Flipped Learning in Computer Science for non-native English-speaking Students: Case Study

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1   INTRODUCTION

Flipped learning is a teaching approach that introduces learning material while students are at home and uses the classroom as an interactive environment for practicing skills and applying knowledge. Most courses using this technique follow a basic concept; web-based technologies outside the classroom; instructor-student interaction during class time. When designing such a course, it is particularly important to also take into consideration the teaching and learning environment and culture of the students. Flipped learning is not a fully grounded category in education literature and is just one type of blended learning; the area has been examined in several studies, but the methodology and its concept are not completely standardized [1, 2]. In this case study we review the application of this technique within a non-native English-speaking student group of Computer Science students and reflect on the effectiveness of the approach.

The flipped learning concept reached the Republic of Korea (RoK) over a decade ago because of challenges East Asian universities were facing: to enhance the quality of education, to keep up with international trends and to make education as cost-effective as possible [3]. Tham and Tham [4] reviewed blended learning practices, including flipped learning, in higher education across Asia and noted that whilst there are several challenges in introducing alternative teaching strategies in general, in Korea, there was considerable interest and approval for such a format. As a new, and in Western countries highly praised, methodology, it requires careful consideration and examination. Keeping in mind that Korean education methodology and students' school behavioural patterns are potentially different from Western higher-education systems [30], this paper compares the recommendations made and features considered ideal by the literature, to the reality of a flipped learning course delivered in the RoK while acknowledging that there is no absolute recipe to a successful flipped learning course. English comprehension of the material is also considered, in our assessment of the effectiveness of the teaching approach. Indeed, some literature proposes that Korean students in the flipped classroom environment are more involved in learning than their counterparts in the non-flipped classroom environments due to online pre-learning activities [29]. The case study presented in this paper is the first flipped learning course examined in such a setting, with similar courses being considered. Therefore, lessons learned from this case study will help in designing and implementing similar courses in the future. Similarly, it is important to note that this case study pre-dates the Covid19 global pandemic (taking place in the Summer of 2019), meaning that social distancing and other related concerns were not relevant during delivery. However,

knowing about the successes and challenges of such formats is of relevance to educators in more recent times, as we have become more reliant on blended/online teaching and learning.

2   DEFINITIONS AND METHODOLOGY

Although the concept of flipped learning is new to education in both practice and research [5], many definitions exist ranging in focus and context which are often criticized for being either overly specific or overly obscure [6]. In this paper we find it more effective to use the following definition. "*Flipped Learning is a pedagogical approach in which first contact with new concepts moves from the group learning space to the individual learning space in the form of structured activity, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter"* [31]. This definition is sufficient to ensure we do not limit the scope of the evaluation and to allow for a broadly scoped analysis of flipped learning in the context of our case study.

Flipped learning is also a form of blended learning, which encompasses a broader range of educational pedagogy [7]. Whilst blended learning means partial replacement of traditional face-to-face (F2F) teaching by a technology-based teaching medium, flipped learning does not necessarily require the involvement of technology in teaching, but it many cases the teaching material provided out of the classroom has a technology dimension such as the use of video, audio, digital material. [8].

When new or even well-researched concepts, are analysed for the first time in a new context, all existing research evaluation methodologies are useful. The best possible outcomes are obtained by using a combination of various methodologies [1]. This paper uses a case study to examine flipped learning in the context of teaching a module on cloud computing to students in a non-native English-speaking setting in RoK. Descriptive and comparative methods are also used to identify relevant similarities and differences between the non-flipped native English-speaking version of the course, along with a literature review and qualitative research. The analysis of the case study is based on a pre-session survey detecting previous international experiences and expectations; in class surveys on the quality of materials provided; and a post-session survey on the experiences of students; and an interview with the academic delivering the course.

