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TEACHERS' PERCEPTIONS OF FACTORS AFFECTING THE USE OF HEARING ASSISTIVE DEVICES TO IMPROVE LEARNING OUTCOMES AMONG STUDENTS WITH HEARING IMPAIRMENTS IN INCLUSIVE CLASSROOMS

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Abstract:

This qualitative study investigates teachers' views on the implementation of Hearing Assistive Devices (HADs) to facilitate learning by hearing-impaired students in inclusive classes. Although their effectiveness in enhancing auditory access has been rigorously proven, their systematic use in schools, especially in special education, is low. The research has three aims: (1) to explore the views of teachers about the potential of HADs in the support of hearing-impaired students, (2) to identify facilitators and barriers that influence the use of HADs, and (3) to uncover methods by which teachers modify lesson plans to incorporate HADs successfully. Data were gathered through semi-structured interviews with three veteran special education teachers and analysed thematically according to Braun and Clarke's six-phase method. Analysis of the interviews yielded four prominent themes: (i) readiness and awareness of HADs among teachers, (ii) benefits of HADs towards promoting pupil motivation and understanding, (iii) emotional and social difficulties experienced by pupils using HADs, and (iv) significance of institutional support and instructional practices, e.g., modifications to conventional instruction practices. This research contributes to inclusive education literature by placing a focus on the interconnectedness of pedagogy, assistive technology, and students' outcomes. It leverages Bronfenbrenner's ecological systems theory and the Technology Acceptance Model (TAM) to present an integrative theoretical model for HAD implementation in classrooms. Results emphasize the need for targeted professional development, enhanced technical support, and family-based interventions to mitigate stigma and ensure sustained use of HAD. Results are pertinent to policymakers, teacher educators, and school leaders in developing appropriate strategies for enhancing the learning experiences of hearing-impaired pupils in inclusive classrooms.

Keywords:

Teacher Perceptions, Hearing Assistive Devices, Inclusive Education, Special Education, Hearing Impairment, Lesson Adaptation

Introduction

Hearing impairment is one of the world's most prevalent sensory disabilities, with currently about 430 million people affected and projected to rise to over 700 million by the year 2050 (World Health Organization (WHO), 2021). In learning environments, individuals with hearing impairment face serious challenges in learning, communication, and participating in social interaction, mainly in the absence of proper assistive technologies. Hearing Assistive Devices (HADs) such as hearing aids and frequency modulation (FM) systems have been shown to greatly facilitate auditory access, understanding, and participation in the classroom settings were used regularly (Knoors & Marschark, 2014).

Despite these benefits, empirical research has shown that the use of Hearing Assistance Devices (HADs) is variable and is influenced by a variety of psychological, contextual, and pedagogical factors (McCracken & Laoide-Kemp, 1997; Darc Piculo dos Santos et al., 2020). Teachers have the essential role in advocating the efficient use of such technologies; yet, many lack the training and self-confidence to ensure the integration of HADs in their pedagogy (Fernández-Batanerov et al., 2022; Jelas & Mohd Ali, 2014). The challenge is especially acute in inclusive learning settings, where hearing-impaired learners learn in the same classroom with their hearing peers, thus increasing the need for pedagogy and classroom arrangement adjustments (Chin, 2020).

In Malaysia, the inclusive programmes began in the early 2000s with the assistance of the Ministry of Education. Despite the effort, it remains difficult to use assistive devices in the classroom. Studies by Abu Bakar and Nordin (2024) and Khairuddin and Miles (2020) determine that teachers lack adequate training, the devices are poorly maintained, and the sound quality in the classroom is poor. There exists a wide research lacuna since little has examined what teachers feel and experience in employing Hearing Assistive Devices (HADs), particularly in Malaysian inclusive settings. The majority have only addressed technical or clinical perceptions while overlooking social as well as pedagogy elements, which influence the usage as well as maintenance of the devices in the long term (Gustafson et al., 2024; Boothroyd, 2004).

This research examines the teachers' beliefs on the factors influencing the uptake of Hearing Assistive Devices (HADs) in the support of hearing-impaired pupils to learn. Based on Bronfenbrenner's Ecological Systems Theory and the Technology Acceptance Model (TAM), the research examines the interplay effects of teachers' beliefs, setting, pupils' beliefs, and support from the school on the uptake of hearing technology in inclusive education. Despite progressive national plans like the Malaysia Education Blueprint 2013–2025 and the Ministry of Education's (MOE) Inclusive Education Program (Program Pendidikan Inklusif, PPI), inclusive education practice is still uneven, especially in the case of supporting dependent students with hearing impairment. One of the problems most quoted is the variable deployment of Hearing Assistive Devices (HADs) in regular classrooms daily, mainly because of teacher,

psychosocial, and infrastructural factors. This is still an issue for Malaysia as it makes efforts to meet its commitment under Sustainable Development Goal 4 (SDG 4) to provide "inclusive and equitable quality education for all" (UNESCO, 2015) as well as the Convention on the Rights of Persons with Disabilities (CRPD), which also require the right to receive quality education through reasonable accommodation and assistance. The current study responds to the important gap in the literature by examining how teachers view and operate under the complex surrounding factors for HAD use in inclusive classrooms with a focus on offering directions for teacher training, classroom instruction, and inclusive policy enactment.

