

## Technology of vocabulary development in English lessons for students of grades 5–6 with poor hearing

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### Abstract

The purpose of this research is to get teachers' opinions on the use of word development technology in English lessons for grade school students. In this study, the phenomenology design, one of the qualitative research models, was used. The study group for the research consists of 20 English teachers working in various schools for the hearing-impaired in Kazakhstan. Research data were collected with a semi-structured interview form developed by the researchers. As a result of the research, it has been determined that the majority of English teachers participating in the research support the use of technology in the education of hearing-impaired fifth- to sixth-grade students, and they sometimes use word development technology in the education of hearing-impaired fifth- to sixth-grade students. The majority of English teachers stated that they sometimes use word development technology in the education of hearing-impaired fifth- to sixth-grade students; that it has a positive effect on the participation of students with hearing impairments; that it makes it easier for students with hearing impairments to understand what they read; and that it facilitates the success of hearing-impaired students.

Keywords: Vocabulary development technology, English education, teacher opinions;

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## 1. Introduction

Thanks to their senses, human beings provide the relationship and association between their needs and the external world conditions (Akhisar, Yurtay, Yurtay, & Equalti, 2016). In this respect, hearing and understanding are the cornerstones of oral language that enable human beings to socialise, think, speak and reveal themselves and their thoughts. Sensory perception is of great importance in the education of hearing-impaired individuals as well as learners who do not have any special needs in learning processes. Hearing disability is not a directly conspicuous disability, like a physical disability, but when it comes to displaying a communicative skill, this reality emerges as a very concrete situation (Bell, 2013).

### 1.1. Theoretical and conceptual framework

In today's world, rapid developments in technology have provided convenience to people in every field (Keser & Semerci, 2019). Especially, the development of computer and Internet technologies has made the use of information technologies indispensable in educational environments (Al Rub, 2015). It is known that the use of information technology supports, enriches and facilitates education (Pascu, Simo, & Vernica, 2019; Pinpathomrat, 2017). In addition, students are provided with the opportunity to learn according to their own abilities and speed with individualised education materials. Information technologies are also used in the education of individuals with hearing impairment, as well as individuals with normal development (Baglama, Haksiz, & Uzunboylu, 2018).

It is necessary to design the education process according to individual differences, to prioritise the use of the auditory channel, to include visuality in the process in order to match auditory experience and visual cues and to prioritise communicative and social purposes, as well as academic purposes (Bamu, De Schauwer, Verstraete, & Van Hove, 2017). Hearing impairment is a sensory disorder that can lead to psychological and social disorders. Limited communication with the environment due to hearing impairment often leads to the isolation of the individual from society. The value of hearing for the development of an individual can only be realised when the functionality of the hearing organ is reduced or the hearing is completely lost (Zanin & Rance, 2016). It is stated that the concepts of hearing impairment and hearing impairment are used synonymously. Hearing impairment can be expressed as a situation in which the educational performance and social adaptation of the individual are negatively affected due to difficulties in speaking, using language and communication due to partial or complete insufficiency of hearing sensitivity (Susetyo, Maryanti, & Siswaningsih, 2021).

In order to understand the situation of the hearing-impaired in society and in the educational environment, it is necessary to seek an answer to the question of which communication model, which greatly affects the education of the hearing-impaired, can improve their communication skills as much as possible (Prakash, 2012). For years, experts, educators and families of children working in this field have discussed which communication model should be used with the hearing-impaired. However, when the literature is examined, it is seen that there are four basic communication models for hearing-impaired individuals. These are as follows: 1. verbal-auditory method; 2. signal method; 3. mixed method; and 4. bilingual method (Rekkedal, 2012).

By making use of the opportunities provided by information technologies, learning environments and learning materials suitable for the needs of individuals with hearing impairment can be arranged to minimise their disadvantaged situations compared to their normally developing peers. In this respect, the tools and application possibilities offered by information technologies for the education of individuals with hearing impairment are very important (Hashim, Tasir, & Mohamad, 2013).

### 1.2. Related research

Standley (2005) conducted a comprehensive literature review on the sociolinguistic perspectives on the education of deaf children in inclusive settings. As a result of the examination, it was emphasised that hearing-impaired children should have proficiency in two languages when they enter the educational environment. In addition, the importance of developing communicative competence and literacy in their first language was emphasised before hearing-impaired students acquire literacy in their second language.

