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Deaf and Hard of Hearing Students' Perceptions of the Flipped Classroom Strategy in an Undergraduate Education Course

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Abstract: This study aims to evaluate the academic outcomes of the flipped classroom approach in the teaching of students who are deaf or hard of hearing (DHH). Furthermore, it aims to activate the role of the teacher through encouraging both teachers and students to engage in active learning styles, while acknowledging individual differences. Participants consisted of 15 female undergraduates with hearing disabilities in a 251 CI course (applications of ICT in teaching and learning) at the College of Education, King Saud University. The study was applied throughout a semester on the contents of the course. The content material and pre-class assigned work (e.g. instructional videos and tasks) were delivered through Blackboard (learning management system), while active learning activities were carried out in class. Using mixed methods, students' perceptions of their new learning environment were explored through a post-term questionnaire distributed at the end of the semester, in addition to writing a reflective report. Furthermore, participants were requested to write a reflective journal at the end of each lecture. Results indicated the effectiveness of the flipped classroom strategy for students. Moreover, the data indicate a positive impact on students' content learning and improved skills (e.g. collaboration and interaction). The content material which was developed for the specific course (251 CI) could be utilized for the remaining students enrolled in this course. The researcher recommends using the flipped classroom teaching strategy for courses in higher education, as the methodology can be extended and implemented through following a similar framework applied in this study.

Keywords: *Flipped classroom, technology integration, active learning, special education needs, DHH.*

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Introduction

The interest in flipped classroom approaches has risen exponentially in the past decade as educators are constantly exploring new strategies and learning styles to improve learning experiences and engage students in the classroom. Ample academic research has been conducted in recent years to evaluate the efficacy of blended learning styles and, more specifically, the flipped classroom approach (Bormann, 2014; Mehring & Leis, 2017; Zainuddin & Halili, 2016), but despite this there has been a lack of sufficient studies conducted in the Arab world context (Alzain, 2015).

The 'flipped' or 'inverted' classroom strategy moves the traditional lecture out of class time through the use of computer and web-based technologies (e.g. video-recorded lectures available online or on CD/DVD) to teach learners the key concepts of a particular topic in advance as homework. These lectures are replaced in class by a set of interactive problem-solving activities designed to induce active learning thereby prompting students to apply and further comprehend the learned concepts. The philosophy in the flipped classroom teaching methodology is that it enables the instructor to teach both content material and the process in which to practice such content (Findlay-Thompson & Mombourquette, 2014). This resonates with the two basic procedures in the learning process: first, the transfer of information and, second, making sense of that information by connecting it to personal experiences and organizing the information in the learner's intellect (Demski, 2013). The flipped classroom strategy employs both processes by teaching the content material prior to the classroom interaction while providing in-class practice through creating a collaborative learning environment, thereby meeting these two learning objectives.

The teaching model in this unique approach is considered effective since the traditional information-transmission instruction element (i.e. face-to-face lecture) is replaced by pre-class online self-paced lecture recordings. The effectiveness is based on sound theory and evidence due to the refocus from traditional in-class lecture instruction to more interactive collaborative classroom tasks. Lectures are used to transmit information while excluding practice and

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subsequently not viewed as very effective methods for teaching skills or personal development (Bligh, 2000). In fact, self-paced preparatory work is seen to manage the working memory more efficiently than traditional lectures (Clark, Nguyen, & Sweller, 2005). Furthermore, students subject to controlling learning environments in the traditional lecture-style teaching methodology lack the sense of autonomy and have been found to learn less effectively due to the passive, transmissive experience (Abeysekera & Dawson, 2015). On the other hand, the flipped classroom learning style enables the practitioner to teach content pre-class while providing adequate in-class active learning processes.

However, the success of the flipped classroom approach is dependent on student pre-class preparation. This entails an additional load on teachers, who need to check whether students have prepared sufficiently for the in-class tasks. Furthermore, Tucker (2012) reported that teachers agreed that viewing the lectures pre-class was not enough for the success of the model, but required the integration of the instructional videos with an overall approach which would induce the required learning outcomes. For this purpose, there is a crucial need to train practitioners in the pedagogy and software required to properly effect this strategy. Finally, students should be prepared for this transformation and guided to accept responsibility for self-directed learning in the new learning style.

