Relationship Between Course Effectiveness, Satisfaction, Access and Academic self – efficacy in the HyFlex mode of Instruction

Hira Raza
Innovative Technologies in Learning,
National University of Science & Technology, Islamabad, Pakistan
hira.raxa@gmail.com

Tahira Anwar Lashari
Innovative Technologies in Learning,
National University of Science & Technology, Islamabad, Pakistan
tahira.anwar@seecs.edu.pk

Sana Awar Lashari
School of Applied Psychology Social Works and Policy, Universiti Utara Malaysia
sana.anwar.lashari@uum.edu.my

ABSTRACT

Considering the transition of education activities from traditional classroom to online due to covid-19, Pakistan has witnessed a new social inequality – Digital Divide. To fight this inequality among masses in the country this research proposes a new way of instructional design i.e., HyFlex. Access to education in general is problematic in Pakistan. Hyflex proposes easy access to education for Pakistani students through improved methods of delivery. HyFlex is a short form for Hybrid Flexible (HyFlex) Classroom. Hyflex is an instructional technology that erased the boundaries between distance learning and physical classroom. It gives students to choose method of attending lectures according to their flexibility. Because of the growing digital divide in Pakistan, not every student has access to internet /electricity/digital devices etc. Hence, this instructional technology can help students and teachers to attend classes according to their flexible time and needs. This research aims to measure through HyFlex accessibility of the course, level of achieved learning outcomes, student motivation and availability of hardware technology (Smart classroom). A survey was conducted from the Pakistani university students' majority of them were computer science students. The results were run on AMOSS SPS. The results show that academic self-efficacy is achieved among students through course satisfaction and course effectiveness.

Keywords: *HyFlex, Hybrid Flexible, Technology, Innovation, Education Technology*

INTRODUCTION

The HyFlex course format is an innovative approach to education that combines both face-to-face (F2F) and online learning. This instructional approach allows students to participate in each class session and learning activity either in-person, synchronously online, or asynchronously online. The HyFlex approach aims to provide students with autonomy, flexibility, and seamless engagement, no matter where, how, or when they choose to engage in the course (Kohnke et al, 2021). The central principle of the HyFlex model is that the learning is equivalent, regardless of the mode. Flexible education has often been used in the exchange of distance education for the main purpose of this is to ensure access to education and minimized cost and hardships in daily life (Ann et al, 2023) Although the benefits of the HyFlex approach are not limited to students, faculty members can also reap its benefits. For instance,

some students may "attend" class virtually alongside the lecturer, while others may physically attend from a room on campus. (Beatty, 2019). This approach requires teachers to rethink the learning experience and the way engagement take place among how students, instructor, content, and colleagues (Ann Miller et al, 2021). The teacher develops the course content and organizes the curriculum to reflect the structure. All participants must have equal access to the learning materials, the instructor, and each other, regardless of how they choose to join. Effective use of classroom strategies and/or technology is important so that all students can hear verbal and nonverbal interactions (S. Binnewise et al, 2019). HyFlex courses frequently have an asynchronous component as well, enabling distant learners to see lecture recordings at a later time. However, making distant learning as participatory and interesting as in-person instruction is the fundamental goal of this educational strategy (Alvarez et al, 2023). HyFlex courses prioritize active learning for both audiences, and the flexibility provided by the approach ensures that it doesn't come at a cost to the quality of the education (Wright, 2016). Hycrhonous is a term proposed for the blended learning model to be adopted in tertiary education. It's a blend of synchronous, asynchronous and hybrid (Jalil et al, 2022).

HyFlex courses are successful for various learners, especially for students who are neurodiverse or who are balancing the demands of their families or employment. The approach gives students freedom to choose the way they participate in classes, resulting in more engagement and success (Kakeshitta et al, 2021). Sometimes circumstances prevent students from learning in person, even if they would rather do so. HyFlex allows students to log into class from anywhere, saving them from having to endure a long trip through heavy traffic. It also makes managing disruptions like medical appointments easier (abdalmalak et al, 2018). HyFlex courses have been around since 2006 introduced by Brian J. Beatty and others. While the approach played a key role in keeping students and teachers safe during the COVID-19 pandemic, it will continue to enable institutions to meet learner needs when the pandemic is a distant memory. According to Beatty (2019), there are four core values that inform HyFlex courses: Learner Choice, Equivalence, Reusability, and Accessibility.

