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Exploring Remote Realtime Captioning for Students with Hearing Impairments in Inclusive Settings: A Focus on Evaluations by Students, Teachers, and Parents

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Introduction

The purpose of this study is to clarify the impact and tasks of remote realtime captioning for students with hearing impairments (SwHIs) in a regular classroom. For SwHIs, it is not an easy task to obtain sufficient audio information during class. Therefore, it is necessary to provide information and communication accessibility as a support for SwHIs that conveys the same information to them as hearing children are able to obtain.

Methods of support for SwHIs can be divided into two categories: Devising helpful ways for teachers to speak and providing suitable arrangements to the class environment. According to a questionnaire survey of all high schools in the Kinki region, the percentage of schools that have arrangements for SwHIs is generally very low (Shimonakamura, 2018). Though individual teachers in charge of classes are aware of the need to provide arrangements regarding speaking styles to a certain extent (Shimonakamura & Furuta, 2017), this is not enough to meet the needs of SwHIs, who require a way of speaking that is easy to hear and easy to lip read (Shimonakamura & Furuta, 2016). It may be difficult for individual teachers to take care of SwHIs completely by themselves. In addition, among the arrangements regarding the class environment, there were only a few cases in which support personnel were assigned to provide written information (referred to below as realtime captioning (RTC), which is a common means of support for SwHIs). Although there were a few cases where support personnel was assigned, it became clear that no such assigned personnel was in high schools (Shimonakamura, 2018). Meanwhile, according to a questionnaire survey conducted on elementary, junior high, and high schools in Ehime Prefecture in Japan, RTC was found to be conducted in several schools of each school type (Kawamura and Takahashi, 2013). In addition, in a questionnaire survey targeting public junior high schools with classes for SwHIs nationwide, asking about the

presence or absence of support and implementation methods, about 50% of all responding schools implemented handwritten RTC, about 10% of the schools implemented RTC by typing (Shimonakamura, 2017). Although there has not been a nationwide survey on the implementation rate of RTC and the persons in charge of implementation (teachers, support staff, etc.), it can be assumed that such services are offered at a low rate around Japan.

Where junior high schools offer SwHIs classes, the reasons behind the delay in RTC for SwHIs are: lack of understanding on the part of teachers regarding the necessity of RTC, e.g. lack of knowledge and awareness about RTC, lack of devices and equipment for implementing RTC, lack of technical skill such as application use and typing, and lack of human resources (Shimonakamura, 2017). In addition, it has been pointed out that regular class teachers are not always positive about accepting SwHIs in regular classes, and that there are cases where they have expressed negative views (Vermeulen et al., 2012). Considering that there are similar problems in elementary schools and high schools, the task of developing methods and an environment to solve these problems such that support can be implemented is an urgent one. Since the personnel responsible for RTC for SwHIs are not necessarily teachers, personnel with equipment and skills are in short supply. Considering that the people who provide the support prepare the equipment, securing a means of resolving the shortage of human resources is top priority.

So far, local governments have conventionally provided an interpretation by RTC for adults with hearing impairments as a social welfare service. In addition, the number of non-profit organizations that specialize in interpretation by RTC is increasing at the present time. However, when requesting RTC of such an organization, compensation for the time taken for the RTC is a requirement, and a budget is required to cover costs. Since RTC for SwHIs is required on a weekly basis, a corresponding budget is also needed. It is hoped, therefore, that local volunteers and university students will take on the role of captioners. In this study, the authors focus on university students, who are relatively easy to secure as human resources.

The authors reported on an online RTC training practice aimed at fostering students capable of offering support, who will be responsible for providing remote RTC to SwHIs (Shimonakamura and Furuta, 2022). In this report, through the training period was relatively short at seven to eleven months, it was found that: (1) basic typing skills were acquired, (2) typing skills were acquired by repeating the training, and coordination among students was perceived as smooth, (3) the ability to type with appropriate characters improved compared to before the training, and (4) the notation was inconsistent the greater the volume of information (Shimonakamura & Furuta, 2022). Although there are problems in training in a short period of time, it is possible to train the students providing support to carry out remote RTC in classes in which SwHIs participate, and it is possible to train them and thereby help to resolve human resource shortages.