While Malaysia has taken commendable steps in inclusive education, the deployment of assistive technologies like Hearing Assistive Devices (HADs) remains inconsistent. Globally, educational systems are increasingly leveraging cloud-based smart technologies and AI-powered solutions to enhance inclusivity (Papadakis et al., 2023; Lavidas et al., 2024). For example, computer simulations and cloud-based platforms have shown promise in improving accessibility and engagement among students with diverse learning needs (Papadakis et al., 2023). These global innovations offer valuable insights for Malaysia's education reform efforts, especially in aligning with SDG 4 and enhancing HAD utilization through scalable and interactive platforms.

Literature Review

The effective use of Hearing Assistive Devices (HADs) in educational settings has been widely studied in both clinical and pedagogical contexts. However, despite substantial evidence of their benefits, numerous challenges continue to hinder their consistent application in classrooms, particularly in inclusive environments. This section discusses relevant literature according to three thematic domains: (1) teacher training and competence, (2) student acceptance and psychosocial barriers, and (3) environmental and institutional constraints.

Teacher Training and Competence in Assistive Technology Use

The incorporation of Hearing Assistive Devices (HADs) in inclusive classrooms is not only dependent on the presence of technological supports, but also on the didactic skills of instructors for their appropriate use. Various global research findings highlight that teacher training is an important factor in establishing whether the integration of HADs is effective. Fernández-Batanerov et al. (2022) posit that teachers are not aware of how to effectively apply maximum utilization of HAD, for instance, applying optimal speaking distances or acoustics modification within classrooms to clarify sound. Teachers mostly utilize trial-and-error methods or experiential learning to incorporate HADs in their teaching, and this results in inconsistency in the support for the hearing-impaired among students.

Masuku et al. (2024), concluded that there is insufficient structured, formal education in the utilization of hearing technology in teacher training programs, especially among general education and early-career special education teachers. According to their research, even those with experience may be unsure how to use equipment like FM systems or cochlear implant processors. Similarly, McCracken and Laoide-Kemp (1997) noted that mainstream teachers develop caution or discomfort in coping with the technical needs of HADs because they have limited exposure to audiological consultation and in-service education.

In Malaysia, teacher unreadiness has been reaffirmed in research by Jelas and Mohd Ali (2014), which finds that despite inclusive education policy promoting equal opportunities, systemic training of teachers in HAD operations remains lacking, perpetuating a residual gap in implementation. The constraints undermine teaching quality alongside teachers' attitudes toward the use of devices, promoting a passive integration approach. Thus, teacher proficiency is the key predictor of HAD effectiveness and enhancing pre-service and in-service training programs is the key to enabling teachers to offer stable, high-quality auditory support.

Recent EdTech literature has shown that the integration of immersive and intelligent systems such as augmented reality (AR), AI learning companions, and cloud computing can significantly transform learning for students with disabilities. Papadakis et al. (2023) emphasize the role of cloud-simulation environments in facilitating open, accessible learning, while Aravantinos et al. (2024) show how AI applications have been embraced in inclusive primary school settings to support cognitive diversity. These approaches not only complement assistive hardware but also offer adaptable pedagogical pathways for learners with hearing impairments. Thus, including these innovations in the discourse on HADs expands the scope of assistive pedagogy beyond traditional models.

Student Acceptance and Psychosocial Barriers

Though technical and pedagogical preparedness is essential, the experience and attitude of the students towards HADs also determine how usable the devices will be. For most of the hearing-impaired students, HADs are visual markers of difference and thus vulnerable to judgments or rejection by their peers. As noted by Darc Piculo dos Santos et al. (2020), negative concepts of self, social stigma, and embarrassment about wearing visible devices, particularly during adolescence, are among the primary concerns discouraging frequent usage. These psychosocial aspects of device usage are under-researched in most education systems, where priorities are still concentrated on the availability of hardware and not user accommodation.

Khairuddin and Miles (2020) further observe that hearing-impaired Malaysian students face double challenges: besides having an issue with linguistic access, they also have emotional challenges related to peer relationships and self-esteem. These are further compounded in inclusive regular classrooms where device visibility, like BTE (Behind-the-Ear) hearing aids or external cochlear processors, may enhance otherness among the students. McCracken and Laoide-Kemp (1997) also reported the same trends to be in effect in the UK, as the pupils were not willing to use hearing aids because of teasing and feeling "different."

To reduce this, academicians have advocated for increased socially responsive teaching culture. Chin (2020) requires awareness-raising with all students and suggests whole-school strategies that allow HAD to adopt the norm of classroom diversity. Teachers' responsibilities go beyond pedagogy to include emotional advocacy to establish nurturing environments, device use acceptance modelling, and family involvement to develop healthy mindsets. These results indicate that without psychosocial readiness and an open class climate, the learning gains of HADs will not be achieved.