3   RELATED LITERATURE AND CASE STUDIES

There are numerous case studies and guidelines on how to plan and execute a flipped learning course in the literature. Although the value of case studies as a research tool is limited, they still represent a way to share best practices. Most case studies published on flipped learning were implemented in the United States (for example [9, 10, 11, 12]). The literature suggests that a significantly smaller number of analysed flipped learning courses have been organized in Asian learning environments [13, 5, 14]. Consequently, case study focused research on flipped learning is dominated by student participants who were primarily native English-speakers. Flipped learning is traditionally popular for STEM subjects [5], with engineering being one of the most prominent disciplines, however some studies have been conducted in the social sciences (even in language education for non-native English speakers) [10]. Based on Zainuddin and Halili`s observation, most case studies report on undergraduate courses [2], with more recent examples including postgraduate settings [15]. These studies vary in scale ranging from small participation groups to large group [16]. Our literature search did not find any case-studies on intensive short courses (e.g. summer school or short-term deliveries), only full-term courses [9], including courses with two or three contact hours per week [10, 11].

Even though flipped learning does not exclusively use pre-recorded videos for introducing students to information before class, the literature suggests that they represent the most popular teaching format with other sources (guidelines, textbooks) playing a secondary role. Most authors agree that videos should not be longer than 10 minutes to focus attention [17, 18]. However, not all practitioners use self-prepared videos, instead citing existing open-source learning material [17, 5].

Teaching methodology in flipped classrooms is centred on interaction between the instructor and individual students or groups of students. Unlike traditional didactic lectures, in a flipped course, the instructor has more time to interact with students on an individual basis, answering questions and helping students resolve problems at their own pace. Such a structure provides an opportunity for using active learning techniques [9, 5]. The work of the instructor is usually supported by teaching assistants [11] and technical support [11, 10] provided by the hosting institution. The latter sometimes also includes post-production assistance in preparing videos.

Regardless of the teaching methodology used, the effective assessment of students remains challenging in any setting. While checking student knowledge of course material is primary in all teaching methods, flipped learning courses also provide an opportunity to monitor the students' effort and engagement with the learning process. Most flipped learning instructors use diverse methods to check whether students engaged with the materials provided before the class by using pop quizzes (usually a small portion of the final grade points) or even analysing the statistics of the video interaction or verifying student login history [13, 9, 5]. This practice encourages less motivated students' participation. Slomanson did not consider this check on student engagement necessary at first but will reconsider his decision for future deliveries [18]. The assessment of the knowledge gained in flipped classroom case studies is generally done using traditional methods, (i.e. examinations). The examined case studies worked with multiple choice questions (MCQs) [11], open-ended questions [10] and presentations [13].

Although flipped learning is considered to be an innovation in learning and teaching and the literature is broadly supportive and positive on its results, it cannot solve all problems in education.The general observations in terms of benefits for students include higher level of engagement, including attendance [5, 2]. The improvement of student performance is more difficult to judge for two reasons: first, not every case study could produce a valid comparison; second, not every study observed increases in grades. Jensen et al. [11] state that the performance increase in flipped learning classes is not due to the flipped nature, but the use of active learning strategies. So the benefits are attributed to the fact that students are able to cover material at their own pace [9] and that their learning is on a high level in the Bloom's taxonomy [17]. The literature also cites benefits for instructors. Although in practice the main fear of instructors is the increased workload, most case studies report greater impact with less time consumed. Hence flipped courses represent an opportunity to reach more students effectively without extra effort or time-input and without changing the actual course setting [18].

Previous studies of flipped learning have received a variety of feedback from students relating to how they felt about the class and new format of course content delivery. From student feedback, it is evident that some students have embraced the flipped learning concept. They noted the feeling that online resources helped them to increase their motivation for learning and to gain a better understanding, since the internet-based materials enabled them to interact with their peers and receive immediate notification of updates [19]. Students enjoyed not having the traditional lecture-based classes and come to enjoy the activities-based class time

[20]. Gilboy et al. found that approximately three-quarters of students (76\%) preferred watching a video lecture over a F2F lecture for the topic, and that a majority of students (64\%) would rather participate in in-class activities for 2 class periods rather than listen to the instructor lecture for the same amount of time [17]. These types of feedback have fostered the idea that flipped learning may be worth investigating for application in environments where student-centred learning is of utmost importance. Li et al [21] found that offering flexible blended deliveries are rated positively among students in a Hong Kong university, particularly when the quality of technologies was high, and the teaching was adapted to their needs, particularly when learning through a non-native language. Afitska, in a UK based study provides additional supporting evidence that scaffolding learning using a flipped classroom setting for non-native English speakers in science subjects allows students to focus on their knowledge and understanding of the material and overcoming the difficulties identified in linguistic challenges [32]. Lee & Wallace conducted research within a Korean university, where flipped classroom was used teaching English as a foreign language, reporting that students enjoyed the classroom setting with the instructor finding higher levels of student engagement [29]. Hsieh, further demonstrated the use of technology within a flipped classroom environment for teaching English as a non-native language not only enhanced the motivation of the students, but also resulted in significant improvement in their knowledge [33].