Until now, there have been several studies on support for SwHIs in Japan, such as RTC in regular classes, and support staff who are responsible for support (Kuroda, Washio, Matsumoto, 2002; Ota & Shimojima, 2003; Shimojima & Ota, 2005; Mino & Torigoe, 2007; Nomi & Yokkaichi, 2009; Hasegawa & Sato, 2022, etc.) It has been shown that human resources such as support staff are important in terms of implementation (Kuroda, Washio. and Matsumoto, 2002; Hasegawa and Sato, 2022). When implementing remote RTC, since the person in charge of support is not in the classroom, there is a role to be played by support staff. On the other hand, when implementing support, it is necessary to evaluate the SwHIs and related parties. Alto, to ensure quality, RTC itself should be evaluated.

Regarding evaluations by users and related parties, Ota & Shimojima (2003) pointed out that SwHIs at junior high school were able to understand the class content, the character of the teacher, the interaction between the teacher and other students, and the addition of the SwHIs made the class more interesting. On the other hand, it has been pointed out that it is difficult for SwHIs who are engaged in school life, to make evaluations, and that they are not necessarily aware of issues and support needs (Mino & Torigoe, 2007). Regarding evaluation of the relationship with academic performance, the effectiveness of RTC was suggested by the improvement in regular exam scores before and after the introduction of RTC. In addition, it has been pointed out that verification of the status of disabilities and the appropriateness of RTC (Shimojima & Ota, 2005) is needed. Regarding

evaluation of RTC, although there is a previous study using discourse analysis (Nomi & Yokkaichi, 2009), so far there has been no previous research that analyzes the appropriateness of the content of RTC comparing it with remarks of teachers and students. Regarding the appropriateness of RTC content, remote RTC can be evaluated by recorded data of remarks by teachers and students in the class and comparing them with the text data; that is logs remaining after the RTC is implemented. Therefore, it will be possible to elucidate the impact and problems caused by remote RTC. The three skills for RTC are: typing skill, typing skill with coordination, and character notation (Shimonakamura & Furuta, 2022). Typing skill with coordination can be analyzed by comparing recordings and logs. Since there are few reports on the implementation of remote RTC, the authors believe that this practice will contribute to a compilation of cases and knowledge regarding the introduction of remote RTC. It should be noted that this paper deals only with evaluations by students and related parties, and with evaluations related to academic not performance. Evaluation of RTC will be examined in a separate article.

Method

Participants

Seven SwHIs, three elementary, one junior secondary, and three high school students participated in this study.

Two elementary schools, one junior high school, and two high schools accepted our remote RTC trial with oral consent obtained from parents of SwHIs. RTC was implemented three times in elementary schools (two in one school, one in another school), one time in junior high schools, and three times in high schools (twice in one school, once in another school). In elementary schools, all SwHIs belong to the upper grades. Social Studies was selected since it has a large amount of oral information in class teaching. RTC was implemented in Social Studies class in elementary and junior high schools, Modern Society, Japanese History and Geography were included for RTC in high schools.

Getting Ready for Remote RTC

In implementing remote RTC, the first or the second author visited the school and prepared equipment for remote RTC in the classroom. First, Roger touch screen microphone and Roger neck loop (Phonak by Sonova Japan Co., Ltd.), and iPad (Apple Inc.) were used. Next, as a system for ensuring remote RTC, captiOnline (Daisuke Wakatsuki, Tsukuba University of Technology) was used as a typing application. Third, ZOOM Meeting

as a conference application for acquiring audio and video information and delivering it to students providing RTC at home, forth, a Wi-Fi router was prepared as an Internet environment for sending the class audio and video information and receiving the characters entered. Fifth, LINE WORKS (Works Mobile Japan Co., Ltd.) was prepared as a means of contacting tool for unexpected situations during remote RTC.