Turan, Taşkıran Küçüköncü, Cankuvvet, and Yolal (2012) aimed to evaluate the language and listening skills of children who use cochlear implants and hearing aids. The sample of the study consisted of 25 children with moderate and severe hearing loss, aged between 43 and 84 months, attending preschool education at Anadolu University Hearing-Impaired Children's Education and Research Centre. According to the results of the study, there was no significant difference between the language performances of children using Cochlear implants and children using hearing aids; there was no significant difference in open set word discrimination skills. However, it was determined that children with implants have a higher rate.

Shojaei, Jafari, and Gholami (2016), on the other hand, aimed to evaluate the effect of early intervention on language development in children with hearing loss. The study group consisted of 30 Iranian children (14 girls and 16 boys) aged 6–7 years who had a congenital severe sensorineural hearing loss, did not have a second disability, used bilateral behind-the-ear hearing aids and were of similar socio-economic status. In the research, the increase in the language development of hearing-impaired children who were diagnosed or intervened early was significant in all the evaluated sub-tests.

Dammeyer and Ohna (2021) discussed the changes in educational planning for deaf children in Scandinavia in the last 30 years in their study. It is a study prepared in a literature review pattern that presents the history of education approaches, the language of communication used, education policies and new technologies in Scandinavian countries. The findings of the study show that educational planning in Scandinavian countries has progressed similarly over the years, adopting a bilingual–bicultural approach to education 30 years ago, and then an auditory–oral approach that uses sign language less.

Studies conducted abroad on the use of technology-assisted teaching materials in the education of hearing-impaired individuals were also examined. Trezek and Wang (2006) worked on the integration of mobile technologies into the educational environment of hearing-impaired students, and the use of these technologies facilitated students' access to information and learning. They achieved positive results.

### *1.3. Purpose of the research*

The purpose of this research is to get teachers' opinions on the use of word development technology in English lessons for grade school students. For this purpose, the following sub-objectives have been established:

1. How do English teachers support the use of technology in the education of hearing-impaired fifth- to sixth-grade students?
2. What is the situation of English teachers using word development technology in the education of hearing-impaired fifth- to sixth-grade students?
3. What is the contribution of English teachers' vocabulary development technology to the participation, reading comprehension and success of hearing-impaired students?

## **2. Methods and materials**

In this section, the demographic characteristics of the English teachers participating in the research, the semi-structured interview form to be applied to the English teachers to collect data, the method used in the research and the application and evaluation process of the semi-structured interview form are explained in detail.

### 2.1. Research method

In this study, the phenomenology design, one of the qualitative research models, was used. In phenomenological studies, it is tried to document in their own terms how individuals subjectively experience their own conditions from their own perspectives. Phenomenology studies can make important contributions to both scientific literature and practice. In phenomenology research, data sources directly experience the phenomenon that the research focuses on, i.e., individuals or groups who have lived experiences of the relevant phenomenon and can express or reflect this phenomenon (Patton, 1990). In this study, the opinions of English teachers were handled in accordance with the phenomenology pattern.

### 2.2. Participants

The study group for the research consists of English teachers working in various schools for the hearing-impaired in Kazakhstan. The English teachers who constituted the study group of the research agreed to participate in the research voluntarily.

Table 1. Demographic characteristics of English teachers

Experience	Gender		Sum
	Female	Male	
1–5 years	2	-	2
6–10 years	1	5	6
11–15 years	-	7	7
16 years and above	4	1	5
<b>Total</b>	7	13	20

In Table 1, the experience and gender distributions of the English teachers participating in the research are given. Two English teachers have 1–5 years, six have 6–10 years, seven have 11–15 years and 5 have 16 years or more of experience. Seven English teachers are female and 13 are male. A total of 20 English teachers participated in the study.

### 2.3. Data collection tools

Research data were collected with a semi-structured interview form developed by the researchers. Semi-structured interviews are frequently preferred by researchers due to their certain level of standardisation and flexibility, eliminating the limitations of tests and questionnaires based on writing and filling and helping to gain in-depth information on a particular subject. Semi-structured interviews are neither as rigid as fully structured interviews nor as flexible as unstructured interviews; they are located between two extremes (Yıldırım, 1999). While preparing the semi-structured interview questions, a literature review was conducted. The questions in the semi-structured interview form were sent to two field experts to provide control. In line with the suggestions of the experts, the semi-structured interview form was given its final form. The semi-structured interview form created to collect the research data is given in Table 2.

