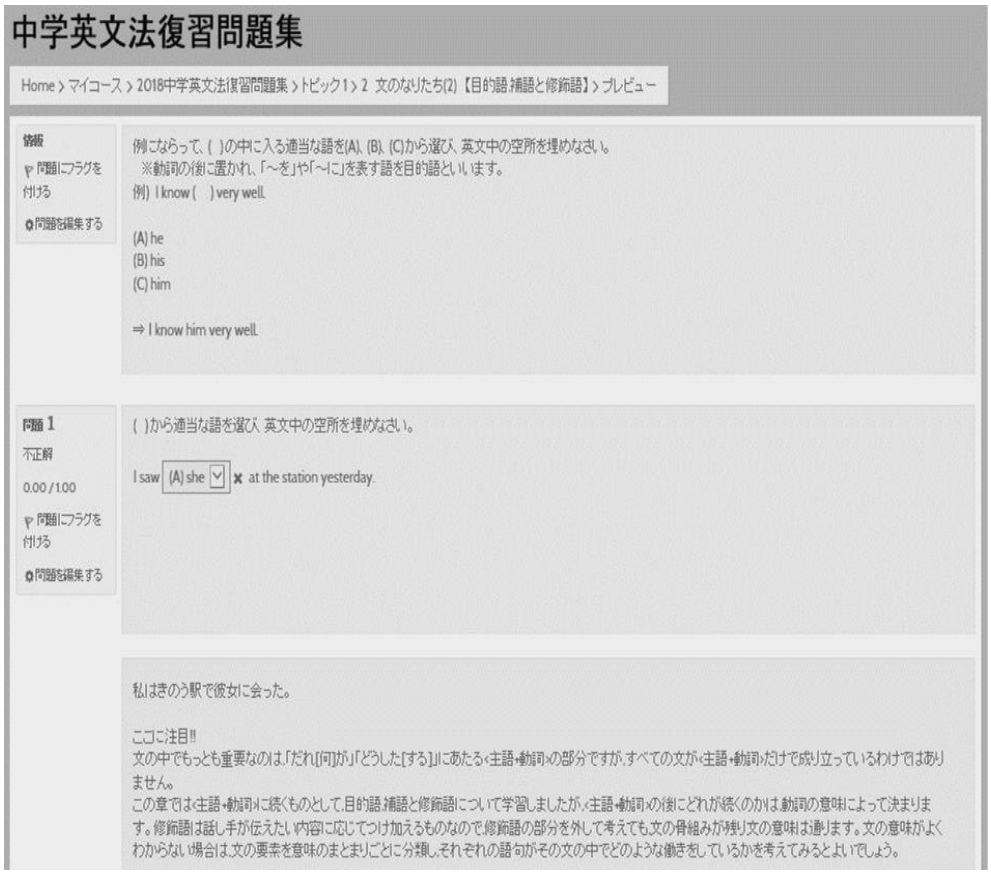
I saw ____ at the station yesterday. (she, her, hers)

The original format showed entire sentences, including the blanks, followed by the answer choices. Students had to memorize all the choices, before returning to the blank space to provide an answer from the options. If students could not remember one of the words, they would have to go back to view the choices again.

■ Improvement

A drop-down menu was added to indicate choices for the blank space. In this system, students could answer and fill in the blank when they read or listened to the sentence, without having to return to the options after reading or listening to the entire sentence.

Figure 1.
Screen for Fill-in-the-blank Question 1.



(ii) Multiple Choice Questions

■Original Question

“Fill in a suitable answer for the next sentences with the correct symbol selected from choices (a) through (e).”

1) Must I go with you ( )
2) Shall we go to see a movie tonight? ( )
3) Will you come to the party ( )
4) May I sit next to you? ( )
5) Shall I open the window ( )

(a) Yes, let’s! I want to see the new comedy.
(b) Yes, I’m looking forward to it.
(c) No, my friend will be back soon.
(d) No, you don’t have to. Wait for me here.
(e) No, thank you. I’ll do it.