While we typically found positive comments within each study, there are also those for whom flipped learning is not embraced and who are critical of having to learn to adapt to this method instead of the traditional classroom lecture environment with which they are comfortable. These critical comments of flipped learning stem from a variety of student concerns. Student's whose university major or experience is not tied closely with computers and technology have expressed that they felt uncomfortable with software programs, slow Internet connections, and the lack of technological expertise [19]. Others have found that when the course content became difficult to comprehend, they had low motivation to do previews and felt pressure in the flipped classroom, where they were required to directly apply what was supposed to have been previewed. Other student criticisms of this pedagogical approach include not having the instructor available to ask questions during the out-of-class portion and the possibility that other students would not be prepared for the F2F active learning [17].

4   MOTIVATION FOR KOREAN CASE STUDY

The subject of the present research was a course taught at a top Korean university in June 2017, during its summer school program. The module was delivered using a flipped classroom learning approach in a compressed format of two weeks. The course was an intensive course (3 contact hours from Monday to Friday, for a total of 30 hours), taught in English focusing on Computer Engineering (Cloud Computing). The instructor was an invited lecturer from Ireland who facilitates an identical full semester course at his home university.

The specific research aims of the case study were to: -

1. Determine the strengths and the weakness of using a flipped classroom in a non-native English-speaking environment
2. Consider ways to improve the delivery approach when developing courses for partner universities who have traditionally non-native English speakers and non-native deliveries in English.

The demand for courses delivered by native English instructors in Asia in growing [22] and to support and fund partner institutes online, blended or flipped classroom deliveries are

being considered as a possible solution to reduce the travel time and cost associated with these deliveries.

5   BACKGROUND IN IRELAND

This case study provided an opportunity to determining how effective a flipped learning teaching approach would be in the context of a non-native English-speaking environment in South Korea specifically Kyungpook National University (KNU). Multiple deliveries of this module have already been delivered and developed in Ireland for a 3rd year Honours Degree Programme in Computer Science in the Technological University of Dublin. These earlier deliveries were for primarily native English speakers with a computer science or engineering background, although some visiting European Erasmus students from Germany, France and Finland were included in the cohort. The delivery method in Ireland differed in the amount of total elapsed time during the course delivery when compared to this case study. In Ireland the course was delivered in weekly sessions of two laboratory hours and one offline hour of pre-prepared video material over a thirteen-week semester.

6   DEVELOPMENT AND DELIVERY OF FLIPPED MODULE IN KOREA

In this section, we will discuss the delivery of the flipped module in detail. The case study methodology using is that of Yin [34] which has four stages.

1. Designing the case study (Section 5.1, 5.2).
2. Conducting the case study (Section 5.3, 5.4).
3. Analysing the case student evidence (Section 6).
4. Developing the conclusions, recommendations, and implications (Section 7).

6.1 Schedule, Recruitment and Student Cohort

In Korea, the delivery was compressed into ten daily sessions over a two-week period, with three-hour laboratory sessions followed by daily pre-prepared video sessions. The compressed nature of the Korean delivery was a function of the funding model available using a Summer School environment for the course delivery. The compressed delivery also helped evaluate one of the delivery options available in a remotely supported delivery.

Student recruitment for the case study was required given that the Summer School operates using a student opt-in approach, which means that students are not required to take the module. A series of lectures on the course content was given to the Engineering and Computer Science students in the Korean University and this was followed by the creation of an online video to advertise the course.

Initial limitations set were that the maximum class size would be constrained by the capacity of a single computer laboratory to ensure that the lecturer delivering the course would be always present. The expectation was that approximately twenty students could be accommodated. However only ten students registered. Of these students eight attended the first class and one of them dropped out after the first day. Despite the recruitment process explaining the contents and delivery method of the course, the students attending did not have equivalent coding experience to those taking the same course in Ireland. There were six male students and one female student in final attendance. Of these students, six students were from a Computer Science major with basic programming experience, and one student had no prior programming experience with a background in Material Science.