Environmental and Institutional Constraints

Classroom settings, school facilities, and infrastructure of support systems are focal in either enabling or discouraging the use of HADs. Boothroyd (2004) illustrates that even the optimum assistive technology will not work where the components are acoustically unsatisfactory, for

instance, in large classrooms with hard surfaces, ambient noise, or improper speaker placement. In inclusive classrooms, the problem is compounded due to the diversity of students' needs, class size, and availability of educational resources.

In a Malaysian study by Abu Bakar and Nordin (2024), the authors discuss infrastructural barriers to the maintenance of HAD, such as sluggish processes of repair, insufficient budgeting of batteries and spare parts, and the lack of regular device checks by audiologists. The teachers who were involved in the study testified that despite the period when they discovered the significance of HADs, the limited support from institutions, e.g., a lack of reserve units, inadequate technical training, or no access to support staff, greatly limited their ability to troubleshoot or ensure device functioning.

Gustafson et al. (2024) further state the lack of multidisciplinary collaboration in Malaysian schools. Even though audiologists are required for equipment calibration and constant monitoring, various schools either do not have effective connections with these professionals or refer students out to parents to get the devices repaired. This creates delays, wasted class time, and frustration for both teachers and students. Across the world, schools with inclusive mandates tend to ignore environmental design changes needed, including sound-field amplification gear, quiet areas, or better seating arrangements that would facilitate HAD use. In even more developed countries, occasional funding or priority restrict organizational capability to continue assistive technology programs after installation (Knoors & Marschark, 2014).

Gaps in Existing Research

Whereas there has been considerable research on most of the obstacles to the optimal use of HADs, from training requirements and environmental factors through attitudes among students, few have examined them from the teacher's point of view, particularly in low- and middle-income countries. Whereas technical or medical approaches dominate, exploring the functionality of devices or the audiological quality of devices irrespective of what teachers know and do about assistive device use during teaching daily practice,".

Additionally, research that does incorporate teacher perspectives is likely to be based on surveys or shallow in its approach to lived experience and situational richness (Masuku et al., 2024; Darc Piculo dos Santos et al., 2020). There is a need for more qualitative, interpretive studies that consider how teachers imagine, navigate, and react to the complex issue of implementing HADs in their classrooms. This research fills that gap by embarking on a phenomenological approach to gaining access to special education teachers' lived experiences in Malaysian inclusive classrooms, offering rich descriptions about the sociocultural, institutional, and pedagogical drivers informing HAD use.

Although many Western research studies have looked at determinants of assistive technology use for hearing (Masuku et al., 2024; Knoors & Marschark, 2014), comparatively few have conducted so in Southeast Asia, where cultural, infrastructure, and policy environments vary greatly. For example, in Indonesia, Prana et al. (2023) found in their study that teachers are not regularly trained to handle assistive technologies since professional development programs are not common and inclusive policies are weakly implemented. And, in the Philippines, Campado et al. (2023) found in their study that despite urban schools having available assistive devices,

most rural communities experienced device underutilization due to less frequent maintenance and poor support from teachers.

These results underscore the geographic data deficit on how national education systems facilitate (or limit) the use of HADs, especially for inclusive education systems. In contrast to nations such as Malaysia, for instance, where inclusive education has been institutionalized through the Malaysia Education Blueprint and the Special Education Integrated Program, there is less research that has centrally addressed teacher attitudes and classroom-level processes in terms of HADs. Thus, this study makes not only national contributions but also produces worthwhile input to the general Southeast Asian region, where common issues like infrastructural imbalance, teacher preparedness, and disability cultural orientations are present.

Theoretical And Conceptual Framework

The adoption and continued utilization of Hearing Assistive Devices (HADs) in special education are multi-faceted processes influenced by a variety of psychosocial, technological, and contextual factors. In offering an explanatory understanding of such processes, this research relies on three concurrent theoretical models: (i) Bronfenbrenner's Ecological Systems Theory (1979), (ii) Davis's Technology Acceptance Model (TAM) (1989), and (iii) Bandura's Social Learning Theory (1977). These models all together guide the study design, inform data interpretation, and uphold the conceptual model developed for this study.

This conceptual model Figure 1) illustrates multiple levels of interaction between the teacher, student, and systemic determinants in adopting and utilizing Hearing Assistive Devices in an inclusive classroom. The model is based on Bronfenbrenner's Ecological Systems Theory, Technology Acceptance Model (TAM), and Bandura's Social Learning Theory. Important determinants of HAD adoption and effect can be reflected at all levels, from the macro policy structure level to the classroom level of teacher modelling.