In the original format, students had to return to the multiple choice question after reading all the questions and choices.

■ Improvements

The format was changed so that it showed all the choices for each question. A new feature was also built in to enable students to answer questions by pushing a radio button.

“Fill in a suitable answer for the next sentences with the correct symbol selected from choices (a) through (e).”

1) Must I go with you
   ○Yes, let’s! I want to see the new comedy.
   ○Yes, I’m looking forward to it.
   ○No, my friend will be back soon.
   ○No, you don’t have to. Wait for me here.
   ○No, thank you. I’ll do it.
2) Shall we go to see a movie tonight?
   ○Yes, let’s! I want to see the new comedy.
   ○Yes, I’m looking forward to it.
   ○No, my friend will be back soon.
   ○No, you don’t have to. Wait for me here.
   ○No, thank you. I’ll do it

In this format, students can choose the suitable answer immediately after reading or listening to the question, without returning to each multiple choice question each time they read or listen to the same answer choices.

Figure 2.
Screen for Multiple Choice Questions.

(iii) Writing Task Questions

■Original Question

“Circle the modifier in the underlined portion.”

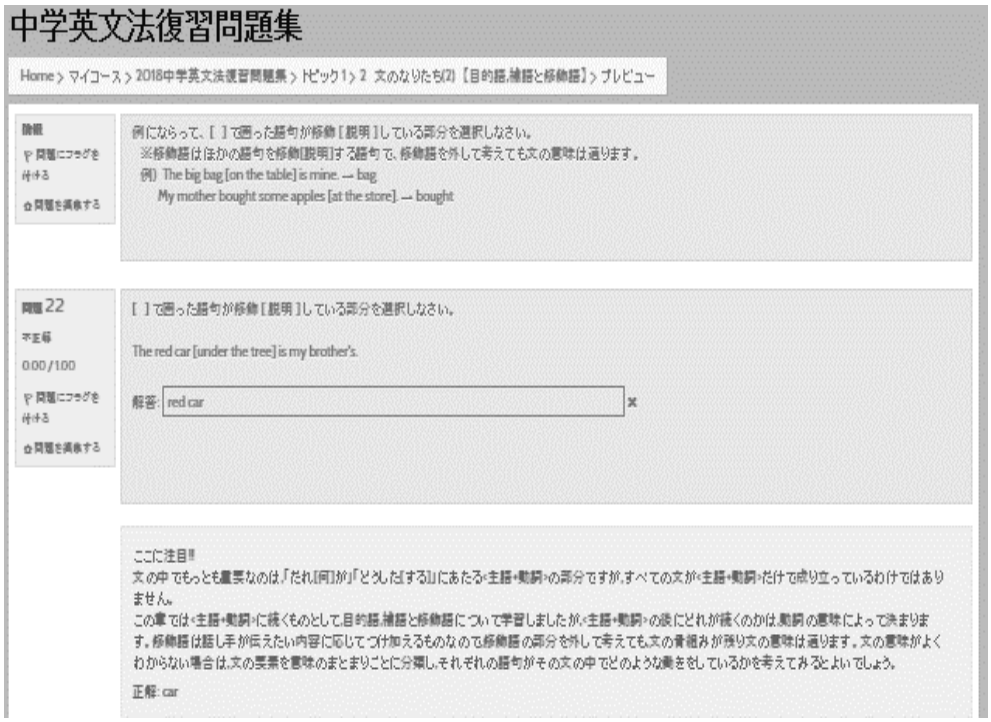
The red car parked under that tree belongs to my brother.