6.2 Virtual Learning Environment

A cloud-accessible Virtual Learning Environment (VLE) was developed to support the course delivery. The system was based on a hybrid architecture of commercial, public cloud computing services and a self-hosted virtualized environment. The goal of the solution was to enable the rapid provisioning of securely accessed private development environments for students and instructors without the requirement to install or maintain any special campus-local software or hardware.

An instructor could provide a whitelist of student credentials using an administration dashboard in advance of a course delivery and distribute these to students. The authentication service was implemented using commercial server-less functions and a key-value store.

Students could access the service using a browser-based user interface comprising a syntax-highlighting code editor, a file browser, and a terminal emulator. The corresponding back-end environment, allocated by user, was implemented as a set of managed virtualized Linux containers. Each isolated container environment maintained a file store and a development tool chain which were persisted across login sessions.

Code authored in the browser could be saved, executed, and debugged on the back-end host. Users could link their environments to external code repositories for accessing and sharing teaching and learning assets. In addition, a command-line shell allowed users secure, isolated access to their files and tools.

At the conclusion of a course delivery, students could export their files and the system could be torn down for re-provisioning for future class deliveries.

6.3 Course Materials and Teaching Methodology

The module title, which was the subject of the case study, was ``Cloud Computing Technologies" and was developed as a stand-alone Continuing Professional Development module validated by the Irish University prior to the delivery of the course in the Korean University. The validation of the course was to allow it to function as a registered module for Korean students who are not based in Ireland. Students must complete enough work to be awarded 5 European Credit Transfer System (ECTS) credits which is equivalent to 3 Korean credits. The Irish University awarded the credits, which are international credits transferable to the Korean students. The following is a summary of the learning outcomes of the module: -

- Build a basic cloud system.
- Demonstrate an understanding of the evolution of cloud computing technologies.
- Demonstrate a practical understanding of cloud computing technologies in the lab.
- Configure basic infrastructure components used with the cloud.
- Critically analyse different methods for implementing cloud solutions.

The module content was published online and provided the following teaching assets in a structured manner:

- Course summary of topics covered and details of each day's activities in advance.
- Structure of each day; including links to the following materials: -
  - o Video lectures for the daily lesson, to be watched in advance of the lesson. Each lecture was no more than twenty minutes in length and covered distinct individual topics grouped into coherent themes
  - o Online slides associated with each of the lectures

- o Links to online tutorials and reference material to assist with laboratory work
  - o Access to source code used as a starting point or solution to each assignment
  - o Details laboratory sheets with clearly marked assessment requirements
  - o Online assessment report for students to complete relating to the online video lectures watched
- Access to a pre-provisioned online virtual machine constructed specifically for this module.
- Links to source code repository for students' reference.
- A student survey to be completed at the end of the course.

All material was available online including links to other support technologies such as Google Slides, Google Forms, BitBucket Source code management, Videos hosted by HEANET in Ireland, and VMware virtual systems which were also hosted in Ireland.

Online interactive tutorials could be repeated by students and videos could be replayed to facilitate understanding of the material. The approach taken was that students would consume the online material and answer the online questionnaire and essay question on each topic each day. Queries would be dealt with in the laboratory, and feedback on these essays would be given individually or collectively as required. The laboratory sheets were a core component of the delivery as this is where the primary interaction with the lecturer occurred.

6.4 Student Assessment Method

Two types of assessment were used, formative and summative. There were three assessment points in the course:

1. Online lab reports completed daily and submitted each evening by the student. Each student was required to view a series of online videos on the subject matter and answer questions using an essay style response. These essays were graded, with generalised feedback given to the entire class on the overall submissions' standard, helping students understand how to increase their marks. In-lab worksheets were provided for in-class assessment, which were completed throughout the lab. Students were able to discuss issues and get feedback as they progressed through the lab sheet. Lab instructions were detailed and clearly showed the marking scheme for the work performed. Worksheets contributed to the overall assessment mark of the course. Each new worksheet would provide for increasingly more difficult challenges for the students, allowing them to build up confidence in easier sections early in the class, but challenging them near the end of the lab. As each day passed, students had access to solutions for previous labs, helping them review any areas they did not score well in. The assessments required students to demonstrate their work in person. Submissions were formally made to a source code repository.