Practice of Remote RTC

Fig.1 is an illustration of practice of remote RTC. Audio and video information spoken by teachers and students in the classroom is delivered to support students at home via ZOOM. Students providing RTC typed using captiOnline by getting audio and video information, and delivered text information to iPad that SwHIs use in the classroom. The authors monitored the audio and video sent to the students providing support as well as typing status by captiOnline.

There were a total of 11 students providing RTC. Eight students were in education, two were in law, and one was in medicine. In terms of the academic year, there were two students in their first year of undergraduate studies, two students in their second year of undergraduate studies, 0 students in their third year of undergraduate studies, two students in their fourth year of undergraduate studies, three students in their 1-year post-undergraduate course, and one student in their first year of graduate school. Three of the 11 members belonged to a club that supports students with hearing impairments. Although these students had experience in RTC practice, they had little experience in providing support in class. The other eight participants did not belong to a club and had no practice or practical experience in RTC.



Fig. 1 Image diagram of remote RTC

*Black arrow: Send audio/video

*Black dotted arrow: Send text content

*Gray arrows: Monitoring of transmission status of audio/video and text content

Questionnaire Surveys

In order to clarify the tasks and impact of the remote RTC that the authors tried in a regular class, after implementation, questionnaire surveys were conducted on the seven SwHIs, six class teachers (two elementary school students, one junior high school student, three high school students), two SwHIs class teachers (two elementary school students), and seven parents of SwHIs.

The questionnaire for SwHIs consisted of (1) impression of remote RTC, (2) number of characters, (3) display speed of characters, (4) comprehensibility of kanji (Chinese characters) and symbols (e.g., (), ?, !), and (5) other.

The questionnaire for teachers in charge of classes consisted of (1) burden on teachers, (2) state of SwHIs, (3) impact on teachers, (4) remote RTC, and (5) other.

The questionnaire for teachers in charge of SwHIs classes consisted of (1) state of SwHIs, (2) impressions of SwHIs about remote RTC, (3) remote RTC, and (4) other.

The questionnaire for parents of SwHIs consisted of (1) impressions of SwHIs about remote RTC, (2) parents' thoughts on remote RTC, and (3) other (see Tables 1 to 4).

Analysis

The responses to the questionnaire were classified as "positive" for multiple-choice responses such as "very good" and "good", and as "negative" for multiple-choice responses such as "not very good" and "not good at all". Other responses included "cannot say either way."

In addition, the free-form responses about efforts to implement remote RTC, the number of characters, the display speed of characters, etc., were coded. Coded items were given item names that represent their content, and after the coding process, categories were generated.

Ethical Considerations

The authors explained the purpose and outline of the study both in writing and verbally to the school administrator and in writing to parents of the SwHIs, their parents, and the schools where the SwHIs were enrolled, obtaining their consent regarding the current practice of remote RTC in school classes.

Table 1 Questionnaire Items for SwHIs

1. Impression of remote RTC

(1) Select one of the following impressions about remote RTC. Very good/Good/Can't say either way/Not very good/Not good at all

(2) Why is that? Feel free to answer.

2. About the number of characters

(1) Select one of the following about your impression of the number of characters. Very good/Good/Can't say either way/Not very good/Not good at all

(2) Why is that? Feel free to answer.

3. About display speed of characters

- (1) Choose one of the impressions of the display speed of characters from the following. Very good/Good/Can't say either way/Not very good/Not good at all
- (2) Why is that? Feel free to answer.

4. Comprehensibility of kanji and symbols

(1) Regarding the comprehensibility of kanji and symbols, was there anything that was difficult to understand or difficult to read?

It was/wasn't difficult to understand or difficult to read

(2) What parts were difficult to understand or difficult to read? Feel free to answer.

5. Other

If you have any requests regarding remote RTC, please feel free to answer.

1. Teacher Burden

Did the remote RTC interfere with regular classes? Also, was it ever a burden?

2. SwHIs

Has the SwHIs assisted with captions behaved differently in the classroom compared to receiving regular support in the classroom?

3. Impact on teachers

What kind of influence did it have on you? For example, with remote RTC, have you ever been concerned about how a class is going or how a SwHIs is doing?