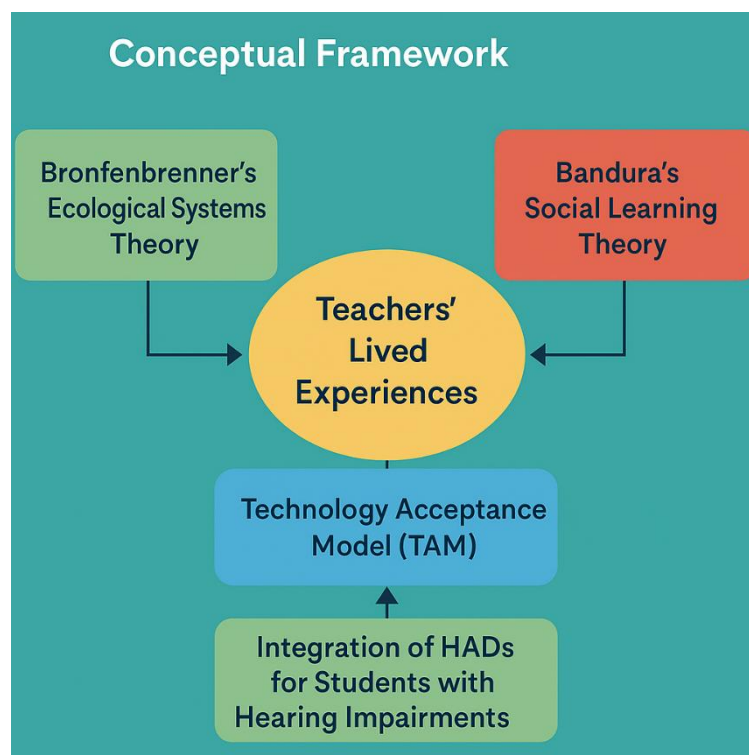


Figure 1: Conceptual Framework

Source: (Author's Work)

Bronfenbrenner's Ecological Systems Theory

Bronfenbrenner's theory provides a multilevel explanation for how a student's behaviour, i.e., HAD use, is influenced by nested systems in the environment. The microsystem (teacher-student relations), for example, has a direct effect on comfort and willingness to utilize HADs in class. The mesosystem, or the school-family interaction (e.g., parent-teacher partnership), also has a significant impact on facilitating or disrupting the implementation of HADs. School policy and administrative backing at the ecosystem level influence the availability and maintenance of HADs, and macrosystem is the societal orientation, educational policies, and norms of integrating people with disabilities. During the first study, the ecological model was used to guide interview question development across school support, family involvement, and peer influence. It was used to structure thematic analysis such that findings could be coded at multiple environmental levels.

"The behaviour and development of learners with disabilities are not merely individual matters but are embedded within and shaped by systems of support and interaction." Bronfenbrenner (1979)

Technology Acceptance Model (TAM)

Davis's TAM is used to explain teachers' propensity to use and disseminate HADs in the classroom based on a cognitive and behaviour-based framework. Two explanatory variables predicting technology acceptance identified by TAM are Perceived Usefulness (PU) and Perceived Ease of Use (PEOU).

- a. *Perceived Usefulness* refers to the degree to which teachers believe that HADs enhance learning and communication.
- b. *Perceived Ease of Use* pertains to how effortless teachers feel it is to integrate and manage HADs during instruction.

This model guided the development of interview questions about teachers' technology self-confidence, training, and inclination to modify lesson plans to incorporate HADs. TAM constructs were utilized in explaining technology integration teacher behaviour and inferring systemic enablers or constraints while analysing data.

“Even the best tools fail if users perceive them as difficult to use or unhelpful in achieving instructional goals.” Davis (1989)

Bandura's Social Learning Theory

Bandura's theory offers a behavioural aspect of the learning process by observation and imitation. Teachers in this study are social models for HAD-using students. If teachers model positive use of HADs, e.g., checking devices, reminding them to use them, or presenting them as usual pieces of learning activities, the student will most likely imitate this act.

This is one theory that is central to explaining student reticence because it emphasizes the significance of social cues and vicarious reinforcement in influencing the confidence of students. In this study, the model is employed to explore the impact of class behaviour on peer acceptance of, and attitudes towards, assistive technology.

“Observational learning is a key driver of behaviour adoption in classroom contexts.” Bandura (1977).

Integrated Conceptual Model of Teacher-Student Technology Interaction

Building upon the above theoretical foundations, the study proposes an integrated conceptual model that illustrates how teacher-related, student-related, and environmental factors interact to influence the use of HADs in inclusive classrooms.

Methodology

Research Design

In this research, a qualitative case study was used to investigate special education teachers' perspectives regarding how factors contribute to the use of Hearing Assistive Devices (HADs) among hearing-impaired students. A qualitative approach was considered suitable to enable a thorough, contextualized, and in-depth examination of teachers' day-to-day experiences, pedagogical practice, and assumptions (Creswell & Poth, 2018).

Participants and Sampling

A purposive sampling approach was used to recruit participants who possessed pre-stipulated inclusion criteria: (i) five years or more experience in the instruction of special education classes, and (ii) prior direct instructional experience with students who had utilized HADs. Three participants were recruited from different school settings in Malaysia. Even though the sample size is limited, it conforms to qualitative phenomenological research norms, which emphasize depth over breadth (Smith, Flowers, & Larkin, 2009). The research was able to attain data saturation, where no more information or themes were produced after three interviews, hence vindicating the appropriateness of the sample size (Guest, Bunce, & Johnson, 2006).

While the sample comprised three participants, this is consistent with established norms in phenomenological inquiry, where the objective is depth rather than breadth (Smith et al., 2009). The aim is not statistical generalizability but *analytical transferability* (Lincoln & Guba, 1985), offering rich, situated understandings. Each teacher represented a distinct school context (urban, suburban, and rural), ensuring cross-setting representation within Malaysia's inclusive education landscape. Saturation was reached when no new themes emerged after the third interview, reinforcing the adequacy of the sample (Guest, Bunce & Johnson, 2006).