2. A capstone project was the final summative assessment component of the course. Students were given a project to complete, within a two-day period, which required them to use all the skills learned in the course. Sample solutions of work completed were provided to ensure students had access to good relevant reference material in the form of lecturer-provided sample solutions. Students were assessed through a demonstration of their work to the lecturer during the final lab. Students could continue to fix issues found during the final assessment, once they were completed, before the end of the lab.

No grading on a curve was required for this assessment, as it fell under the regulations of the Irish University, which does not operate this policy. Students were graded in teams of no more than two. The assessment breakdown for the course was as follows: 30% for written reports, 40% for lab sheets, and 30% for the capstone project, all of which mapped to the technical learning outcomes of the module.

7   CASE STUDY DATA COLLECTION AND ANALYSIS

The following methods were used to collect data for the purpose of evaluation of the case study. A mixture of surveys and interviews were employed throughout the delivery to assess the stated research aims of teaching effectiveness and identifying ways to improve the delivery approach within the context of partner delivery in non-native English teaching environments.

- Survey 1: During the first session of the intensive course, a survey was conducted to find out participants' former international experiences and expectations of the course.
- Survey 2: Throughout the delivery, a daily survey was performed to obtain feedback on the materials provided to the students.
- Survey 3: At the end of the delivery, a final satisfaction survey was conducted focusing on the overall experience of the course material and the assessment methodology.
- Interview 1: At the midpoint of the delivery, an interview was conducted with the lecturer to obtain feedback on the course from the perspective of delivery.
- Interview 2: At the end of the course, post assessment, a final interview was conducted with the lecturer to determine feedback on their experience of the delivery.

7.1 Research Aim 1: Determine strengths and weakness of Flipped Learning in non-native English-speaking environment

The satisfaction rating by the student cohort is an important factor in determining the effectiveness or weakness of the delivery model. Students were required each day to provide feedback on the material and then at the end of the module delivery. The results are presented below with the source of the results identified.

Source: Survey 2: Figure 1 shows the student satisfaction rating, measured daily, throughout the module delivery. Students were asked six questions each day: Was the video easy to understand? Was the video sufficiently technical? Was it easy to watch the video? Was the worksheet provided easy to follow? Was the worksheet material sufficiently challenging?
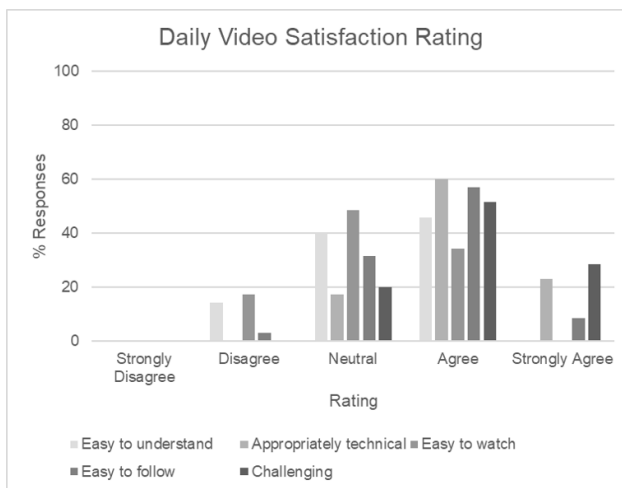

Fig. 1. Source: Survey 2: Daily Video Satisfaction Rating.