The Problem

A challenging situation arises in the teaching of DHH students in King Saud University which requires special considerations to overcome complexities. This particular group present special educational needs which necessitate providing a sign language interpreter who directly translates during the lecture. However, several obstacles confront the instructor in this setting. For instance, the interpreter occasionally misunderstands the scientific terms introduced in the lecture and accordingly provides inaccurate translations. The interpreter may also frequently interrupt the lecturer during class sessions in order to ask for further explanations of a term or subtopic. These interruptions distract the lecturer and his/her sequence of ideas which, in turn, wastes lecture time. Furthermore, the interpreter cannot translate some terms in one word and subsequently consumes lecture time in order to clarify a term. As a result, the course material for students enrolled in this course is reduced. Moreover, the lecturer is not able to effect discussions or proper assessment and feedback during lecture time due to schedule limitations. Another evident difficultly in teaching DHH students is the individual differences among the students, which vary immensely (i.e. various degrees of hearing level and different categories of deafness). Finally, the lecture strategy is still used to teach the course despite the negative impacts of this strategy, and its inappropriateness for students in this electronic era. This problem, highlighted by Peng and Daud (2015a), is that teaching DHH students is associated with "specific learning environment, learning methods and learning tools that are less effective in enhancing their understanding" (p.3).

This study aims to overcome such problems through applying the flipped classroom teaching methodology while at the same time improving the learning quality for DHH students. Consequently, the research aims to explore the impact of this strategy in the teaching of DHH students.

Significance of the Study

This study has made several contributions to the field of teaching DHH students with the use of technology-aided tools which have been advocated by numerous researchers in the teaching of disabled students (Mazlan, 2011; Mich, Pianta, & Mana, 2013). The contributions of this study are presented as follows:

- It assists DHH students' instructors to apply this strategy in their teaching through presenting a framework.
- It highlights the advantages of applying this strategy with DHH students.
- It assists lecturers to resolve obstacles discussed earlier in the teaching of DHH students.

Research Questions

A local intervention was implemented to understand the efficacy of the flipped classroom approach with deaf and hard of hearing students in order to extract students' learning perceptions and experiences. The main question addressed in this study is: What are the impacts of applying the flipped classroom strategy with deaf and hard of hearing students? This question is divided into the following questions:

1. What are the perceptions of deaf and hard of hearing students towards the flipped classroom strategy?
2. What are the difficulties, if any, of applying this strategy with DHH students?
3. What are perceptions of these students of the benefits, if any, of applying this strategy?

The Objectives of the Study

- To create an active learning environment for both student and teachers, and increase the role of students in the classroom;
- To improve the quality of lecture time through activating discussion and engaging students in collaborative activities, in addition to providing immediate feedback to students during the lecture;
- To take into consideration individual differences since each student learns in his/her own pace.
- To ensure that the DHH students share a similar course syllabus with their peers.

Literature Review

Teaching DHH Students

Students with hearing disabilities are generally classified as visual learners with similar learning needs to students in mainstream education. They are categorized with special educational needs in terms of their disabilities since some learning methods or tools are less effective in enhancing their understanding. Hearing impaired students possess a natural orientation to process information through visuals, which necessitates the use of visual material in instruction, such as illustrating abstract concepts through a realistic visual display. Furthermore, DHH students' communication specificities require using sign language as a primary form of communication, in addition to lip reading, body gestures and facial expressions, which necessitates teaching them through the use of speech and gesture simultaneously. Other communication strategies that can be used to facilitate small group work or discussions with DHH students include gestures, writing on paper, and texting with phone applications with or without voice recognition. Despite this, in a recent study which investigated the perceptions of DHH individuals' need for communicating with hearing individuals, participants expressed their dissatisfaction with current strategies and technologies (Elliot, Stinson, Mallory, Easton, & Huenerfauth, 2016). In this regard, the study reported that technology-based strategies, such as texting or automatic speech recognition software, were preferred since these facilitated better communication.

There is evident need for technologies and strategies to facilitate communication, while 21st century educators require specific knowledge and skills to integrate ICT effectively in the classroom. Several studies have shown that ICT should be considered to support hearing impaired pupils' learning (Mazlan, 2011; Mich, Pianta, & Mana, 2013); however it remains under-utilized among educators (Chong & Shaffe, 2015). The success of any technological initiatives depends mainly on the teacher's knowledge and digital skills to utilize them in meaningful ways. Previously, educators were unsure of the digital technology and the pedagogy by which to insert it into the curriculum since there was no set framework for technology integration. For this purpose, a theoretical framework was conceptualized to integrate technology, pedagogy and content knowledge known as (TPACK) which provides a model to guide teachers in planning and directing technology-driven instruction (Chong & Shaffe, 2015). Peng and Daud (2015a) discuss the significance of TPACK in special education and, more specifically, with hearing impaired individuals and argue its significance in providing benefits to prepare them for transitional needs.