4. Remote RTC

Do you want to introduce remote RTC in the future? Indicate the reason.

5. others

If you have any other concerns, suggestions for improvements, or requests, please let us know.

Table 3 Questionnaire Items for Teachers in Charge of SwHIs classes

1.State of SwHIs

If you have any concerns about the SwHIs you are in charge of, please write them down.

2. Impressions of remote RTC for SwHIs

If the SwHIs you are in charge of has told you about their impressions of remote RTC, please fill in the details.

3. Remote RTC

(1) Describe any positive points pertaining to remote RTC.

(2) Do you want to introduce remote RTC in the future? Please also indicate the reason.

4. Other

If you have any other concerns, improvements, or requests, please let us know.

Table 4 Questionnaire Items for Parents of SwHIs

1. Impressions about remote RTC (of your child)

At this time, we had the opportunity to implement remote RTC in your child's classrooms. Please let us know if your child has expressed his/her feelings about remote RTC.

2. Parents' thoughts on remote RTC

Please note your thoughts on remote RTC for children with hearing impairments.

3. Other

If you have any other concerns or requests, please feel free to indicate them.

Results

SwHIs's Perception of Remote RTC

Regarding remote RTC, five out of the total seven SwHIs answered positively, one answered negatively, and one answered that he/she could not say either way. As for the number of characters, all seven SwHIs answered positively. As for the display speed of characters, four SwHIs answered positively, one SwHIs negatively, and two SwHIs could not say either way. Regarding character notation such as kanji and kana, three SwHIs found it difficult to understand, and four SwHIs did not find it difficult to understand (see Table 5 for details).

The number of comments and the number of segments written by SwHIs increased as the school level rose from elementary to junior high to high school. There were total 255 letters / 10 segments in elementary school, total 486 letters / 10 segments in junior high school, total 511 letters / 16 segments in high school.

Next, by classifying the additional comments on perceptions by SwHIs, six categories, 17 items, and 36 segments were obtained (see Table 6 for details). Categories are represented by [] and items are represented by < >.

Regarding [Display speed of characters], it consisted of <Appropriateness of display speed of characters>, <Impact of display speed of characters>, <Delay in display speed of characters>, <Request for display speed of characters>, and <Giving up on display speed of characters>. <Impact of display speed of characters>. <Impact of display speed of characters>. Support of characters>. On the other hand, <Delay in display speed of characters> occurred, so <Request for display speed of characters> and <Giving up on display speed of characters> happened at the same time.

Regarding [Content of character display], it consisted of < Appropriateness of character display>, <Confusion of character display order>, <Inappropriateness of character display method>, <Appropriateness of character size>. and <Appropriateness of character display content> and <Appropriateness of character size> were ensured, while <Confusion of character display order> and <Inappropriateness of character display method> were also observed.

Regarding [Number of characters displayed], it consisted of <appropriateness of the number of characters>. <Appropriateness of the number of characters> was ensured.

Regarding [Impact of RTC], it consisted of <realization of usefulness>, <expectations for RTC>, and <future usability>. Since SwHIs were able to <realize the usefulness> of this remote RTC, <expectations for RTC> and <future usability> have arisen.

Regarding [Other], this category consisted of <Difficulty in judgment due to lack of experience> and <Suggestion of speech recognition software>. <Difficulty in judgment due to lack of experience> was seen because there were students who used the RTC itself for the first time. In addition, there were opinions regarding <Suggestion of speech recognition software> instead of manual typing.