■ Improvement

Students with severe visual impairments (e.g. blindness, almost complete blindness/severe low vision, loss of almost entire visual field) who were unable to use a mouse could not encircle specific words or phrases on the screen, therefore, the word “underlined” was changed into a readable symbol “【 】,” and the phrase “underlined portion” was altered to “portion enclosed in ‘【 】’.” The old format was changed into one in which the modifier related to the underlined portion was described by learners as follows:

The red car【parked under that tree】belongs to my brother.

Figure 3.
Screen for Writing Task Questions.



5.2.2. Overview English grammar in 30 lessons (for 7th Edition) (2015, Pearson Kirihara K.K.)

This textbook covers comprehensive English grammar for high school students and is very suitable for remedial education on English basics. The questions in the book were also

roughly divided into (i) fill-in-the-blanks, (ii) multiple choice, and (iii) writing tasks. The nature of modifications of the original content for question types is described below.

(i) Fill-in-the-blank Questions

■Original Question

“Choose the right word from [ ]. Some questions have more than 2 suitable answers.”
She has a violin [who/which/that] was made in the 18th century.

As shown in the example, the original format displays the entire sentence, including the answer choices, in one place. Students sometimes had to return to the answer choices to select the right answer from all the available choices after understanding the meaning of the sentence. If students did not remember one of the options from the choices, they would have to go back to view the choices again.

■ Improvement

The new system shows the entire sentence, including the answer choices. Original attempts allowed the use of a drop-down menu that indicated answer choices in the blanks. In this system, students fill in the blank(s) immediately as they read or listen, eliminating the need to return to the choices after reading or listening to the whole sentence.

Figure 4.
Screen for Fill-in-the-blank Question 2.

(ii) Multiple Choice Questions

■Original Question

“Choose the correct usage of present tense from ①～③ and fill in the number.”

[①present status ②present repetitive motion ③general fact or truth]

1) Mr. Smith understands Japanese. ( )

2) Water boils at 100℃. ( )
3) My brother plays soccer with his friends on Sundays. ( )
4) Lisa often talks to her Japanese friend on the phone. ( )
5) Mary resembles her mother very much. ( )

In the original format, students had to go back and forth between the question and answer choices, or they had to remember all the answer choices.

■ Improvement

The format was changed so that it showed all the choices for each question. The new format also adopted a radio button. In addition, the underlining was changed into a readable symbol "【 】" so that students with severe visual impairment could listen via the text-to-speech screen reader function.

"Choose the correct usage of present tense from ①～③ and fill in the number."

1) Mr. Smith【understands】Japanese.

○present status

○present repetitive motion

○general fact or truth

Figure 5.
Screen for Multiple Choice Questions.

(iii) Writing Task Questions

■Original Question

“Change the order of the words so that they correspond to the Japanese meaning. Note that there is one unnecessary word in each sentence.”

私は彼をとても親切だと思った。

（him / I / kind / very / thought / kindly）.

■ Improvement

It takes a lot of effort for students with visual impairment to see both a wide area and scan back and forth at the same time. The old format was changed so that each word was put into a drop-down menu. In the new system, students could choose the suitable answer immediately after they read or listened to the question without returning to each word every time.

Figure 6.
Screen for Writing Task Questions.

6. RESULTS

With the improvements, questions and answer choices can be read in the “English mode” of PC-Talker (i.e., a native-speaker or katakana-reading mode), and explanations on grammar can be read in Japanese, after the questions are answered. A user can operate the system while using screen magnification software. The system also allows for braille character output. Students can opt for self-learning via any PC on or outside of the campus.

In this study, e-learning materials that allow students with visual impairment to study were developed with a focus on content-focused accessible e-learning materials as well as technical accessibility to information (i.e., screen magnification software and screen reader). Text-to-speech software was used to make modifications to the learning materials, thereby

offering more than reading of e-learning materials for sighted students. These modifications were the first of their kind in Japan.

Judging from student feedback, the participants became more independent learners through this learning experience, and this was the result that the author had tried to achieve in accordance with Hewett, Douglas, McLinden, and Keil (2018) suggestions.