Teaching with Technology

With advances in 21st century technology, it is important to integrate Information Communication Technology (ICT) in education settings to improve the quality of instruction. The integration of technology in educational contexts helps students participate more effectively, establish independence in their learning environments, accomplish difficult academic tasks and overcome challenges. Thus, there is evident need to update educational programs with digital tools for learners with or without disabilities to improve the quality of instruction, but more specifically in special education programs. In fact, adopting the appropriate technology for students with disabilities would consume less time and effort since it would grant them access to information to successfully engage as learner, while ignoring these tools could prevent them from enhancing their performance (Alnahdi, 2014). Furthermore, the focus on the instructor as the main provider of knowledge in the conventional lecture style of learning has become irrelevant in this digital era (Wang & Heffernan, 2010).

There are two types of technology used in the field of special education. One is assistive technology (AT) that helps students with their physical needs, such as hearing aids, note-takers, real-time captioning, and FM systems (Altan, 2013). Assistive technology is defined as any item or equipment or product acquired commercially and customized for the use of individuals with disabilities (Beard, Carpenter, & Johnston, 2010). The other type is instructional technology (IT) which assists students with their instructional needs. This applies to a host of teaching strategies using technology media such as videos, presentations, simulations, project-based learning, peer assisted learning, higher level discussions and collaborative activities (Peng & Daud, 2015b). Technological instruction enables immediate feedback, independent lessons and instruction, self-pacing and chances to review information independently through a medium. Effecting these strategies for each student would be difficult without using digital technology. However, as stated by Boone and Higgins (2007, p. 138), "Mere access to the content is inadequate as an assistive technology unless that access is mediated by instructional design supports appropriate for the specific disability of the user". Furthermore, Alnahdi (2014) stated it is more practical to search existing technology to find useful devices or software than to focus on finding a technology designed specifically for learners with disabilities fitting their needs and prior skills. There may need to be minor adjustments to available technologies to fulfill students' needs (Beard, Carpenter, & Johnston, 2010). Wehmeyer, Palmer, Smith, Davies and Stock (2008) refer to a technological system for guiding educational practice that supports all students with or without disabilities, which he calls the Universal Design for Learning (UDL). Such a system should (a) be flexible in the presentation of information, ways to engage students, and demonstration of knowledge and skills by respondents, and (b) reduce barriers in instruction and support learners to access the content while maintaining high achievement expectations (Higher Education Opportunity Act, 2008).

People who are deaf or hard of hearing are provided with sign language interpreting or live-captioning services. The sign language or text version of the information aids learners in educational contexts. The lack of direct access is the

main problem for deaf individuals. A suggested number of technologies which could assist students with disabilities in their learning include word processors which, when integrated with speech synthesis, are useful in enhancing students' written language production (Brown, 1987). A student with learning disabilities uses software tools to enhance and support their reading, writing and study skills while speech recognition software which converts audio input into text makes spoken content accessible for people who are DHH (Elliot, Stinson, Mallory, Easton, & Huenerfauth, 2016). Other examples include highlights or zooming functions in texts or icons or complete websites. Furthermore, deaf students also use chat and email applications to participate in the internet community (Alnahdi, 2014). Garberoglio, Dickson, Cawthon and Bond (2015) demonstrated that deaf individuals who email, chat and text gained higher reading and language comprehension skills. Moreover, a student who cannot speak can use a computer-based communication device to participate in class discussions. The benefit of real-time captioning of classroom lectures using Automatic Speech Recognition (ASR) software holds promise as an effective technological solution for making spoken content accessible to facilitate communication, even though this technology is still imperfect for transcribing Arabic text.

In related studies in this field, Anderson, Quinn and Horney (1996) carried out a study on computer-based strategies for students with disabilities, and reported that the students improved their academic achievement when their learning was integrated with technology-supported concept mapping strategies. Additionally, McInerney, Riley and Osher (1999) reported on projects that were conducted on hearing impaired individuals and concluded that supportive captions and text highlighting software technologies led to academic gains. Another research study concluded that exposing students with intellectual disabilities to flexible technologies increased their interaction skills, advanced their strengths and compensated for their weaknesses (Wehmeyer, Palmer, Smith, Davies, & Stock, 2008).