Contents	Answer	Number of students
Remote RTC	Positively	5
	Negatively	1
	Could not say either way	1
Number of characters	Positively	7
	Negatively	0
	Could not say either way	0
Display speed of characters	Positively	4
	Negatively	1
	Could not say either way	2
Character notation	Found it difficult to understand	3
	Did not find it difficult to understand	4

Table 5 Summary of SwHIs's perception of remote RTC

Category	Item	Description
Display speed of character	Appropriate display speed of character	The text was as fast as the teacher could speak. (ES) (2)
		If it was slow, I wouldn't know what everyone was doing, so I'm glad it was fast. (ES)
		Not too fast, not too slow, just the right speed. (HS)
	Impact of display speed of character	It was fast and easy to see. (ES)
		I was surprised at how fast students providing RTC typed this time compared to my usual RTC. (ES)
	Display/delay of character	Once students providing RTC made a mistake, it took time to correct it, and the display of the text was delayed. (JHS)
		When a teacher is giving an explanation using sentences from a textbook, if the content is long, the display cannot keep up with the display at all. (JHS)
		Occasionally, the letters came out after the teacher had spoken for a while. (HS)
	Request for display speed of character	As much as possible, I would like the students providing RTC to shorten the time between teacher speaking and character display. (HS)
	Giving up on display speed of character	I feel that the speed of character display slowed down as the class progressed, but this may be unavoidable. (HS)
	Appropriateness of character display	It was good because there were few typos. (ES)
		Rather than the entire content of the story, the important parts were extracted and summarized. (HS)
		It was easy to see because the long spoken words were put together appropriately. (HS)
	Appropriate font size	It was just the right size and was easy to see. (ES)
Content of Character display	Character Display Order Confusion	When teachers talk about a lot of content at once, it takes time even if they shorten it and the division of work did not go well, and two students providing RTC were typing the same content at the same time and yielding to each other, and the content of the talk was back and forth. (JHS)
		I think it would be easier to see if the teacher's story is entered in order. (HS)
		I was a little worried about the typos, incorrect order, and the time it took to display. (HS)

Table 6	SwHIs's	Perception	of Remote	RTC

*In Tables 6 and 7, numbers in parentheses indicate the number of responses with the same content. **In Tables 6 and 7, ES, JHS, HS refers to Elementary school, Junior High School and High school respectively.

Category	Item	Description
Content of Character display	Inappropriate character display	Some of the long sentences were displayed incorrectly, and it was difficult to understand what was written. (ES)
		Mistakes occurred with kanji input. (HS)
		There were times when the characters did not display, and there were also conversion errors. (HS)
		There were places where the characters were displayed (***) meaning that they could not be understood. (HS)
	Appropriate number of characters	It was very easy to see. (ES)
Number of		Not too short, not too long, just the right number of letters. (ES)
Number of characters displayed		It was easy to understand because it was presented in simple sentences. (JHS)
		I was glad that students providing RTC were able to display every word of the teacher's words. (HS)
Impact of RTC	Realization of usefulness	Because it was visual information, it was easier to understand what the teacher was saying. (HS)
		It was very nice to be able to read the text when it was difficult to hear the teacher's voice. (HS)
		I thought it was amazing because support students was just listening and RTC. (ES)
	Expectations for RTC	I think there is a lot of room for improvement, such as display speed and incorrect conversion, but it would be nice if these problems could be improved. (JHS)
	Future availability	In the future, it may not be possible to maintain the current hearing ability, so I think it will be helpful in terms of the possibility of using it in the future. (JHS)
Burden of RTC	Burden of multiple tasks	It was quite confusing to look at the screen in addition to looking at the blackboard and teachers, reading the textbook and taking notes. (JHS)
		It was a bit tiring to look at the blackboard and look at the material collection while always paying attention to the screen, so I thought it would be okay to focus only on the important parts. (HS)
	Limit of RTC	There may be some limitations due to manual typing, but there were many cases in which erroneous conversions were corrected later. (JHS)
		In live TV broadcasts, sentences are displayed one tempo later, and considerable time is lost due to correction of incorrect conversions, so I felt that there were limits to human typing. (JHS)
Other	Difficulty in making decisions due to lack of experience	Since it was my first time using it, I didn't know what was good and what wasn't. (HS)
	Suggestion of speech recognition software	I think that there is a higher possibility of success in the direction of increasing the accuracy of speech recognition software. (JHS)

Acknowledgement of Class Teachers Regarding RTC

By classifying additional comments on the perception of the teacher in charge, we arrived at three categories, nine items, and 23 segments (see Table 7 for details). Categories are represented by [] and items by < >.

