My name is Raquel Martinez Diez, I am studying a master’s degree in cyber security in the University of Essex. Today I am going to present a research proposal to review and analyze the use of assistive technology in education for hearing and speech impaired children.

The term assistive technology hereinafter referred as AT is defined by the United States Individuals with Disabilities Education Act (IDEA, 2004) as any device that is used to increase, maintain or improve the functional capabilities of a child with a disability. Thanks to the rapid developments in AT in recent years, devices have become widely available. This fact has facilitated their use in special education and has helped disabled children to break barriers to learning. Since their introduction, a lot of research has been performed about the effects of using AT for children with disabilities. Results show that AT benefits these children as it increases their independence and performance in school. They have a positive effect on children’s confidence and increase their participation in class (Tamakloe & Agbenyega, 2017). Nevertheless, statistics show that the technology still remains inaccessible to a high percentage of students. In 2020 Bouck & Long performed a data analysis of the use of AT among students with disabilities in the United States and results showed that only 30% of them used AT in school. 14.5% of these students were speech impaired and 43.8% hearing impaired. These statistics show very low usage rates and given the described benefits, the question why the technology is not more widely used is raised. Many research initiatives have worked to identify the issues for this low rates.

Existing research has been focused on evaluating the use of AT for children with disabilities in general. Several papers have highlighted the aspects that could be improved for the technology to be more efficiently applied. However, even if studies analyze data including different types of disabilities and sometimes give statistics categorized by type, the recommendations are general for all types. There has been little research on whether general recommendations are equally effective for all types of disabilities. The relevance of this study is that research will concentrate on the use of AT specifically for hearing and speech impaired students.

In order to fill this gap, the proposed study will answer the following research questions focusing on students with hearing and speech impairment:

* What types of AT devices are effective in helping these students?
* How are the AT devices available for these students being used by the educators?
* What gaps and challenges is facing the use of AT in the education of this type of disabled students?

Answering these questions, the research aims to identify the types of AT that work best for the students and to outline effective ways to use them in schools. The main objective of this research is to identify actionable information to promote and increase the use of AT for students with speech and hearing impairments and to help professionals to improve the AT implementation in class. Another objective is to identify opportunities for future research.

Existing literature has well documented the AT that is used by students with communication difficulties. Augmentative and alternative communication or AAC devices are used by speech impaired students to facilitate communication. AAC devices can range from simple picture boards to more advanced digital devices that convert text to speak or TTS. In recent years technological developments in speech recognition use neural network-based speech synthesis that have enormously improved the quality of speech processing (Ren et al., 2019). TTS devices have features like ready-made sentences or word and sentence prediction to make the communication faster. Likewise, assistive listening devices or ALD help hearing impaired students to participate in school. ALDs are sound amplifying systems that can be installed in places where there’s a lot of background noise such as classrooms to transmit an amplified sound to a hearing aid worn by the receiver.

There is also extended research on the current state of adoption of AT in schools and the effectiveness of using it. Main factors that prevent the effective use of AT are insufficient training for the education professionals that are going to use them, access to information about what technology is available for the different types of disabilities, and inadequate assessment of the children needs (Atanga et al., 2020; Torrado et al., 2020). The results of these analysis advocate for including specific AT training in the training programs for educators, including university degrees, as this knowledge has a positive impact in the educator’s perception of the technology and adoption in class. Torrado et al. (2020) suggest that AT development with a research approach involving education professionals has good results in the adoption of the technology and facilitates design based on children’s needs.

To achieve the objectives, this research study will be based on exploratory and descriptive research (Dawson, 2015). The exploratory research will be conducted at the beginning of the research to clarify the nature of the problem, identify the data collection and analysis tools, and confirm the feasibility of the study. Then, descriptive research will allow to identify what AT devices are used for children with the studied disability and how they are used. Data collection will include both primary and secondary data using data from a survey as well as data previously collected and available in databases. According to Dawson, the research should follow a clearly defined process. Therefore, the stages of the research process have been identified and presented here. Although the stages are sequential, some of them can be performed in parallel.

The first stage is to review the existing literature to highlight the questions that have been solved and the questions that need to be answered regarding the use of AT.

Second stage is to design and conduct the survey. Poor survey design can derive in ineffective data collection for answering the research question or in lack of participation (Draugalis et al., 2008). To prevent these issues, survey design will follow best practices including clear definition of research question, appropriate data sampling, pretesting and use of appropriate statistical techniques. The participants of the survey will be educators who have experience teaching students with this type of disability and graduate students enrolled in education-related programs which include AT in the curriculum. Recruitment will be done through email notifications and publication in relevant social media forums.

Third stage is to perform a secondary research based on available data sources about the experiences of using AT with disabled children and the effects they have in their learning. I will have to identify suitable data sources and make sure that access can be granted.

In the fourth stage data obtained from primary and secondary sources will be analyzed. Since I will be collecting qualitative data, the analysis process will aim to extract useful information from the data by inspecting, cleaning, and transforming it with a data analysis tool. One problem with qualitative data is that it cannot be measured objectively, and it’s open to subjective interpretation. Therefore, in the analysis process, I will have to avoid biased interpretations. The main method to analyze qualitative data is the thematic analysis, the data analysis tool will be designed to identify recurrent keywords or topics in the data, and group them into meaningful themes.

The final stage will be to write a structured dissertation paper introducing the research subject, explaining the methodology used, presenting the results of the investigation, and presenting the conclusions and opportunities for further research.

Given the nature of the research, there will not be need for system prototypes or simulators. The final product will be a research dissertation paper and the artifacts of my research will be a survey to collect data and a data analysis tool to extract conclusions from the survey results and secondary data.

In research practice there is an expectation that ethical considerations are part of the research work. In this case, ethics are extremely important as the research involves minors and vulnerable people. This fact can make it difficult to obtain the necessary approval from the university to conduct the proposed survey. For this reason, the benefits of involving people to answer the research question need to be clearly presented. Another ethical consideration is that people must give their consent to participate in surveys. If participants are minors their parents or representatives must give the consent for them. Due to these considerations, selected participants will not include minors but professionals in education. Also, to encourage the participants consent they will be informed about the objectives of the research, how the data is going to be processed and the confidentiality of their responses. Due to data privacy regulations such as the General Data Protection Regulation (GDPR) (European Parliament, 2016) the survey has to protect the privacy of participants and avoid collecting any unnecessary personal data.

The risks that I foresee at this moment include lack of participation in the survey, biased answers and access to secondary data. The results of the survey are an important source of my research, and in order to draw valid conclusions from the data it is mandatory to have a minimum amount of information. Therefore, to mitigate the lack of participation I plan to follow Jackson & Furnham (2000) guidelines and clearly communicate the value of the research, guarantee the anonymity of participation, describe the survey process, and make it short and easy to take. Another potential risk in data collected through surveys is biased answers from participants. To mitigate this, there are specific guidelines in survey design that help formulate questions to prevent biased answers. For the secondary research proposed in stage four, identification of suitable data sources and provision of access is needed. During the literature review on this subject, I have come across existing databases that contain suitable data such as the National Longitudinal Transition Study database in the United States or the Ambient Intelligence Lab in the Universidad Autonoma of Madrid. The data sources for my research are jet to be identified and I plan to seek advice from my project tutor on how to proceed with this task.

Finally, this Gantt chart presents the timeline of my project. The duration is estimated to six months, with some stages overlapping. The first stage will take 1 month and analysis stages 2 and 3 will be concurrent and finish end of December. The analysis, stage 4, will start after these two stages. The last stage for writing the dissertation will last three months and end in February 2023.

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