The Flipped Classroom Strategy

Active learning styles are advocated and considered a remedy for passive learning approaches, such as traditional lectures, which may induce learning difficulties in undergraduate courses (Andrews, Leonard, Colgrove, & Kalinowski, 2011). In fact, active learning processes improve learning and have a positive impact on students due to apparent conscientiousness, concentration and the deep approach to learning (Andrews et al., 2011; Richardson, Abraham, & Bond, 2012). The flipped classroom learning environment enables students to actively engage in the learning process. Here the 'flipped' or 'inverted' classroom moves the traditional lecture out of class time through the use of computer and web-based technologies to teach learners the key concepts of a particular topic as assigned homework. These lectures are replaced in class by a set of interactive problem-solving activities designed to induce active learning, requiring students to apply the knowledge learned. Furthermore, post-class work could be assigned as a means to reinforce and consolidate the knowledge acquired. The flipped classroom environment is characterized by the following:

- Lecture-style learning moved out of the class, presented in advance as assigned homework
- Practice of concepts provided inside the classroom
- In-class activities emphasizing active learning, peer learning and problem solving
- Technology as a key component to present lecture material outside the classroom setting
- Students required to complete pre- and/or post-class activities.

In the process, students are immersed in basic content material (pre-class), sufficient practice of material (in class), and after class home learning tasks which consolidate the knowledge learned.

The flipped classroom approach of moving transmissive teaching out of the classroom is seen to allow better management of the cognitive load due to the self-paced elements as students are able to manipulate the pace of those videos (fast-forward or repeat videos) to better manage their working memory. Furthermore, Abeysekera and Dawson (2015) argue that this teaching approach improves student motivation and aids in managing the cognitive load. Motivation is crucial for progress in the process and is defined as the self-determined will and enthusiasm to learn, which would influence learners' focus and level of effort in an educational activity (Cole, Field, & Harris, 2004). The flipped classroom's success depends on students' motivation to undertake expected pre-class work, therefore students need incentives to watch the lectures at home, as with any other homework assignment. Moreover, the basic cognitive needs addressed in the flipped classroom strategy are: the need for autonomy, competence to master the required knowledge and skills, and a sense of relatedness to social contexts (Pintrich, 2003). The learning environment created within the flipped classroom active learning approach is considered to satisfy students' need for autonomy and relatedness as well as to induce higher levels of motivation. Furthermore, engaging students in activities is essential through providing positive, work-related activities which induce an active state of mind accompanied with dedication and absorption while participating in the learning community. Higher education learning environments require similar substantial out-of-class efforts of 10-12 hours of work per subject per week, in addition to student engagement displayed through active participation in his or her learning community, which conforms to the flipped classroom approach.

A flipped classroom can also better accommodate a mixed class of experts and beginners since the teacher is able to better tailor online and face-to-face activities to actual individual needs through carefully designing pre-class work and providing multiple versions of material to serve different levels. Furthermore, the availability of online shared

resources lessens the work load on the practitioner and allows the generation and flow of ideas and exchange which in return supports the learning process. Nevertheless, there is need to change media and pedagogy and add innovative elements to induce change, as the mere move from traditional lecture to presenting the same thing online would be most unlikely to result in learning differences. Other benefits which could be extracted from pre-class interactions are web-based questions or quizzes tailored to identify common areas of difficulty for students which could direct instruction to areas of student need and enable better in-class time management (Berrett, 2012). However, a significant fault in the approach is that not all students have access to the same technology, which would cause a digital divide in the use of this specific methodology (Frydenburg, 2012).

Tucker (2012) reported the first experience of the flipped classroom technique from two chemistry teachers who used it to reteach lessons to absent students through recording the lessons and posting them online. The results were unexpected as they found that the majority of the class viewed the recorded lectures as a means to review and reinforce classroom lessons. Harvard University's Professor Eric Mazur was one of the early adopters of this approach and emphasized students' engagement with the content material rather than their passive absorption of it (Demski, 2013). Strayer (2012) reported on the effectiveness of flipped classrooms at an HE institute through assessing students' perceptions of the learning environment (preferred and actual experience). Here students expressed their preference for a learning environment which combined innovation and cooperation. In another study, at Clintondale High School, Michigan, where more than half of freshmen students had failed English and the school administration had had to confront 736 discipline cases, the school converted to the flipped classroom strategy, which they considered would improve school performance and discipline. The results were that, a year after implementation, the proportion of failing students decreased in all subjects. The study concluded that the effectiveness of this approach was because it assisted educators to eliminate learning obstacles as well as giving them the opportunity to innovate and share resources (Alvarez, 2012). Alzain (2015) conducted a study which applied the flipped classroom strategy in the Department of Education in Prince Nourah University, KSA, and which monitored students' academic achievement while using a control group. The results indicated the effectiveness of the flipped learning strategy on the academic achievement of participating sections. Another research study implemented in King Saud University applied the flipped classroom approach and investigated students' academic achievement as well as satisfaction with their learning experiences in a section of the College of Education while remaining sections were taught through the traditional lecture style (Alsadoon, 2016). The results showed significant differences between the means of both groups with regard to students' achievement and satisfaction.