Table 2. Semi-structured interview form

#### Demographic characteristics of English teachers

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**Your gender:** Woman: ( ) Male ( )

**Your professional experience:** 1–5 years ( ) 6–10 years ( ) 11–15 years ( ) 16 years and above ( )

**Interview questions for English teachers**

**Do you support the use of technology in the education of hearing-impaired fifth- to sixth-grade students?**

- I support ( )
- I'm undecided ( )
- I do not support ( )

Your comments:.....  
 .....

**How often do you use word development technology in the education of hearing-impaired fifth- to sixth-grade students?**

- I always use ( )
- I often use ( )
- I use it sometimes ( )
- I rarely use ( )
- I never use ( )

Your comments: .....  
 .....

**K hand development technology to the participation of hearing-impaired students?**

- Affects class participation positively ( )
- Does not affect class participation ( )
- Affects class participation negatively ( )

Your comments: .....  
 .....

**To what extent does word development technology contribute to the reading comprehension of students with hearing impairments?**

- Makes reading comprehension easier ( )
- Does not affect reading comprehension ( )
- Makes reading comprehension difficult ( )

Your comments: .....  
 .....

**To what extent does word development technology contribute to the success of students with hearing impairments?**

- Makes it easier to achieve success ( )
- Does not affect achievement ( )
- Makes it difficult to achieve success ( )

Your comments: .....  
 .....

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In Table 2, the semi-structured interview form prepared to get the opinions of the English teachers participating in the research is given. In the form, there are two questions determining the demographic characteristics of the teachers. Demographic questions are aimed at determining the professional experience and gender of teachers. There are five English teachers in the form with hearing-impaired students in grade 5–6. Semi-structured interview questions were given to primary school students to get their opinions on the use of word development technology in English lessons. The questions were created to receive both closed-ended and open-ended answers.

**2.4. Data collection process**

In the process of collecting the research data, interviews were conducted in order to get the opinions of the English teachers participating in the research at the schools where the teachers were employed. In the face-to-face interviews, teachers were asked to fill in semi-structured interview

forms. It took approximately 30–35 minutes for the teachers to fill in the semi-structured interview forms. It took about 2 weeks to complete the interviews with 20 teachers who participated in the research.

### 2.5. Data collection analysis

Descriptive analysis method was used in the analysis of the research data. It is an analysis technique in which the data obtained are summarised and interpreted according to previously determined themes; direct quotations are frequently used to reflect the views of the interviewees in a striking way; and the results are interpreted within the framework of cause—effect relationships. In the presentation of the data, the criteria of striking (different opinion), explanatory (conformity to the theme), diversity and extreme examples were taken into account for the selection of citations (Creswell, 2002).

### 3. Results

In this section, the answers given by the English teachers participating in the research to the questions in the semi-structured interview form were analysed. Analyses are given with frequency and percentage tables.

In Table 3, the status of English teachers participating in the research supporting the use of technology in the education of hearing-impaired students in grade 5–6 is given.

Table 3. Situations of English teachers supporting the use of technology in the education of hearing-impaired fifth- to sixth-grade students

Category	Teacher opinions	F	%
<b>I support</b>	T-1: As in all areas of education, I support the use of technology in English education.	15	75
	T-9: I support the technology-supported teaching of the lessons as it makes it easier for the student to learn.		
	T-13: Educational technologies accelerate the learning of English for hearing-impaired students.		
	T-16: I think the use of technology in the English education of children with disabilities is very effective.		
	T-19: I support the use of educational technologies in English education.		
<b>I am undecided</b>	T-3: I think technology has pros and cons. So I was a little undecided.	3	15
	T-4: Educational technologies can lead students to success or failure. That's why I'm undecided.		
	Sometimes technology affects students' motivation positively. Sometimes students are under the influence of the negative effects of technology rather than learning.		
<b>I do not support</b>	T-2: I do not support technology addiction in education because I find it dangerous.	2	10
	T-20: I am a teacher who supports the classical education approach. I believe that the use of technology in education reduces the quality of education. That's why I don't support it.		
<b>Total</b>		20	100

In Table 3, the status of the English teachers participating in the research supporting the use of technology in the education of hearing-impaired students in grade 5–6 is categorised. 75% of the

English teachers answered that they support using technology in the education of hearing-impaired fifth- to sixth-grade students. 15% of the English teachers gave the answer that they are undecided; 10% do not support. In this direction, it is possible to say that the majority of English teachers participating in the research support the use of technology in the education of hearing-impaired fifth- to sixth-grade students.