Source: Survey 3: Figure 2 shows the overall student satisfaction rating with the materials provided and the delivery of the material. Questions from the surveys were aggregated under four headings; Delivery of the material; Amount of lecturer/student interaction; Pace of course delivery; Quality and suitability of the resources provided. Figure 2 also shows the overall student satisfaction rating with the assessment methodology. Questions from the surveys were aggregated under four headings; Balance of the material; Clarity of the criteria used; Amount of feedback received on assessment; Guidance provided during and after the assessment period. In addition to the above graph, students also commented on the feedback received. Of those students who commented, they reported that the feedback received was individual, relevant, and enhanced their understanding of the problem and was a strong component of the delivery.
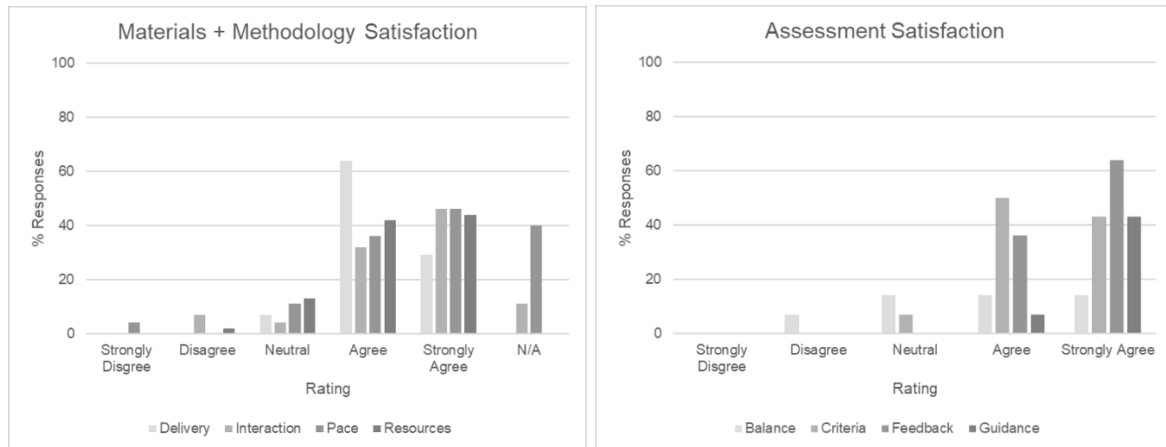
Fig. 2. Source: Survey 3: Satisfaction Ratings for Materials and Assessment

In addition, students also commented on the material provided. Some students reported other differing issues such as difficulty with English comprehension. One student note, issues with the pace of the delivery; and one student wanted further details on some of the online tutorials provided. Students showed extensive satisfaction with the feedback process, identifying the individual feedback aspect of the course as being especially effective. However, the overall workload was an issue given the compressed nature of the delivery.

7.2 Research Aim 2: Consider ways to improve the delivery approach when developing courses for partner universities

Data Source: Interview 1, Interview 2, Survey 1: We reviewed the selection process and the student cohort, to better understand the student sample used for the analysis of the case study. The results are presented below with the source of the results identified. Although students did not have a clear definition of flipped learning, five students said that they participated in courses before, where watching videos or consulting other materials was a prerequisite of active participation in sessions, but only two of them took fully online courses before, in both cases the language of instruction was Korean. Thus, most students had previous experience of having materials distributed online in preparation for a class.

Interestingly, 7 out of 8 students did not have any international experience before taking the flipped learning course taught in English by a native English-speaker. One student had a

summer school overseas experience, where they had the opportunity to experience group project-based teaching methodology, as opposed to the traditional F2F learning.

Although students had access to a video introducing the flipped learning class (and other materials), none were familiar with the concept of flipped learning. Students' motivation to take the course were varied. Some students needed the academic credit (3 students). Others chose the course because it was taught through English (3 students). One student was interested in the topic and one student was preparing for a student mobility programme, hoping that this experience would help in the recruitment process. Students were asked to evaluate their English skills (speaking skills, listening comprehension, reading, and writing) in a 1-5 scale (1 - low level, 5-high level). In line with our previous anecdotal experience with Korean students in general, they considered their abilities to be poor with only 3 students giving themselves a rating of 4, and even then, for only one of the component skills listed.

Knowing the materials in advance, students were asked how many hours of study they expected to invest in the flipped learning course. The answers were very diverse from 30 minutes to 14 hours per week.

The main expectations concerning the final outcomes of the course, were asked based on a 5-point Likert scale (completely agree, agree, disagree, completely disagree, I do not know). All students agreed or completely agreed with the following statements: *"I expect my English skills to improve"*, *"I expect better job opportunities after this experience"*, *"I expect to be more prepared for the lectures"*, *"I expect good communication with the professor"*, *"I expect good communication with fellow students"*. One student out of 7 disagreed with the statements: *"I expect to have immediately applicable, practical knowledge right after this course"* and *"I expect to gain real life skills"*. The rest of participants either agreed or completely agreed with these latter 2 statements too.