Methodology

This study used a mixed methods approach, incorporating both quantitative and qualitative methods. It will be addressed in the following sections.

The Context

King Saud University initiated a new program in 2011 in which they started accepting DHH and special need students in its undergraduate programs. Here students with special educational needs commence their studies through enrolling in the Qualifying Year Program for Deaf and Hard-of-Hearing Students preparatory year, which is basically a language development program to prepare for undergraduate study. Saudi Arabia is considered a pioneer in this initiative in the Middle East. After finishing preparatory year courses, these students can enter the college and course track of their choosing, in separate sections, in order to meet their special educational needs (KSU, 2018). There were 57 DHH students enrolled in King Saud University.

Participants

The study was carried out in the College of Education, King Saud University, as 49 students out of the 57 DHH students were enrolled in this particular college. In the semester the study was conducted, there was one section specified for DHH students in course 251 CI (ICT applications in learning and education), so all the 12 female DHH students registered in this course participated.

Table1: Sample Description.

Disability		**Specialists**	
Deaf students	3	Special Needs Education	11
Hard of hearing students	9	Art Education	1
Total	12	Total	12

Procedure

The researcher reviewed the basic course materials and designed additional source materials, based on the flipped classroom approach, to upload for pre-class assigned work. Afterwards, approval for the newly developed content was obtained from the course lecturer who reviewed and accepted the plan. The new learning approach was then introduced to students at the start of the semester and explained in detail in the first introductory lecture with the help

of the signing language translator who assisted the instructor in the course. In addition, the study was explained to them and a consent form explaining their rights obtained from all of them. They were free to write a reflective journal, a reflective report, or fill in the questionnaire. Furthermore, they were introduced to Blackboard, the learning management system, and instructed on how to view basic content material with related instructional videos and how to submit the assigned homework, in addition to basic instructions on the role and tasks expected of them.

Content material (e.g. video, PowerPoint presentation, or website) for each lecture was sent one week prior to the lecture through Blackboard. This also included assigned homework tasks and questions. The questions selected were designed to encourage further inquiry into the subject. At the beginning of each lecture, the pre-class assigned homework was reviewed while inquiries related to the content were discussed. After that, the planned in-class activities were implemented with the aim of reinforcing the course material. These were mainly active learning and collaborative activities which included cooperative learning, group discussions or designing of booklets or concept maps. The role of the instructor here was that of a facilitator who guides, provides feedback and motivates students to complete related activities. Finally, a general review of the material and associated activities was made at the end of the lecture. Students were then requested to write a reflective journal of the lecture in the remaining five minutes. The lecturer would review students' work to reflect on their progress and include feedback and clarifications in the following lecture. This process is summarized in Figure 1:

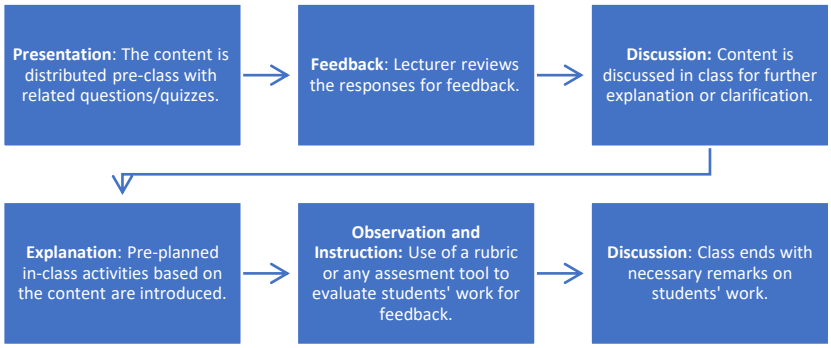

Figure 1: Framework for Applying Flipped Classroom Strategy.

Instruments

The study was carried out over one semester with one group of DHH students at KSU. A mixed methods approach was applied which included a weekly anonymous reflective journal. At the end of the semester, a reflective report was written and a questionnaire distributed in order to answer the research question: what are the impacts of applying the flipped classroom strategy with deaf and hard of hearing students?