Learner Choice means that the course provides alternative participation modes that are meaningful and allow students to choose the mode of engagement that works best for them (Miller et al, 2013). This value acknowledges that not all students learn in the same way and provides them with the opportunity to choose the mode that best suits their learning style (Beatty 2019). Equivalence means that the modes, though not equal, provide equivalent learning outcomes. All students are expected to reflect, contribute developing ideas, and interact with their peers in the process of learning. This value recognizes that while the modes of participation may differ, the learning outcomes should be equivalent, and all students should have an equal opportunity to engage with the course material. (Beatty 2019)

Reusability means that artifacts from learning activities in each mode are captured and can be reused in other modes. Representations of in-class activities (recordings, discussion notes, etc.) are available online for all students, and activities produced by online students (asynchronous discussions, posted files, etc.) connect to and support all students. This value recognizes that the artifacts produced in one mode can be used to support students in another mode, creating a more cohesive learning experience (Beatty 2019). HyFlex instruction is a mode of teaching that combines both in-person and online instruction, allowing students to choose the learning format that best suits their needs and preferences (Detyna et al, 2023). It is called Hybrid Flexible mode of instruction, where students can switch between in-person and online instruction depending on their preference or the situation. This mode of instruction aims to provide flexibility and accommodate the diverse needs of students while maintaining a sense of community and interaction within the class (Rosen 2021). The HyFlex model typically involves synchronous instruction, meaning that the class meets at a set time, whether in-person or online. However, the students have the choice to attend the class in-person, remotely or a

combination of both depending on their preference (Miyazoe et al, 2022). HyFlex instruction also requires a high degree of planning and preparation from the instructor as they need to design and deliver the course in a way that is inclusive to all students regardless of their mode of attendance. It requires the use of technology, such as video conferencing, collaborative tools, and online platforms to facilitate online participation (Barclay et al, 2021) HyFlex instruction is often used in response to the COVID-19 pandemic, as it allows for social distancing in the classroom while still providing in-person instruction. It also allows students who are unable to attend in-person classes due to health concerns or other reasons to still participate in the class remotely (Wilson et al, 2021). Assessments in the HyFlex mode are of high importance. Digital assessments are now used to enhance psychological abilities among students (Lashari et al, 2023).

An exploratory case study was conducted by Tonia J. Wilson and Melina Alexander to assess student perception and participation in HyFlex course delivery. The classroom curriculum was created using the backward design method. Using this method learning objectives, classroom assessments etc. were designed prior to designing an online version of the class. The case study showed positive outcomes with respect to flexibility of the course and higher satisfaction among students (Wilson et al, 2021). Designs for learning is set of conditions and situations such as institutional norms, governing documents etc for designing learning environments (Hortan et al, 2011). The designs for learning affect the designs 'in' learning that is the strategy of teacher. According to the study, the teachers decided the strategies according to the spaces. There are three teacher strategies in HyFlex environment: Online and room oriented, room oriented, and room oriented and online on-demand. Hyflex environment requires increased knowledge on designing for learning (Leijoun et al. 2019). HyFlex course helps students in choosing their modes of instruction but there are design challenges that need to be considered. For example, stable internet connectivity and bandwidth for students taking courses synchronously. There are five tips to design hyflex course. For example, design course asynchronously and then add elements of synchronous practices. Design collaborative activities for students to give them sense of belonging. Lastly, take students formative feedback to improve and make changes (Naffie et al, 2020).

Academic self-efficacy refers to an individual's belief in their ability to succeed academically. Access to the course refers to the ability of students to log in and access the course materials, such as readings, lectures, and assignments (Hanham et al, 2021). Both access to the course and availability of hardware technology can affect the ability of students to participate in distance learning and can impact their academic performance (Eduljee et al, 2023).