8   CONCLUDING REMARKS

We conclude by reviewing our findings under the themes presented in the results section of this paper.

8.1 Limitations of the case study

The level of the participation within the case study was small. Partly this was due to competing courses within the university for the summer school, where the delivery was through Korean. The case study may suffer from selection bias, where students who were concerned about their level of English ability would not opt to take the course. Further studies would need to ensure that the selection of students included students of different linguistic abilities. However students responded to the survey that they targeted the course specifically because it was in English, with the hope of improving the fluency.

Students reported general satisfaction with the quality and detail of the online material presented but the compressed nature of the delivery, made it difficult for them to spend sufficient time on each section. The compressed nature of the delivery may not have provided sufficient time for the students to absorb new technical terms in English. A slower delivery may be more effective depending on the level of English of the student cohort.

8.2 Recruitment

Students were mainly motivated to take this course not because of its flipped nature, but because it was taught in English by a native English speaker. This is no surprise since having high English exam scores is essential for Koreans in the highly competitive job market [23].

Additionally, all students evaluated their English skills poorly, thinking that it indeed needed improvement. Since some students considered the course as an opportunity to improve their language skills, they did not consider the special nature of the course important. They were not familiar with the flipped learning methodology, although course materials were provided long before the class. Although the number of students who participated in the course was small (<10), they nevertheless provide findings that are transferrable to similar contexts.

8.3 Material Provision and student methodology

The lecturer was required each day to adjust the pace of the course to maintain sufficient progress through the module. This was possible only due to the extensive preparation performed by providing solutions to students and working through examples when students struggled with the material. Students found some parts of the course difficult, and more focus was placed on these areas during the delivery. This was only possible due to the constant daily feedback from the students. Interestingly, the student satisfaction at the end of the course on the video material was in fact higher than the recorded data during the course delivery.

8.4 Assessment

The ability to alter pace and having all material extensively prepared was a key factor in addressing the students' differing backgrounds. The nature of the flipped delivery and feedback allowed the students to engage and perform well despite expressing difficulty with some of the worksheets. A strength of the flipped learning model was evidenced by the highly engaging nature of the contact time. Because the lecturer was not presenting new material in the class, but rather addressing issues and problems raised by students in their feedback, it ensured that the actual teaching was targeted and relevant. Students overwhelmingly identified the assessment and feedback as being a critical component to the success of the module. The lecturer also used the feedback to modulate the delivery pace and assessment to allow maximum student engagement.

9   LESSONS LEARNED

There were a number of lessons learned in this delivery model to be considered in future iterations of this flipped classroom delivery:

- Considering the low number of students, more intensive promotion of the course is required. If a higher number of students are targeted, the language of instruction should be emphasized to attract more students during recruitment.
- For quicker adjustment to the structure, requirements, and methodology of the course, it is desirable that students have a clear understanding of the flipped learning concept before the beginning of the course.
- The compressed nature of the delivery did not add in a positive way to the module experience for either the students or the lecturer. While the module ultimately resulted in a positive outcome for the students, a larger cohort may have had a difference experience.
- Students reacted well to the video material and found it engaging and challenging. However, further worked examples in the online format may have helped enhance the students understanding. Future implementations will focus equally on theory and practical online videos.
- Korean students engaged extensively during the delivery. While initially quite reluctant to engage, the students quickly started to ask many questions and interacted well with the lecturer.

- The feedback methods within the classroom ensured that the lecturer was aware of what students were struggling with and allowed the lecturer control over the pace of the course. Students expressed some considerable satisfaction with the feedback and engagement elements of the module, identifying it as a highlight of the module.

Flipped learning provides a benefit to students when it combines a flexible pace with delivery of modules. This flexibility is only made possible through responding to feedback from students on an ongoing basis. This response could take the form of altering assessments, adding additional explanations to the material, providing additional sources of reference, or working through the problem with the students as a group in an interactive way. To accomplish this, the lecturer in the room should be a subject matter expert and highly experienced in the course material. Moreover, to successfully implement a flipped learning course in Korea, the specific Korean setting should be considered during designing and delivering the course.

Based on our final findings presented in this case study it seems certain that the flipped learning methodology has a future in Korean higher education, emphasis should be put on student/teacher discourse in order to encourage naturally shy students to engage with the instructor, to increase constructive interaction throughout the course.

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