7. ASSESSMENT

The author conducted an assessment of the content-focused accessible e-learning materials to confirm the educational effect of the materials for visually impaired students. The process is described below.

In their first year, NTUT students take an English placement test (EIKEN Institution Based Assessment (EIKEN IBA)) just after entering university. The author gave 25 first-year students with visual impairment an assignment to use the content-focused accessible e-learning materials and provide feedback based on the following questions:

1) Analyze your present English skills based on the EIKEN IBA score
2) Use one of the content-focused accessible e-learning materials that you find helpful for studying at least ten grammatical items

Provide feedback both on what is effective and what needs to be improved/revised

3) Provide feedback on your development of autonomy for studying English
    a. Did the materials develop active opportunities for you to study English?
    b. Did the materials develop your frequency of studying English ?
    c. To what degree have your English skills been improved by using the materiasl?
4) Provide information about your visual impairment (voluntary disclosure)

Further, the author compared the students' grades before and after using the materials. The before data was provided by the EIKEN IBA score, the after data came from the score of the final examination in the first semester. The students' visual impairments are as follows (student total numbers):

- blind (4)
- almost blind (3)
- severe low vision (6)
- loss of most of visual field (4)
- low vision (10)
- narrowed visual field (3)
- central scotoma (1)
- night blindness (3)
- light aversion (1)

Many students had combined symptoms of several visual impairments. Students were classified into five categories as follows:

1) users of braille (6)
2) users of text-to-speech function (6)
3) users with almost complete loss of visual field (4)
4) other users (low vision, narrowed visual field, central scotoma, night blindness, light aversion) (18)
5) users who can read printed learning materials without major difficulties (5)

An additional important factor to consider in students' learning environments is whether their visual impairment is congenital or acquired. Students whose visual impairment is both severe and acquired recently have greatest difficulty (2 students). Their feedback was important to this study.

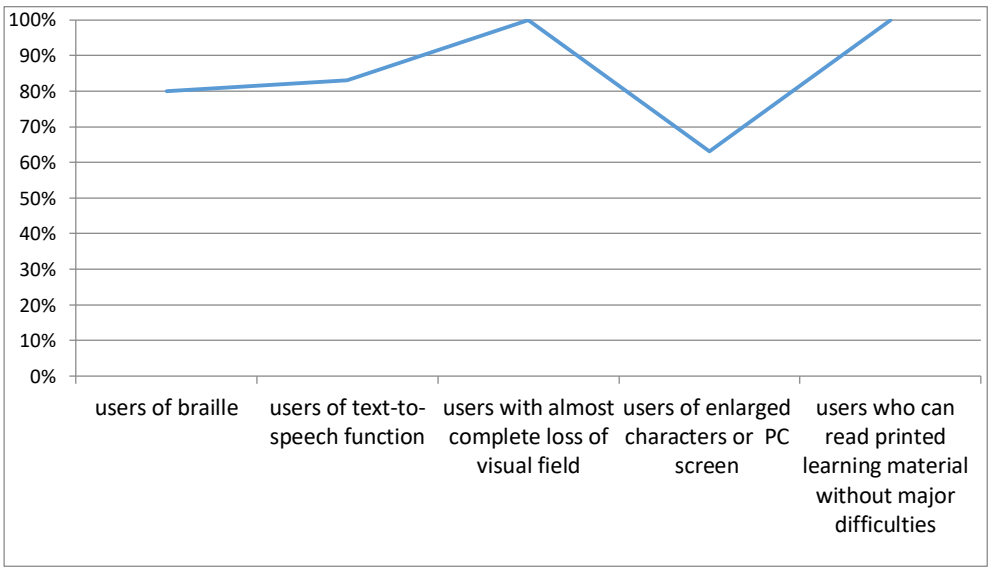
The author analyzed the students' feedback from the following perspectives:

1) effectiveness of content-focused accessible e-learning materials
2) suggestions to improve/revise content-focused accessible e-learning materials
3) development of autonomy for learning English after using content-focused accessible e-learning materials

Further, the author analyzed the students' grades before and after using the materials. The students' feedback revealed four interesting results:

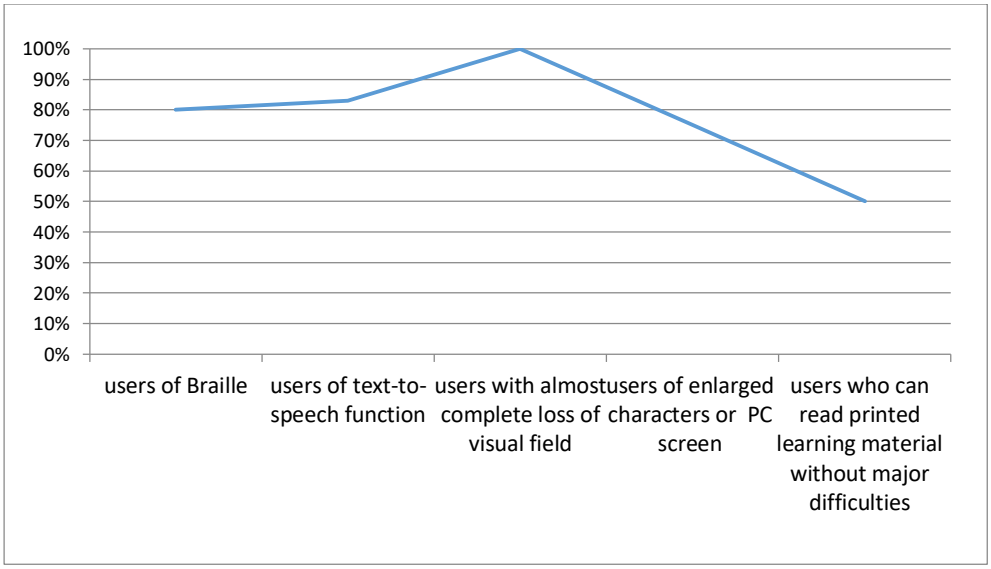
1) Approximately 92% (12/13 students) students with severe visual impairments (blindness,
almost complete blindness, users of text-to-speech functions and/or braille, almost complete loss of visual field) found content-focused accessible e-learning materials very useful[v] (Figure 7).

Figure 7.
Effectiveness of Content-Focused Accessible E-Learning Materials.



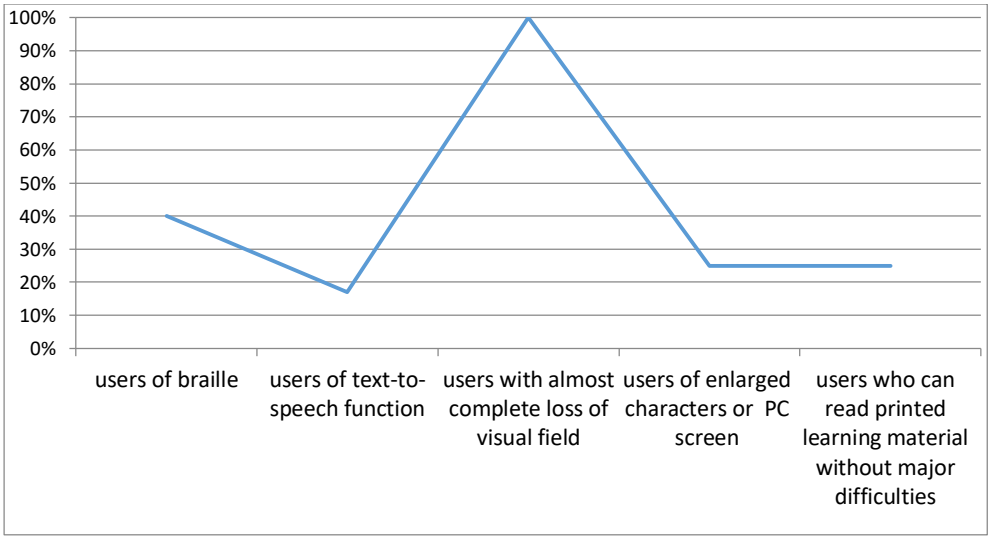
2) Those with severe visual impairment provided both positive feedback and more detailed suggestions for improvement/revision of the materials.
3) Approximately 92% (12/13 students) of the students with severe visual impairment significantly developed their autonomy for English learning after studying materials developed for this study[vi] (Figure 8).