In Table 4, the frequency of using word development technology in the education of hearing-impaired fifth- to sixth-grade students is evaluated by the English teachers participating in the research.

Table 4. Frequency of English teachers using word development technology in the education of hearing-impaired fifth- to sixth-grade students

Category	Teacher opinions	F	%
I always use	T-5: I always use word development technology in the education of hearing-impaired students.	2	10
	T-9: I think that the use of word development technology in the hearing-impaired will positively affect the language development of the students. That's why I always use it.		
I use often	T-1: I often use word development technology. I find it very useful.	3	15
	T-17: It is a technology that I frequently use to ensure the continuity of students' learning in the classroom environment and at home.		
I use it sometimes	T-15: I sometimes use it depending on the content and suitability of the course.	1	55
	T-6: I sometimes use it to not only provide technology-based education to students.		
I rarely use	T-3: I use it very rarely. I believe that teaching with classical methods leads the student to success.	2	10
	T-14: I rarely use technology in some of my lessons.		
I never use	T-2: I do not use educational technologies in my lessons.	2	10
	T-20: I have never used word development technology before.		
<b>Total</b>		<b>20</b>	<b>100</b>

In Table 4, the use of word development technology by the English teachers participating in the research in the education of the hearing-impaired fifth- to sixth-grade students is categorised. 10% of the English teachers participating in the research answered that they always use it, 15% use it frequently, 55% sometimes use it, 10% rarely use it and 10% never use it. In this direction, it is possible to say that the majority of English teachers participating in the research sometimes use vocabulary development technology in the education of hearing-impaired students in grades 5–6.

In Table 5, the opinions of the English teachers participating in the research on how word development technology affects the contribution of hearing-impaired students to the lesson are evaluated.

Table 5. Opinions of English teachers on how word development technology affects the contribution of hearing-impaired students to class participation

Category	Teacher opinions	F	%
Affects class participation positively	T-13: I think that technology supported education will always positively affect the student's participation in the lesson.	13	65
	T-17: Since students are more interested in the lesson, they participate more in the lesson with love and willingness.		

<b>Does not affect class participation</b>	T-10: I do not think that the methods used in the lesson have any effect on the participation of the students in the lesson.	5	25
	T-14: I think that the student's participation in the lesson depends on the teacher's motivation to the lesson. So my answer is that it doesn't.		
<b>Affects class participation negatively</b>	T-2: In my opinion, since the proposal development technology encourages individual learning, it negatively affects students' participation in the lesson.	2	10
	T-7: I think that the more frequently students use technology in learning, the more they will stay away from class participation.		
<b>Total</b>		20	100

In Table 5, the opinions of the English teachers participating in the research on how word development technology affects the contribution of hearing-impaired students to the lesson are categorised. 65% of the English teachers gave the answer that it positively affects class participation, 25% gave the answer that it does not affect class participation and 10% gave the answer that it affects class participation negatively. In this direction, it has been determined that the majority of English teachers participating in the research are of the opinion that word development technology positively affects the participation of students with hearing impairments.

In Table 6, the opinions of the English teachers participating in the research on how word development technology contributes to the reading comprehension of students with hearing impairments are evaluated.

Table 6. Opinions of English teachers on how word development technology affects the contribution of deaf students to reading comprehension

Category	Teacher opinions	F	%
<b>Makes reading comprehension easier</b>	T-1: I think word development technology also has a significant impact on the reading comprehension of deaf students.	11	55
	T-17: Since I think it is beneficial, I also think it makes it easier.		
<b>Does not affect reading comprehension</b>	T-12: Students do not have any problems with reading comprehension anyway. They have trouble expressing. So I don't think it will make any difference.	8	40
	T-15: Vocabulary development technology does not make any changes on students' reading comprehension levels.		
<b>Makes reading comprehension difficult</b>	T-20: I think that the content of the courses that are tried to be taught with technology will negatively affect the students.	1	5
<b>Total</b>		20	100

In Table 6, the opinions of the English teachers participating in the research on how word development technology contributes to the reading comprehension of students with hearing impairments are categorised. 55% of the English teachers gave the answer that it facilitates reading comprehension, 40% gave the answer that it does not affect reading comprehension and 5% gave the answer that it makes it difficult to understand what they read. In this direction, it was determined that the majority of the English teachers who participated in the study said that word development technology facilitates the reading comprehension of students with hearing impairments.