Regarding [Impact of RTC], it consisted of <same learning attitude as usual>, <conducting classes as usual>, <devices when introducing RTC>, and <effectiveness of written information>. The students were learning in <the same learning attitude as usual>, and the teachers were also working on <conducting classes as usual> or <devices when introducing RTC>. In addition, teachers who experienced RTC recognized the <effectiveness of written information>.

Regarding [Expectations for RTC], it consisted of <expectations for remote RTC> and <suggestions for introducing remote RTC>. The teachers in charge of the class had <expectations for remote RTC>, and some teachers even made <suggestions for introducing remote RTC>.

Regarding [Concerns about RTC], it consisted of <questions about the necessity of RTC>, <concerns about the introduction of remote RTC>, and <concerns about the burden on remote RTC implementation personnel>. Among the teachers, there were those who had <questions about the necessity of RTC> and those who were <concerned about the introduction of remote RTC>. In addition, some teachers were concerned about the burden on remote RTC staff, rather than the teachers themselves.

Category	Item	Descriptions	
Impact of RTC	Usual learning approach	As always, I feel like SwHIs were actively learning. (ES)	
		The behavior of the SwHIs was no different. (ES)	
		The person in charge of the class could not see anything particularly unusual. I think SwHIs was able to concentrate in class, just like in a regular class. (HS)	
		There was no particular difference from usual. (HS) (2)	
	Carrying out classes as usual	I was able to continue my classes as usual. (ES)	
		There was no particular impact. (HS) (2)	
	RTC devices	I was conscious of using coherent and easy-to-understand words to make it easier to type. I feel that by summarizing the words and instructions in a concise manner, it has become easier for other students to hear. (JHS)	
		I spoke more slowly than usual, and took longer intervals. (HS)	
	Impact of written information	I don't know unless I check with the SwHIs themselves, but I think it's a good result if various opinions can be communicated in real time by having multiple people transcribe them. (ES)	
		SwHIs can clearly understand the part that is difficult to hear in the text, so I think this has reduced the stress of SwHIs. (JSH)	
		I think it varies depending on the subject, but for subjects such as social studies where the teacher explains a lot of content, I think it would be good if there was visual support because it would improve understanding on the part of students. (HS)	

Table 7 Recognition of Class Teachers Regarding Remote RTC

Category	Item	Descriptions
	Expectations for remote RTC	I want to introduce in terms of guaranteeing learning, I think it's good to have choices and learning opportunities. (ES)
		I think there are many potential benefits of remote RTC. (ES)
Expectations for RTC		If students providing RTC can provide remote and multiple support, we will be able to guarantee class information in real time. (ES)
		If character typing is automated and accelerated through the use of AI, etc., I think that convenience can be improved, so I think it would be good to introduce it. (JHS)
		If it becomes possible to introduce remote RTC, there will be no restrictions on seating arrangements, outdoors, etc., so SwHIs will be able to lead school life in the same way as other students. (JHS)
		The class teachers did not feel burdened at all, so if it improves the students' understanding of the class, I agree with the introduction of remote RTC for the students as well. (HS)
	Suggestions when introducing remote RTC	As a homeroom teacher, it was the same as usual, so I thought it would be good to think about the impact on the SwHIs and the convenience of the people who actually work. (ES)
		I think it would be good if the opinions of others could be understood in real time when the children are deepening their own thoughts through group interaction, such as questions that they want to confirm immediately or questions that they have difficulty understanding. (ES)
		I think it would be ideal to have a two-way exchange. (ES)
Concerns about RTC	Questions about the necessity for information security	I personally don't feel the need for RTC, as I didn't have any problems with my regular classes, but what about the SwHIs themselves? (HS)
	Concerns when introducing remote RTC	There is no particular burden in conducting classes, but I thought it would be difficult to suddenly change the timetable because it is linked to other places. (ES)
	Concerns about the burden on remote RTC personnel	I felt that the burden on the side of remote RTC was also excessive. (HS)

Recognition of Teachers in Charge of SwHIs Classes Regarding Remote RTC

A teacher in charge of a SwHIs class in elementary school pointed out that SwHIs used remote RTC for the first time, and that some SwHIs were looking at the RTC with more interest than the RTC that they usually do themselves.