Data Collection Procedures

Data were gathered via semi-structured interviews, carried out on different online platforms such as Google Meet, WhatsApp voice call, and TikTok private messaging. The involvement of TikTok was necessitated by participants' demand for convenience and familiarity, especially under scheduling limitations. As unconventional as it is, conducting research via social media has gained widespread acceptance in qualitative research for contacting specialized groups and facilitating natural communication (Snelson, 2016; Manca, 2020). Interviews were between 15–25 minutes and tape-recorded after permission was granted. Transcripts were typed out verbatim and checked for consistency by the researcher.

Although the interviews were relatively brief, the conversational flexibility of platforms like WhatsApp and TikTok enabled teachers to respond in familiar, less formal contexts, increasing comfort and authenticity of responses (Snelson, 2016). Nonetheless, the brevity posed limitations in probing deeper affective narratives. To mitigate this, iterative follow-up questions and member checking were used. Future studies may benefit from in-person or asynchronous diary entries to deepen thematic density.

The brevity of interviews may have constrained depth, especially for nuanced emotional or policy-related insights. However, the recurrence of rich, layered descriptions across all three participants validated via triangulation and audit trails provided sufficient interpretive power to anchor thematic analysis within the study's conceptual framework.

Data Analysis: Thematic Analysis

Data were subjected to Braun and Clarke's (2006) six-stage thematic analysis process, which included:

- i. Familiarization with data (multiple readings of transcripts),
- ii. Generation of initial codes (e.g., "technical barriers," "teacher modelling," "student reluctance"),
- iii. Searching for themes (e.g., "pedagogical adaptation," "psychosocial discomfort"),
- iv. Reviewing themes,
- v. Defining and naming themes,
- vi. Producing the final report.

Four overarching themes were uncovered from the analysis:

- i Teachers' preparedness and HAD knowledge,
- ii. Perceived quality of HADs,
- iii. Emotional and social challenges with students,
- iv. Institutional and lesson planning support.

There was a trail of audit throughout the process, tracking coding choices and theme evolution.

Trustworthiness and Rigor

To substantiate the credibility and rigor of the findings, the study followed Lincoln and Guba's (1985) trustworthiness guidelines:

- i. Credibility: Member checking was enabled through prolonged engagement, and transcripts and interpretations were returned to participants to check and confirm.
- ii. Reliability: A method journal was maintained to note decisions, procedures, and alterations carried out during data collection and analysis.
- iii. Confirmability: The researcher peer debriefed with two qualitative researchers to avoid bias and ensure objectivity.
- iv. Transferability: A Rich description of teaching and education settings was conducted so that the other researchers could evaluate against their contexts.

These measures enhance the study's qualitative integrity and support its contribution to both research and practice in inclusive education.

Ethical Considerations

Ethical approval was obtained from the Universiti Sains Malaysia Human Research Ethics Committee (Reference: USM/JEPeM/2025-0421). All participants were informed of their rights, including voluntary withdrawal, anonymity, and data protection. Written consent was obtained, and pseudonyms were used to protect participant identities.

Findings

Thematic analysis of interview data revealed four main themes: (1) Teacher preparedness and knowledge, (2) Perceived effectiveness of HADs, (3) Student emotional and social factors, and (4) Institutional and pedagogical support. These themes are discussed below with illustrative quotes and interpreted in light of the study's theoretical framework and relevant literature.

Theme 1: Teacher Preparedness and Knowledge of HADs

All three subjects evidenced a good working knowledge of the range and uses of hearing assistive devices (HADs) such as BTE hearing aids, FM systems, and external microphones. Teachers were certain that such a working knowledge was acquired mainly via in-service training and hard work.

"I've been teaching special education for almost 10 years. I know how each device works. I always check with students whether they're comfortable with the settings." (Teacher 1)

"We're taught about the technical specs during workshops, but in practice, we often have to troubleshoot issues ourselves." (Teacher 2)

These results align with TAM's perceived ease of use construct; instructors who felt at ease with HADs tended to utilize them more in regular teaching (Davis, 1989). From Bronfenbrenner's microsystem viewpoint, direct interaction between teacher and student is of utmost importance; an experienced teacher can establish a facilitating context for the adoption of HADs (Bronfenbrenner, 1979).

This aligns with Bronfenbrenner's microsystem layer, where direct teacher–student dynamics shape engagement with assistive technology. Teachers' confidence enhanced student compliance, reinforcing Bandura's (1977) premise that modelling shapes learner behaviour. Yet, variation in institutional training suggests a weak mesosystemic link—limited reinforcement from teacher education programs or administrative support.

Theme 2: Perceived Effectiveness of HADs in Enhancing Learning

Teachers uniformly perceived HADs as beneficial in improving student communication, focus, and academic engagement.

"After using the device, one of my students became more active. He would ask questions and even help his peers." (Teacher 3)

"They participate more in group work and understand instructions better when their devices work well." (Teacher 2)

These observations resonate with findings from Knoors and Marschark (2014), who reported that HADs significantly enhance classroom comprehension and interaction. Moreover, the data support Bandura's social learning theory, whereby students become more communicative when observing positive reinforcement from peers and teachers.