In Table 7, the opinions of the English teachers participating in the research on how word development technology contributes to the success of students with hearing impairments are evaluated.

Table 7. Opinions of English teachers on how word development technology affects the success of students with hearing impairments

Category	Teacher opinions	F	%
<b>Makes it easier to achieve success</b>	T-9: I think that word development technology facilitates the success of students with hearing impairments.	14	70
	T-16: Vocabulary development technology has a positive effect on student success.		
<b>Does not affect achievement</b>	T-4: When we consider the positive and negative effects of technology together, I think that it will not affect success.	5	25
	T-12: It facilitates learning, but it can also make the student lazy. So I don't think it will affect much.		
<b>Makes it difficult to achieve success</b>	T-7: The teacher has a role rather than technology in all kinds of education to be given to hearing-impaired students. Technology can negatively affect success.	1	5
<b>Total</b>		20	100

In Table 7, the opinions of the English teachers participating in the research on how word development technology contributes to the success of students with hearing impairments are categorised. 70% of the English teachers answered that it makes it easier to achieve success, 25% answered that it does not affect success and 5% answered that it makes it difficult to achieve success. In this direction, it was determined that the majority of English teachers participating in the study said that word development technology facilitates the success of hearing-impaired students.

#### 4. Discussion

It is possible to say that the majority of the English teachers participating in the research support the use of technology in the education of hearing-impaired fifth- to sixth-grade students. The majority of the English teachers stated that they sometimes use word development technology in the education of hearing-impaired fifth- to sixth-grade students; they reported that word development technology had a positive effect on the participation of students with hearing impairments; they stated that word development technology made it easier for students with hearing impairments to understand what they read; and that word development technology facilitated the success of hearing-impaired students.

Ditcharoen, Naruedomkul, and Cercone (2010) implemented an alternative language learning tool to translate sentences from different sources (textbook, cartoon, story and newspaper) into sign language. This tool has been tested and evaluated for accuracy and user satisfaction. The satisfaction levels of the participants in the study were high. Panselina, Sigalas, and Tzougraki (2002) found that while using a computer programme designed for hearing-impaired students during the research process, hearing-impaired students were most interested in video clips, the dictionary application of the programme was used very little and additional pictures and diagrams on the screen during video clips attracted students' attention. Demirhan (2008) examined the effect of information technologies on the education of the hearing-impaired in his study. In the study, 11 hearing-impaired students in the 7–11 age group were studied. As a result of the research, it was seen that the achievements of the students who receive education in a classroom environment equipped with information technologies are higher than those of the students who receive education in regular classes. Reitsma (2009) developed two computer-based exercises for 11-year-old children with hearing impairment to learn reading and spelling, and concluded that these exercises increased students' reading levels. In

their study, Marschark et al. (2006) examined the learning situations of students with hearing impairments with the help of sign language programmes and simultaneous feedback applications. As a result of the study, the students achieved what they learned faster, thanks to the programmes and applications used.

## 5. Conclusion

The use of technology containing visual and auditory information increases the recall and processing of information in deaf and hard-of-hearing students. With the development of computer and Internet technologies, the opportunity to access information has increased rapidly. Like every individual, hearing-impaired individuals also need to access and use information. However, the opportunities of hearing-impaired individuals to access and use information are not at the same level as normal individuals. In order for the hearing-impaired to continue their social life, it is necessary to carry out studies for them. Therefore, this study aimed to get teachers' opinions on the use of word development technology in English lessons for primary school students. As a result of the research, it was determined that the majority of English teachers participating in the research support the use of technology in the education of hearing-impaired fifth- to sixth-grade students and they sometimes use word development technology in the education of hearing-impaired fifth- to sixth-grade students. The majority of English teachers stated that they sometimes use word development technology in the education of hearing-impaired fifth- to sixth-grade students; they reported that word development technology had a positive effect on the participation of students with hearing impairments; that word development technology made it easier for students with hearing impairments to understand what they read; and that word development technology facilitated the success of hearing-impaired students.