Regarding the impact of remote RTC, a teacher in in elementary school noted that the typing speed did not change compared to on-site RTC, and the SwHIs were able to understand the content in real time by typing by multiple people, so they were able to participate in the class comfortably. There was an opinion that it was possible to know even the details of the teaching because there was a lot of information. On the other hand, some comments, such as the following, were raised: (1) It is possible to provide appropriate RTC that meets the needs of the SwH, by communicating between the person in charge of remote RTC and the SwHIsI, and (2) It is not easy for the SwHIs to expresses his/her opinion on RTC. (3) It would be better if the person in charge of remote RTC could hear and type the speech of the students in the back of the classroom.

Parents' Recognition of Remote RTC

Parents of SwHIs noted that remote RTC makes it possible to secure support personnel and assign them to SwHIs who need them, leading to higher quality support. There was also an opinion that the burden on teachers of SwHIs would be reduced if remote RTC was used, and that the RTC could be realized, which would be beneficial to SwHIs. On the other hand, there was a comment regarding the lack of information due to summarization and typographical errors. One parent noted that if there are more people involved in RTC, there is concern that sufficient information cannot be guaranteed unless there is good cooperation between student captioners and teachers. Another parent pointed out that the provision of a learning environment with full information would motivate SwHIs to learn and enable them to participate in school life with peace of mind.

Discussion

Impact of Introducing Remote RTC

It was clear that remote support was effective for most SwHIs by introducing remote RTC into regular classroom lessons. This is due to the fact that this time university support students were in charge of RTC remotely and the necessary information was obtained even though the RTC was implemented outside the classroom.

Next, for the teacher in charge of the class, there is no burden when implementing remote RTC, and the SwHIs is able to learn as usual. Opinion was positive with regard to the introduction of remote RTC when it is useful for the learning of SwHIs. This seems to indicate that the teachers themselves are aware of guaranteeing learning opportunities for SwHIs in regular classes in the same way as other children.

Finally, parents also pointed out that remote RTC can secure support personnel that lead to support for SwHIs. Even if it is not possible to allocate personnel for normal face-to-face support, remote support can be implemented to ensure learning by SwHIs.

Issues in Introducing Remote RTC

As a result of introducing remote RTC, it became clear that remote support was effective for most SwHIs, but it might not be effective for some SwHIs. Some of the SwHIs were not fully aware of the impact and problems because they were using the remote support for the first time. Although it depends on the hearing level of the SwHIs and the extent to which they use their hearing, the need for RTC is clear because it is possible to understand the content of classes and the content of exchanges between teachers and other students (Ohta & Shimoshima, 2003). However, the fact that some SwHIs were not aware of the necessity of RTC was indicative of their limited understanding of their own needs (Mino and Torigoe, 2007). On this point, a teacher in charge of the SwHIs class pointed out the necessity of communication between the person in charge of RTC and SwHIs.

Where RTC is provided in the community or support for SwHIs is provided at a university, it is possible to clarify support needs through interaction with the target SwHIs. It is important for SwHIs to continuously use RTC and to recognize their own needs, as well as to form continuous relationships and relationships of trust with persons in charge of RTC. The involvement of university students as experts in RTC is thought to be one of the solutions. Therefore, it is important to develop methods for clarifying the needs of SwHIs.

In addition, parents pointed out the need for cooperation among those involved in RTC. For example, when it comes to confirming the needs of SwHIs, if it is normal RTC, it is possible to confirm on the spot, whereas the instance of remote support, there are cases where there is no direct meeting, so confirmation is done through the teacher. Cooperation among related personnel is important for remote RTC.