Theme 3: Student Emotional and Social Challenges

Here, Bandura's theory extends beyond observational learning; emotional arousal and perceived social consequences (e.g., peer teasing) shaped students' decision to reject HADs. These findings highlight the role of vicarious reinforcement and the urgent need for inclusive peer modelling within the class to reduce stigma.

Consistently, the instructors viewed HADs as beneficial for aiding the students' communication, attentiveness, and academic participation.

"Some students say the sound is too sharp or robotic. One said, 'My friends laugh when they see it on my ear.'" (Teacher 1)

"It takes time. I need to convince them it's okay. For new users, it's very common for them to reject it initially." (Teacher 2)

These findings align with those of Knoors and Marschark (2014), who demonstrated that HADs contribute significantly to classroom understanding and class participation. Furthermore, the findings align with Bandura's social learning theory, which posits that students become more communicative when they witness positive responses from others and their teachers.

Theme 4: Institutional and Pedagogical Support

Ecosystem-level policy failure (e.g., slow repair cycles) echoes Bronfenbrenner's macrosystem. The lack of operationalisation of inclusive policy undermines both the mesosystem (school-home-audiologist collaboration) and microsystem (classroom implementation). Only where proactive teachers adapted lessons independently was the ecological support chain partially restored.

Instructional staff reported variable institutional support, such as delayed repairs, limited spare parts, and limited cooperation with audiologists.

"We inform the school when the device breaks, but it can take weeks to fix. There's a lot of red tape." (Teacher 1)

"I've adjusted my lesson plans. I use more visual materials and repeat instructions slowly." (Teacher 3)

This is indicative of systemic constraints at the ecosystem level, with administrative policy and bureaucratic delay hindering timely intervention (Abu Bakar & Nordin, 2024). Anticipatory lesson adaptation, by contrast, is equivalent to TAM's "perceived usefulness" and represents special education teachers' adaptive professionalism.

Cross-Case Analysis

Table 1: Cross-Case Matrix of Teacher Perceptions

Aspect	Teacher 1	Teacher 2	Teacher 3
Teaching Experience	10 years	7 years	10 years
Device Familiarity	High	Moderate	High
Barriers Noted	Peer stigma, delayed repairs	Discomfort, sound distortion	Emotional resistance, admin support gaps
Adaptive Teaching Strategies	Visuals, repeated instructions	Extra worksheets, proximity cues	Eye contact, flexible lesson planning
View on School Support	Delayed but responsive	Limited and inconsistent	Helpful but slow bureaucracy

Source: (Author's Work)

As shown in Table 1, each of the three teachers testified to the impact of HADs on student engagement in class but differed in their levels of preparedness and access to organizational resources. Comparing them is useful for pointing to the within-context similarity of deep themes, but also to show individual variation in teachers' coping with constraints.

Synthesis with Theoretical Framework

The findings are consistent with the use of Ecological Systems Theory to map environmental impacts on HAD use. Teacher behaviour at the micro-level, parent-school relations at the meso-level, and ego-level administrative support all contribute to shaping learner outcomes. Meanwhile, TAM explains differences in teacher adoption of HADs, while Bandura's theory situates learner uptake in terms of social reinforcement and class modelling. Together, these models underpin a systems-level description of how some learners thrive using HADs while others avoid them.

Discussion

The results reveal that although special education teachers in Malaysia possess strong HAD-related knowledge and demonstrate adaptive pedagogies, system, social, and emotional barriers continue to limit the maximum utilization in inclusive classrooms. The following discussion elaborates these themes in terms of the study's theoretical frameworks and the literature.

Ecological Systems Theory (Bronfenbrenner, 1979)

Outcomes support Bronfenbrenner's contention that student development is influenced by multiple levels of influence:

- i. Microsystem: Unmediated teacher-student interactions mattered most. Teachers who were HAD-literate built more trusting, technology-integrated learning environments.
- ii. Mesosystem: Breakdown in communication among parents, audiologists, and teachers hindered cooperative reinforcement of HAD use.
- iii. Ecosystem: Delay in response at the school level (e.g., device maintenance) mirrors structural inefficiencies.
- iv. Macrosystem: Cultural stigma against assistive devices mirrors wider social attitudes, constraining full inclusion.

This environmental evaluation highlights the need for system-level interventions, as opposed to classroom-based attempts.

Technology Acceptance Model (Davis, 1989)

TAM shows why those teachers who possessed a belief that HADs would be useful and easy to use were more likely to make them function. Teachers with high PU transformed teaching and actively facilitated the use of devices. Teachers with low PEOU hesitated or got frustrated due to technical constraints or poor training. These findings confirm Davis's theory and indicate that special training could improve PU and PEOU, thus strengthening implementation fidelity.

Social Learning Theory (Bandura, 1977)

Bandura's model places student behaviour within social contexts. Within this research:

- i. Teachers demonstrated HAD-appropriate behaviour (device checking, the use of respectful language),
- ii. Students learned these habits with more confidence and peer contact,
- iii. Peer attitudes were also viewed as sometimes providing negative reinforcers (e.g., ostracism, teasing).