## 6. Recommendations

Based on the results obtained from the research, the following recommendations were developed:

1. In-service training seminars should be given so that English teachers can benefit from technology in the education of hearing-impaired students.
2. Seminars should be organised to enable English teachers to benefit from word development technology in the education of hearing-impaired students.
3. In order to support English teachers' use of technology in the education of hearing-impaired students, course curricula should be created for future English teachers studying at universities.

## References

- Akhisar, U., Yurtay, N., Yurtay, Y., & Equalti, F. U. (2016). An ecommerce website usability of visually impaired people in social responsibility projects related feedback. *International Journal of Innovative Research in Education*, 3(2), 50–54. <https://doi.org/10.18844/ijire.v3i2.996>
- Al Rub, M. F. (2015). Teachers' beliefs and technology use in kindergarten and elementary classrooms. *World Journal on Educational Technology*, 7(3), 149–156. <https://doi.org/10.18844/wjet.v7i3.202>
- Baglama, B., Haksiz, M., & Uzunboylu, H. (2018). Technologies used in education of hearing impaired individuals. *International Journal of Emerging Technologies in Learning*, 13(9). <https://doi.org/10.3991/ijet.v13i09.8303>

- Saltanat, S., Akbota, A., Svetlana, S., Gulnur, N., & Dinara, K. (2022). Technology of vocabulary development in English lessons for students of grades 5–6 with poor hearing. *World Journal on Educational Technology: Current Issues*, 14(5), 1622–1633. <https://doi.org/10.18844/wjet.v14i5.8124>
- Bamu, B. N., De Schauwer, E., Verstraete, S., & Van Hove, G. (2017). Inclusive education for students with hearing impairment in the regular secondary schools in the North-West region of Cameroon: Initiatives and challenges. *International Journal of Disability, Development and Education*, 64(6), 612–623. <https://doi.org/10.1080/1034912X.2017.1313395>
- Bell, D. (2013). *Investigating teaching and learning support for students with hearing impairment at a University in the Western Cape* (Doctoral dissertation). Stellenbosch, South Africa: Stellenbosch University. Retrieved from <http://scholar.sun.ac.za/handle/10019.1/80004>
- Creswell, J. W. (2002). *Educational research: Planning, conducting, and evaluating quantitative*. Upper Saddle River, NJ: Prentice Hall. Retrieved from: <http://hdl.handle.net/123456789/1093>
- Dammeyer, J., & Ohna, S. E. (2021). Changes in educational planning for deaf and hard of hearing children in Scandinavia over the last three decades. *Scandinavian Journal of Disability Research*, 23(1), 114–123. <http://dx.doi.org/10.16993/sjdr.680>
- Demirhan, T. (2008). *Investigation of the effect of information technologies on the education of the hearing impaired* (Master's Thesis). Trakya University Institute of Science and Technology. Retrieved from <https://dspace.trakya.edu.tr/xmlui/bitstream/handle/trakya/554/0071011.pdf?sequence=1&isAllowed=y>
- Ditcharoen, N., Naruedomkul, K., & Cercone, N. (2010). SignMT: An alternative language learning tool. *Computers & Education*, 55(1), 118–130. <https://doi.org/10.1016/j.compedu.2009.12.09>
- Hashim, H., Tasir, Z., & Mohamad, S. K. (2013). E-learning environment for hearing impaired students. *Turkish Online Journal of Educational Technology-TOJET*, 12(4), 67–70. Retrieved from <https://eric.ed.gov/?id=EJ1018030>
- Keser, H., & Semerci, A. (2019). Technology trends, Education 4.0 and beyond. *Contemporary Educational Researches Journal*, 9(3), 39–39. <https://doi.org/10.18844/cerj.v9i3.4269>
- Marschark, M., Leigh, G., Sapere, P., Burnham, D., Convertino, C., Stinson, M., ... Noble, W. (2006). Benefits of sign language interpreting and texting alternatives for deaf students' classroom learning. *Journal of Deaf Studies and Deaf Education*, 11(4), 421–437. <https://doi.org/10.1093/deafed/enl013>
- Panselina, M. E., Sigalas, M. P., & Tzougraki, C. (2002). Design and development of a bilingual multimedia educational tool for teaching chemistry concepts to deaf students in Greek sign language. *Education and Information Technologies*, 7(3), 225–235. Retrieved from <https://link.springer.com/article/10.1023/A:1020807530212>
- Pascu, L., Simo, A., & Vernica, A. M. (2019). Integrating Microsoft IoT, machine learning in a large-scale power meter reading. *International Journal of New Trends in Social Sciences*, 3(1), 010–016. <https://doi.org/10.18844/ijntss.v3i1.3815>
- Patton, M. Q. (1990). *Qualitative evaluation and research methods*. SAGE Publications. Retrieved from <https://psycnet.apa.org/record/1990-97369-000>
- Pinpathomrat, N. (2017). Cultural model of information technology usage (CMITU). *Global Journal of Information Technology: Emerging Technologies*, 7(2), 42–49. <https://doi.org/10.18844/gjit.v7i2.2227>
- Prakash, S. S. (2012). Inclusion of children with hearing impairment in schools: A survey on teachers' attitudes. *Disability, CBR & Inclusive Development*, 23(3), 90–111. Retrieved from <https://pdfs.semanticscholar.org/3170/fd2b2d767dcbbb87ef4a2bde7121b680d884.pdf>