Figure 8.
Development of Autonomy for Learning English after Using Content-Focused Accessible E-learning Materials.



4) Finally, about 44% (4/9 students) of students with severe visual impairment at low-to-middle English proficiency levels improved their grades at the end of the first semester after using the study materials (Figure 9). Furthermore, 100% (9/9 students) answered that their autonomy developed through using the materials.

Figure 9.
Improvement of Students' Grades After Using Content-Focused Accessible E-learning Materials.



The results in all figures demonstrate the effectiveness of content-focused accessible e-learning materials as self-learning activities, especially for students with severe visual impairment. The findings are convincing, as students with severe visual impairment require more intensive accessibility modifications than those with relatively lighter visual impairment.

As described in 2) above, those with severe visual impairment provided both a lot of positive feedback and more detailed suggestions for improvement/revision of the materials. This is also a convincing result as they experienced the effectiveness of content-focused accessible e-learning materials to a greater degree and showed significant improvement in autonomy for learning English after using materials developed for the study. Their positive opinions and suggestions to improve/revise the materials are as follows:

- "A drop-down menu inserted in the middle of the question sentence is very useful, and has really reduced our frustration as compared to commercially available learning materials. We cannot deal with the form when lots of words are at the end of the question sentence." (blind student)
- "I use commercially available on-line applied learning materials that do not use sounds. I have found the (study) materials very effective, especially for those who lost their vision later on in life." (user of text-to-speech function)
- "Difficulty and unwillingness for English study has been significantly reduced as compared to using printed learning materials." (student with almost complete loss of visual field)

Conversely, the feedback from students with light-to-moderate visual impairment was positive and but did not refer to the effectiveness of the materials:

- "There is no problem in using these materials. I could use it very easily." (student with normal visual field, low vision)

- It is a little troublesome to have to access Moodle because I can read printed learning materials." (congenital cataract)

On the whole, comments from these students tended to be shorter than those with severe visual impairment. The most common comments are summarized here:

- Concurrent output of braille characters is very useful. (blind students)
- Radio buttons are easy to find for those who are not able to use a mouse. (blind students, low vision students)
- Drop-down menus make learning comfortable. (blind students)
- Writing tasks sometimes cause learners to make spelling mistakes even if they know the correct answer. (blind students, low vision students)
- Explanations were shown even when we chose the correct answers, which is very useful. (blind students, low vision students and other visually impaired students)
- I had difficulty seeing the whole sentence when I widened the screen. (central scotoma students)
- The navigation windows were very useful for confirming where I was. (users of text-to-speech function)

About 32% (8/25 students) of the entire group and about 73% (8/11 students) of those with severe visual impairment had improved grades on the final examination of the first semester. Furthermore, 100% (13/13 students) of those with severe visual impairment answered that their autonomy improved when using the materials.

8. STUDENTS' ENGAGED LEARNING

Based on students' feedback mentioned above, the author finds that most visually impaired students are actively engaged in self-learning as reported by their self-analysis. This finding is significant as it provides new insights that will help facilitate visually impaired students' self-learning.