Reflective Journal

The students were requested to write down any notes on their learning experiences and their opinion of this new learning style, along with any difficulties they faced, at the end of each lecture. They were also given the opportunity to ask any questions related to the content material whether for pre-class or in-class assignments.

Questionnaire

At the end of the semester, all 12 participating DHH students were requested to fill in a written questionnaire which elaborated on this new learning style. The questionnaire was constructed after reviewing the literature on the topic of the flipped classroom. It consisted of ten items aiming to elicit participants' attitudes toward the strategy, in addition to the difficulties encountered or benefits gained. Five-level Likert scale questions were used (strongly disagree, disagree, neither agree nor disagree, agree, strongly agree).

Reflective Report

Finally, participants were asked to reflect on their learning experiences and the course in general at the end of the semester. They were encouraged to make remarks on any difficulties or benefits encountered from this new strategy in their learning process.

Results and Findings

The Reflective Journal

The students were requested to write a reflective journal after each lecture. 78 journals were received from students which considered their new learning experiences of that specific semester. The reflective journals were analyzed qualitatively, and the themes that emerged were then grouped in categories as listed in Table 2.

Table 2: Themes emerging from reflective journals

Categories	Themes
Positive attitude	Enjoyable, clear, satisfying, beneficial, apply to other courses, liked the course, liked learning material and how it is presented, liked the strategy, hope to continue to study like this, excited.
Advantages	Active learner, engagement, students central, group work, discussion, motivate, help to understand, improving skills, use classroom time effectively, understand before the lecture, learn on their pace, clear, space for activity.
Disadvantages	
Comments	Introducing the strategy, sign language video.

Their writing revealed that the students held a positive attitude towards the strategy from the first lecture and described their learning as engaging and satisfying. They also expressed their wish to apply this strategy in their other courses. Furthermore, assessment marks and academic reports clearly displayed an improvement, which evidenced students' engagement in learning. Nevertheless, some comments in the journal expressed disappointment, as one student was not pleased with the translations (in sign language) provided in the recorded videos, stating that *"the video clip with sign language was not clear"*. On the other hand, other journals expressed satisfaction with the translation, clearly saying "*the sign language video was good*". These opposing opinions will be discussed later.

Furthermore, students recognized the advantages of the strategy as they reported that they *"became active and engaged in the lectures"*, and *"they like the group work and in-class discussions which motivated them to learn more"*. They also revealed that the strategy helped them to comprehend the material better. One participant reported that it improved her skills. Another student expressed that this strategy used classroom time more effectively. One student had requested further instructions on the new method at the beginning of the semester, but this request was not repeated, confirming that the guidelines were clear to all.

However, students in three out of the 78 journals expressed their preference for direct lecture instruction. The datasets do not show whether the reports were from the same student since the reflective journals were anonymous. Interestingly enough, the same three reports showed a positive attitude towards the course. For example, the student wrote *"the lecture today was nice and exciting while we discussed… I wish to have you (teacher) present with us next lecture."*

The Questionnaire

Participants reported that learning was pleasant and satisfying with this new strategy and that it should be applied in their remaining courses. Furthermore, they expressed the view that this modern and innovative strategy was significant in this electronic era. Moreover, the majority thought that, with this method, lecture time was used more efficiently since it included group discussions and varied activities.

The majority of participants (83%) appreciated the strategy which, they stated, *"improved their research skills as it encouraged them to read and find out more on vague information on new topics prior to attending the lecture"*. Moreover, the results show that 92% of the participants considered that this strategy assisted them to comprehend the subject in their own time (self-paced learning). However, some students (33%) were not sure whether the strategy had any drawbacks. One participant, for example, reported that she did not have time to absorb the material at home. This could be due to a lack of self-organization, which is not unusual with undergraduate students.

The Reflective Report

At the end of the semester, students were requested to write anonymous reflective reports. Unfortunately, only eight students from 12 responded and submitted their reports. The findings shown in Table 3 reveal that, concurring with the results above, students held a positive attitude towards learning through this strategy. The majority of participants expressed a preference for learning in this way. Nevertheless, one student disagreed and stated that *"I prefer the lecture with direct sign language interpretation"*; however, she then wrote that *"the course was clear and the activities were beneficial"*. Participants suggested applying the strategy for the remaining courses in the college. One student mentioned that *"it - the flipped classroom strategy - helped us to understand the material better… useful especially for disabled students".* On the other hand, no students reported any disadvantages or difficulties encountered with this strategy.