This implies that teacher modelling and peer norm-setting are essential determinants for optimizing students' comfort and normalisation of HAD use.

Synthesis with Literature

Table 2: These Findings Strongly Align with Global and Regional Research

Literature	Convergence
Knoors & Marschark (2014)	Confirmed the effectiveness of HADs for learning enhancement.
Darc Piculo dos Santos et al. (2020)	Echoed stigma and discomfort among student users.
Abu Bakar & Nordin (2024)	Supported the issue of administrative delays and lack of audiological support.
Jelas & Mohd Ali (2014)	Highlighted the gap between inclusive policies and classroom realities.

Source: (Author's Work)

Table 2 displays the integration of findings of this research with the available literature, showing complete agreement between participants' experiences and the available studies. Agreement with Knoors and Marschark (2014) verifies the proven effectiveness of Hearing

Assistive Devices (HADs) in supporting learning for hearing-impaired learners. Likewise, participants documented emotional and social challenges, stigma, and embarrassment, which agree with reports by Darc Piculo dos Santos et al. (2020), who had also documented the same challenges from learners using them.

Administrative inefficiencies and the absence of audiological aid, as identified by teachers in this study, mirror Abu Bakar & Nordin's (2024), referring to systemic issues like delayed servicing and inferior technical support. Finally, the tension between inclusive education policy and classroom practice, which participants in this study identified, is seconded by Jelas & Mohd Ali (2014), who documented a persistent gap between policy intentions and on-the-ground school realities in Malaysia.

This concordance emphasizes the wider applicability and implications of the research results in global as well as national environments of inclusive education and integration of assistive technology.

Practice and Policy Implications

i. Teacher Training

Opportunities for regular professional development in HAD technology should be provided to establish confidence and consistency of use.

ii. Inclusive School Culture

Peer education and stigma reduction interventions should be integrated within inclusive education programs that are school-wide.

iii. Multi-stakeholder Collaboration

Schools need to institutionalize partnerships with audiologists and parents to support a more active mesosystem of support.

iv. Systemic Reform

Administrative practice to repair and replace devices needs to be streamlined, not to be suffocating to learning.

Limitations

Although previous work has provided detailed data on teachers' attitudes to the effects of the use of Hearing Assistive Devices (HADs) within inclusive classrooms, several limitations need to be considered. The findings come from a small purposively sampled group of three teachers and, consequently, are limited in how far they can be generalized to the wider population of teachers. Although data saturation was established, larger and more diverse samples in size and across school types and geographical locations would provide maximum future insight.

Second, the research was based on self-report only through interviews and hence susceptible to social desirability bias or recall constraints. Observational data or triangulation with other parties (e.g., parents, students, audiologists) would increase credibility and richness of evidence.

Third, interview lengths were brief (15–25 minutes), partly because of remote communication limitations and platform tendencies (e.g., TikTok, WhatsApp). Although the electronic medium facilitated participant comfort and ease, it could have limited response richness and spontaneity. Longitudinal or mixed-method designs for future research could monitor change over time and cross-validate evolving themes. These constraints, albeit not reducing the basic

merit of the study, offer avenues for methodological improvement and adjustment in subsequent research.

Future research

Although this research does present useful information regarding teachers' attitudes for the utilization of Hearing Assistive Devices (HADs) within inclusive classrooms, some areas require further research. Firstly, future research could benefit from a greater sample size and diversity, with respondents from different types of schools (urban, rural, government, and private) to provide a more solid basis for result generalizability. Particularly, feedback from general education teachers, school administrators, and audiologists would give a more comprehensive picture of the environment facilitating HAD adoption.

Second, longitudinal designs may study how attitudes and practices related to HADs change as a function of time, particularly in reaction to intensive interventions such as professional development or policy reform. This would yield evidence of the long-term effects of training and support systems on continued device use.

Third, the need is to examine students lived experiences firsthand, particularly from the perspectives of those who utilize HADs in general classrooms. The perspectives of these participants would more clearly shed light on psychosocial variables like stigma, peer interaction, and self-efficacy that could impact device use aside from technical problems.

Additionally, quantitative research using survey tools may accompany qualitative findings by calculating the prevalence of individual barriers and enablers in larger populations. Lastly, research may explore the application of emerging assistive technologies, including AI-driven captioning software or classroom sound-field systems, to determine their ease of use and effectiveness when combined with conventional HADs. Such guidelines would help in bridging existing gaps in knowledge and inform evidence-based improvements in inclusive educational practice among hearing-impaired students.

Conclusion

This research has shed light on the complex dynamics underlying special education teachers' use of Hearing Assistive Devices (HADs) in inclusive classrooms. Through qualitative thematic analysis of interviews with three practicing teachers, the research established four main themes: (1) teacher readiness and information, (2) perceived HAD effectiveness, (3) emotional and social student factors, and (4) pedagogical and institutional support.

Findings indicate that, in general, teachers are favourable toward the implementation of HAD and exhibit superior adaptive behaviours but are frequently blocked from so doing by bureaucratic inefficiencies, student social stigma, and absence of formal support from administrators and specialists. The research further finds that there is a requirement for coordinated ecosystem-level interventions to enhance the implementation of assistive technology in inclusive settings.