Students with visual impairment do not tend to have opportunities to review their English skills, as they have to make a greater effort to keep up with daily tasks (e.g., required English classes). The author found it significant that visually impaired students analyzed their own English skills and decided which content-focused accessible e-learning materials they needed, without guidance, help, or suggestions from anyone else. Students could analyze their weak points and future needs very precisely. Finally, one student chose content-focused accessible e-learning materials that were different to the ones recommended by the author, so it is meaningful to develop these materials as they might inspire students with visual impairment to engage in self-learning, something that can be difficult.

9. DISCUSSION

As indicated by the students' comments, there were some issues that impeded accessibility for students with all types of visual impairment:

1) Some students could not see the whole screen and navigation bar on the edge of it when it was widened, and they occasionally could not understand which question they were working on.
2) Some students with visual impairment face difficulty in seeing ordinal color contrast. Most of them typically use a black-white inverted screen.

3) In writing task questions, it is difficult for users of text-to-speech function and those with severely low vision to discern half-width word spaces. Some questions require half-width word space for a correct answer, which becomes a factor influencing learning motivation.
4) Originally, the number of university students with visual impairments is few. In addition, the learning materials discussed in this study could only be used by NTUT students due to copyright reasons, so the participant numbers were low. However, the author is currently able to further observe students at NTUT, and all of them have various kinds of visual impairment. For this reason, the NTUT setting is highly advantageous for developing this type of study.
5) The effectiveness of content-focused accessible e-learning materials and the students' development of autonomy in learning English seem to have naturally developed. It will be important to verify the relationship between students' improvements and these learning materials. However, establishing and exploring the impact of the learning materials on student autonomy will involve challenges, such as the number of participants, their English proficiency and background, and whether or not they have visual impairments. It is likely to take a considerable period of time to carry out this research, as Hewett (2019) and Hewett, Douglas, McLinden, and Keil (2017) studies have proven. Educational assessments of this type are complex tasks, involving a range of challenges.

Doubtless these problems cannot be solved only through technical accessibility to information; moreover, they may lead to a reduced willingness on the students' part to learn.

By publicizing this study and its impact, it is hoped that there will be possibilities that allow Japanese students with visual impairment at other higher education to undertake independent English learning.

10. PROPOSALS FOR FURTHER RESEARCH

The author is currently working on addressing the problems mentioned in section 9. Points 2) and 3) can easily be dealt with by further modifications. Furthermore, these improvements/revisions would meet the needs of both students with severe visual impairment as well as those with low vision conditions, so the improved/revised materials would apply to all types of visual impairments. As for point 1), careful improvement/revision would be required to address all types of visual impairment.

In the near future,

1) Work will continue on the development of a new version of content-focused accessible e-learning materials for all types of visual impairment and address the problems that students found.
2) It is hoped that Japanese students with visual impairment at other higher education institutions can be reasonably accommodated to learn English independently.
3) It is hoped that students with visual impairment can acquire competency to make effective transitions into further education, jobs, and to continue studying throughout their entire lifetime.
4) It is hoped that an additional longitudinal study can be carried out to discover whether the participants who have developed autonomic attitudes toward learning English and other subjects have become more confident about self-learning and retain this ability after graduating, as they build their careers.

5) It is hoped that this learning experience will enable visually impaired university students to understand their special needs fully and to ask for the consideration and support they need in inclusive educational situations and society.

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[i] This has been requoted from Saito (2009a), since this bachelor's thesis was unobtainable.
[ii] This has been requoted from Saito (2009a), since this article was unobtainable.
[iii] This has been requoted from Saito (2009a), since this article was unobtainable.
[iv] Prior to the creation of the e-learning content and subject to reproduction for persons with visual disabilities, etc. under Article 37 (3) of the Copyright Act, a Memorandum of Understanding for Licensing was executed for the use of computerized data provided by Pearson Kirihara K.K.
[v] The remaining student (one student) stated that she had long ago established her own way of studying English in braille and that her English skill was high.
[vi] The same student for the same reason mentioned above