- Saltanat, S., Akbota, A., Svetlana, S., Gulnur, N., & Dinara, K. (2022). Technology of vocabulary development in English lessons for students of grades 5–6 with poor hearing. *World Journal on Educational Technology: Current Issues*, 14(5), 1622–1633. <https://doi.org/10.18844/wjet.v14i5.8124>
- Rekkedal, A. M. (2012). Assistive hearing technologies among students with hearing impairment: Factors that promote satisfaction. *Journal of Deaf Studies and Deaf Education*, 17(4), 499–517. <https://doi.org/10.1093/deafed/ens023>
- Reitsma, P. (2009). Computer-based exercises for learning to read and spell by deaf children. *Journal of Deaf Studies and Deaf Education*, 14(2), 178–189. <https://doi.org/10.1093/deafed/enn031>
- Shojaei, E., Jafari, Z., & Gholami, M. (2016). Effect of early intervention on language development in hearing-impaired children. *Iranian Journal of Otorhinolaryngology*, 28(84), 13. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4735612/>
- Standley, L. (2005). Sociolinguistic perspectives on the education of deaf children in inclusion placement. In J. Cohen, K. T. McAlister, K. Rolstad, & J. MacSwan (Eds.), *ISB4: Proceedings of the 4th International Symposium on Bilingualism* (pp. 2190–2188). Retrieved from <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.655.3797&rep=rep1&type=pdf>
- Susetyo, B., Maryanti, R., & Siswaningsih, W. (2021). Students with hearing impairments' comprehension level towards the exam questions of natural science lessons. *Journal of Engineering Science and Technology*, 16(2), 1825–1836. Retrieved from [https://jestec.taylors.edu.my/Vol%2016%20issue%20%20April%202021/16\\_2\\_65.pdf](https://jestec.taylors.edu.my/Vol%2016%20issue%20%20April%202021/16_2_65.pdf)
- Trezek, B. J., & Wang, Y. (2006). Implications of utilizing a phonics-based reading curriculum with children who are deaf or hard of hearing. *Journal of Deaf Studies and Deaf Education*, 11(2), 202–213. <https://doi.org/10.1093/deafed/enj031>
- Turan, Z., Taşkıran Küçüköncü, D., Cankuvvet, N., & Yolal, Y. (2012). Evaluation of language and listening skills of children with hearing loss who use cochlear implants and hearing aids. *Gulhane Medical Journal*, 54(2). Retrieved from <https://eds.s.ebscohost.com/eds/pdfviewer/pdfviewer?vid=0&sid=27d5dd35-1db3-4199-b296-7a1b2c14073d%40redis>
- Yildirim, A. (1999). Basic features of qualitative research methods and their place and importance in educational research. *Education and Science*, 23(112). Retrieved from <http://213.14.10.181/index.php/EB/article/view/5326>
- Zanin, J., & Rance, G. (2016). Functional hearing in the classroom: Assistive listening devices for students with hearing impairment in a mainstream school setting. *International Journal of Audiology*, 55(12), 723–729. <https://doi.org/10.1080/14992027.2016.1225991>