Table 3: Themes emerging from reflective reports

Categories	Themes
Positive attitude	Enjoyable, clear, satisfying, beneficial, apply for other courses, liked the course.
Advantages	Active learner, engagement, students central, group work, discussion, motivate, help to understand, improved skills, use classroom time effectively, understand before the lecture, learn on their pace, clear.
Disadvantages	
Comments	Introduction of the strategy, sign language video.

Furthermore, the results showed that students perceived that the new learning strategy made the course content enjoyable, satisfying, beneficial, and suitable for their learning situation. Learners also emphasized it helped them to understand the topics better and subsequently become more active during lecture time. The following are several quotes from the reflective report:

> *"I hope to study a course like this again."*
>
> *"The strategy was suitable and the lectures were enjoyable and satisfying."*
>
> *"I was excited to participate and felt I became very active in this course."*
>
> *"I couldn't miss any lecture because I am enjoying learning."*

All the participants reported that applying this strategy helped them improve their skills in areas such as collaboration and communication, and that doing internet research increased their independence and confidence to participate in class. As one student stated: *"I find that I developed my knowledge and skills"*. Another student reported: *"This course helped me to improve my skills"*.

Discussion and Conclusion

Discussion

The study findings answered the questions presented earlier. The main question was: What are the impacts of applying the flipped classroom strategy with deaf and hard of hearing students? This was then divided into three questions which will be discussed in the flowing sections.

The previous results convey the effectiveness of applying the flipped classroom strategy for DHH students. The research found that DHH students hold a positive attitude towards the flipped classroom strategy; therefore, their responses demonstrate acceptance and comprehension of the course material and support the idea of applying this strategy in other courses.

In line with previous studies, the DHH students confirmed the positive impact of this strategy on their learning because it motivated them to become active learners. Furthermore, they considered it a more student-centered learning style since they were constantly engaged in active learning and collaborative class activities, and beneficial lecture-related discussions. Consistent with a previous study (Wehmeyer, Palmer, Smith, Davies, & Stock, 2008), applying this strategy motivated students to learn and improve their skills. DHH students also appreciated this style since it assisted them to learn at their own pace and in their own time, in addition to taking into account their individual differences. This resonates with other research studies which mention that flipped classroom environments better accommodate individual differences between learners since online and face-to-face activities could be tailored to individual needs (Abeysekera & Dawson, 2015), in addition to self-paced elements which allow better management of the cognitive load (Pearson Education Inc., 2013; Bormann, 2014).

As mentioned above, this study provides further evidence for the advantages of the flipped classroom especially for DHH students, as summarized in Figure 2.

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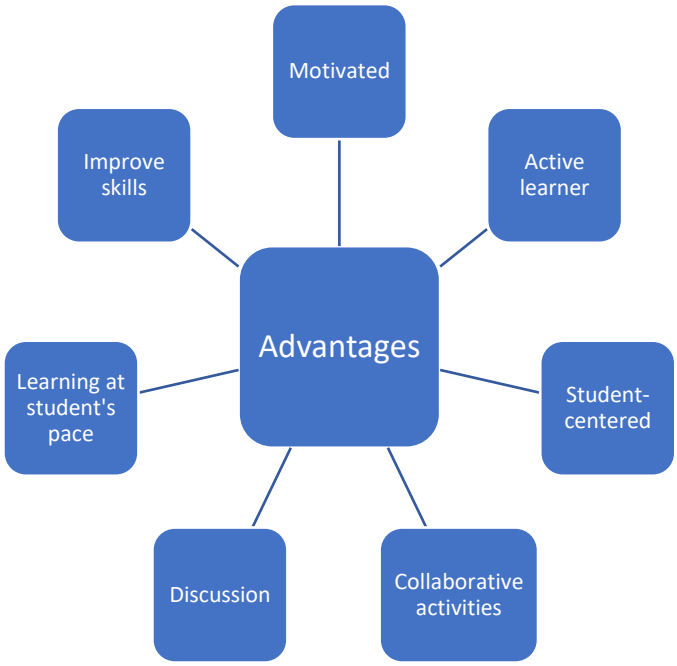