Applying Bronfenbrenner's Ecological Systems Theory, Davis's Technology Acceptance Model (TAM), and Bandura's Social Learning Theory as the analytical framework, this study presents an integrative model to articulate how individual, interpersonal, and institutional levels intersect to define inclusive pedagogical practices with HADs.

Theoretical Contributions

This work contributes to the body of literature by combining three major theories, ecological, technological, and behavioural, into a single model capturing the complexity of HAD use in inclusive classrooms. This combined framework can inform future research and be used as a theoretical foundation for intervention development.

Practical Implications

Special Education Policy Implications

- i. Policy Priority: Policymakers have a similarly critical priority responsibility to ensure the maintenance, updating, and accessibility of HADs as part of national inclusive education policies.
- ii. Funding Mechanisms: Dedicated budgets for assistive technology support, such as partnerships with audiologists and device replacement, need to be institutionalized.
- iii. Accountability Criteria: Schools need to be held accountable for technical troubleshooting of HAD issues on time through audit trails and outcome reporting.

Teacher Practice Implications

- i. Inclusive Lesson Planning: Teachers should be enabled to include HAD-responsive practices in daily planning, e.g., through multimodal teaching, more visual scaffolding, and explicit interaction protocols.
- ii. Student-Centered Communication: Teachers should create psychologically safe spaces for students to communicate freely, and HAD use becomes the standard.
- iii. Peer Mediation Programs: Inclusive classrooms need to adopt formal peer education modules that focus on empathy and de-stigmatization of assistive device use.

Teacher Training and CPD Implications

- Use of Assistive Technology and Troubleshooting Modules: "Assistive technologies for HADs" would be part of training in pre-service and in-service training schools, with modules to be released to the teachers.
- ii. Simulation-Based CPD: CPD should be in an interactive manner through role-playing and simulation to boost teachers' preparedness for actual classroom scenarios outside the classroom with HADs.
 - iii. Collaborative Learning Communities: CPD interventions must be situated in Professional Learning Communities (PLCs) where teachers can learn from one another, discuss difficulties, and HAD best practices.

Research Implications and Future Directions

The following should be considered in future research to further utilize the qualitative depth and qualitative breadth of findings:

Mixed-Methods Research: Include both quantitative and qualitative methods to triangulate teacher attitude with student performance metrics and device logs.

- ii. Intervention-Based Design: Pilot specific interventions (e.g., CPD modules, peer sensitization programs) that are designed to enhance HAD uptake and minimize social resistance.
- iii. Longitudinal Studies: Study the long-term impact of HAD use on academic achievement, socio-emotional growth, and school engagement across several school years.

iv. Stakeholder Diversity: Future research would benefit from incorporating the perspectives of students, parents, audiologists, and school administrators so that a 360-degree view of the ecosystem is captured.

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Appendix: Interview Summaries

Participant 1 – Teacher Sarra

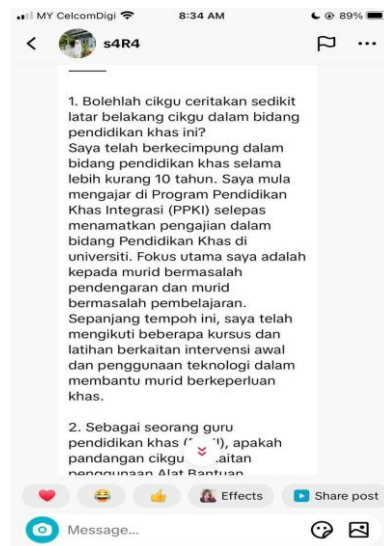
Position: Special Education Teacher (Hearing and Learning Disabilities)

School: Integrated Secondary School, Selangor

Interview Date: 15 April 2025

Platform: TikTok private messaging (online)

Experience: 10 years in special education



Participant 2 – Teacher Hazim

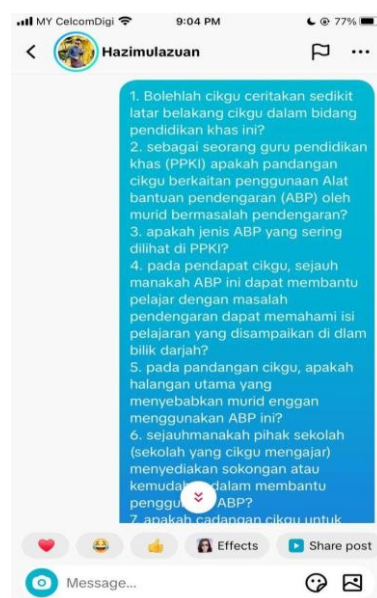
Position: Special Education Teacher (Hearing Impairment)

School Location: Rawang

Interview Date: 19 April 2025

Platform: Google Meet (online)

Experience: 7 years in hearing impairment education



Participant 3 – Teacher Hifzan

Position: Special Education Teacher (Hearing Impairment)

School: Secondary School, Kelantan

Interview Date: 18 April 2025

Platform: Phone call (online)

Experience: 10 years in hearing impairment education