Conclusion and Research Perspectives

Conclusion

This study introduced remote support in regular classes for SwHIs, clarifying both impact and issues. For most SwHIs, the remote RTC is effective from the viewpoint of the number of characters and the display speed of characters. Teachers in charge of classes, teachers in charge of SwHIs, and parents also gave positive opinions regarding remote RTC. On the other hand, to utilize remote RTC, it is necessary for SwHIs to be aware of their own needs with regard to their hearing impairments. In addition, compared to normal face-to-face RTC, when remote RTC is implemented, the question of how to establish cooperation between related parties is an issue for further discussion in the future. It is important to consider these points in ongoing efforts to introduce remote RTC.

Research Limitations and Future Direction

In this study, remote RTC was introduced once or multiple times in elementary, junior high, and high schools. The challenges of introducing remote RTC compared to conventional face-to-face RTC have been clarified, and it is conceivable that new issues will arise with the continuous implementation of remote RTC. Also, this time, remote RTC was implemented only for specific subjects (related to social studies). It remains to be verified whether the impact and problems revealed in this study are due to specific subjects or whether they are common to all subjects. Therefore, it would be beneficial to introduce remote RTC, including other subjects, and clarify the impact and problems further.

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References

- Hasegawa, C., & Sato, A. (2022) Attitudes of support staff who support hearing-impaired children enrolled in regular classes. *Japanese Journal of Disability Sciences*, 46(1), 101-112. (Japanese)
- Kawamura, Y., & Takahashi, N. (2013) The situation for the regular school children with hearing impaired in Ehime Prefecture. Bulletin of the Faculty of Education, Ehime University, 60, 185-194. (Japanese)
- Kuroda, Y., Washio, J., & Matsumoto, Y. (2002) Participation support by notetaking for children with hearing impairment in ordinary classes. *The Japanese Journal of Hearing and Language Disorders*, 31(3), 129-136. (Japanese)
- Mino, T., & Torigoe, T. (2007) A survey on the support to deaf and hard of hearing children in an inclusive environment: A narrative analysis. *The Japanese Journal of Research on the Deaf*, 49(2), 47-66. (Japanese)
- Nomi, Y., & Yokkaichi, A. (2009) Case study of teaching an assistant performing captioning for a child with hearing impairment in elementary school: Discourse analysis of voice interactions and captioned interactions. *Japanese Journal of Disablity Sciences*, 33, 199-209. (Japanese)

- Ota, H., & Shimojima, K. (2003) Notetaking for the hard of hearing in junior high school. *The Japanese Journal of Research on the Deaf*, 45(3), 191-202. (Japanese)
- Shimojima, K. & Ota, H. (2005) Notetaking for the hard of hearing in junior high school (2). *The Japanese Journal of Research on the Deaf*, 47(2), 69-75. (Japanese)
- Shimonakamura, T., & Furuta, H. (2016) Accommodating educational needs of high school students who are deaf or hard of hearing in general education classrooms: From the perspectives of students. *SNE Journal*, 22(1), 147-160. (Japanese)
- Shimonakamura, T. (2017) Support for junior high school students who are deaf and hard of hearing in general education classrooms: Real-time notetaking by writing or typing, and interpretation by sign language. *The Japanese Journal of Hearing and Language Disorders*, 46(1), 21-35. (Japanese)
- Shimonakamura, T., & Furuta, H. (2017) Accommodating for high school students who are deaf or hard of hearing in general education classrooms from the perspectives of subject teachers. *SNE Journal*, 23(1), 161-172. (Japanese)
- Shimonakamura, T. (2018) A survey on provisions of accommodation for high school students who are deaf or hard of hearing (DHH) in regular classes:
 From the perspectives of both of manner of speaking and classroom environment. *The Japanese Journal of Hearing and Language Disorders*, 47(1), 39-50. (Japanese)
- Shimonakamura, T., & Furuta, H. (2022) Online training for university students who support deaf or hard of hearing students in mainstream schools using remote real-time captioning: Focusing on development of support skills. *The Japanese Journal of Research on the Deaf*, 64(2), 41-53. (Japanese)
- Vermeulen, J., Denessen, E., & Knoors, H. (2012) Mainstream teachers about including deaf or hard of hearing studens. *Teaching and Teacher Education*, 28, 174-181.