Figure 2: Flipped classroom advantages for DHH students

On the other hand, the disadvantages of such a strategy for DHH students remain unclear in this study since students expressed it implicitly a few times when asking to use the old way – direct lecture instruction with a sign language interpreter - without giving any clear explanation for their request. One explanation could be that, since this is their first experience of flipped learning, some learners who are used to traditional methods may resist the new procedures. Another possible reason is that students could not express their opinions and needs in writing. For this reason, emphasis should be placed on the proper presentation of the strategy in the first introductory lecture to prepare students for the transformation and to accept responsibility for their self-directed learning. Mull and Sitlington (2003) affirmed that training students on the procedures is essential and helps them increase their educational gains. Another explanation could be that the pre-class home assignments consume a lot of time in order to prepare for the coming lectures, which could result in some students rejecting the method. Therefore, instructors should be trained to create an integrated overall approach which properly balances content reading and instruction with collaborative activities in the learning process while taking students' commitment into consideration (Tucker, 2012).

Finally, as most of the learning materials are in written form, it will improve the writing/reading skills and understanding (Debevc, Milošević, & Kožuh, 2015) of DHH students.

Conclusion

This paper discussed the flipped classroom strategy applied with DHH students in King Saud University during one semester for the course 251 CI (Applications of ICT in teaching and learning). A framework was designed to guide instructors to implement this strategy in the course.

The results show the effectiveness of the flipped classroom strategy for the selected students. Students' responses reflected a positive attitude towards the strategy. The strategy had a positive impact on students' learning as it increased their motivation for learning and kept them engaged in active student-centered activities which developed their collaborative skills, in addition to developing their research and inquiry skills. These results are promising and suggest implementing this effective innovative pedagogical approach in diverse higher education contexts.

Recommendation and Limitations

The current study's results emphasize the usefulness of the flipped classroom strategy for all courses in higher education, on which all participants were agreed. The strategy could be implemented with other courses by following the framework and procedures applied in the study, and the content material which was designed for the specific course (251 CI) could be used with future students. Furthermore, the results show the importance of clearly explaining the strategy in the introductory lecture since this has a direct impact on the students' acceptance of the strategy and their motivation to commit to completing the assigned homework. Moreover, it is recommended to take note of students' inquiries on the strategy and resolve any discrepancies. Prioritizing feedback should also be a concern since it has a significant impact on students' motivation.

Some difficulties were faced in the recent study. A main difficulty which emerged was translation choices for DHH students since there is no reference or dictionary for sign language in Arabic and, consequently, meanings may differ from one individual to another. Unfortunately, students mostly depend on personal translations, as explained by Habib

Al-Habib, the administrative supervisor of the Higher Education Program for deaf and hard of hearing students at King Saud University. As a result, and after remarks and feedback from students, the researcher did not translate the whole content into sign language but substituted instructional videos that included visuals supported by written captions, which increased students' comprehension (Debevc, Milošević, & Kožuh, 2015). Moreover, it is evident that DHH students do not possess a rich vocabulary and, consequently, cannot understand new terms in technology or write in an established academic style in their reflective reports.

Hence, applying this new strategy to students who have been studying in a different way for more than nine years in their general school education introduces numerous complexities. Nevertheless, difficulties were reduced gradually from lecture to lecture. A main difficulty encountered was how to encourage students to view the content at home prior to attending lectures. One idea applied was to embed interesting activities in the assigned home material in order to motivate them. Thus, the instructor should consider assignments which should be motivating and engaging to students prior to distributing the material.

This section presents some possible applications of the current study. The study has gone some way towards enhancing our understanding of special needs students' perceptions of learning with this new strategy. It is also hoped that this study will make a valuable contribution towards reducing the difficulty of teaching DHH students. In our view these results represent an excellent initial step towards teaching special needs students with technology. One promising application of this study would be to encourage innovative strategies and techniques in teaching special needs students. The procedure in this study could be applied to other courses in higher education. Furthermore, this research could also support decision-makers because it highlights the difficulty of teaching DHH students and the need to support their instructors as well as the students themselves. Our research suggests that it is important for policy makers to improve the general education of special needs students, as closer inspection revealed that DHH students' reading/writing skills are weak. Also, the results underline the importance of reassessing the preparatory year for DHH students.

Finally, a number of potential limitations need to be considered in this work. First, the current study was limited by the sampling method, which was not random, as explained above. Another important limitation is a result of students' lack of reflective writing skills, as they had not previously written reflective reports. In addition, the data were all collected from the students' point of view, not the instructors'. As a result, future research should consider the instructors' point of view on applying the flipped classroom strategy with DHH students. In addition, it would be important for future research to investigate the impact of the flipped classroom strategy on DHH students' academic performance.

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