Course satisfaction refers to the level of satisfaction that students have with a particular course. It is a measure of how well the course meets the needs and expectations of the students (Du et al. 2023). Factors that can affect course satisfaction include the quality of the course materials, the effectiveness of the instruction, the level of engagement and interaction with the course, and the level of support provided by the instructor (Athens et al, 2023). The effectiveness of the HyFlex course model, which combines both in-person and online instruction, has been studied in several research studies. The results of these studies have been mixed, with some studies showing that the HyFlex model is effective in improving student engagement, motivation and learning outcomes (Heilporn et al, 2023).

Overall, HyFlex instruction is a versatile teaching model that provides students with more options and flexibility in their learning, while also accommodating the new normal during and after pandemics.

A. Research objectives

The objectives of the research will be:
1. To measure the effectiveness of the HyFlex course model through accessibility of the course, and the availability of hardware, student satisfaction through academic self-efficacy and task value.
2. Propose an effective instructional technology in Pakistan to bridge the digital divide and increased access to course

B. Research questions

This research is based on following research questions:
a. Does HyFlex mode of instruction attain higher academic performance?
b. How satisfied students are with course in HyFlex mode of Instruction?
c. How effective HyFlex mode of instruction is in course effectiveness?
d. Does HyFlex mode of instruction affect hardware accessibility?
A. Hypothesis
Hyflex course increases academic self-efficacy and task value among students with greater course satisfaction and availability of the hardware.

C. Problem Statement

Considering the transition of education activities from traditional classroom to online due to covid-19, Pakistan has witnessed a new social inequality – Digital Divide. To fight this inequality among masses in the country this research proposes a new way of instructional design i.e., HyFlex. Access to education in general is problematic in Pakistan. Hyflex proposes easy access to education for Pakistani students through improved methods of delivery.

MATERIALS AND METHODS

A. Research design

This research has quantitative design and was conducted through a survey method. The survey was designed on 5-point Likert scale; Strongly disagree, Agree, Neutral, Disagree, Strongly disagree. The four survey questionnaires used for each variable were adopted from the already published research papers with the permission of the authors. The survey had 4 sub-categories measuring each of the variable: Self-efficacy and task value, student satisfaction, effectiveness and hardware accessibility. Each category had 7-8 questions and the survey was filled out by public and private university students in Pakistan. The analysis was run on SPSS AMOS for Structural Equation Modelling (SEM).

B. Sampling

Population in this study comprises of undergrad university students in Pakistan. This is a purposive sampling and the data is collected from Pak-Austria Fachhochschule Institute of Applied Sciences and Technology, Haripur a public sector university. National University of Science and Technology (NUST), Islamabad, Shaikh Ayaz University, Shikarpur Sindh and Newports Institute Karachi. The sample size was 300 students. The reason for choosing the proposed universities is because all four universities are well equipped with hardware technology for Hyflex course models and to cover the various regions of Pakistan; Southern Sindh, Northern Sindh, Federal Capital of Pakistan and Khyber Pakhtunkhwa. Link to the survey conducted is given below:

https://docs.google.com/forms/d/e/1FAIpQLSejE8PEIEmgIUP7XKA6wDQkBemaTw_F2po
zKEjURGR8DOBUfQ/viewform?usp=sf_link

C. Validity and Reliability of the tool

Four survey tools have been adopted from the already conducted studies to be used in this study:

1. Student Satisfaction Survey Questionnaire used in the paper "Academic Students' Satisfaction and Learning Outcomes in a HyFlex Course: Do Delivery Modes Matter?". The survey has Cronbach alpha value of 0.95.

2. Effectiveness Questionnaire used in the paper "Using the SWIVL for Effective HyFlex Instruction: Best Practices, Challenges, and Opportunities" The survey has Cronbach alpha value of 0.8.

3. Online Learning Value and Self-Efficacy Scale (**OLVSES**). The survey has Cronbach alpha value 0.95 for Task Value and 0.85 for self – efficacy.

4. Assessment of Distance Learning Modes for Tertiary Education In Pakistan, The Paper was published on 16th International Conference on e-Learning, Lisbon, Portugal 19 – 21 July 2022. (The tool adopted from this study has content validity and was reviewed by three experienced subject and domain experts)

RESULTS AND DISCUSSION

The survey conducted from various universities of Pakistan was run on SPSS for EFA and AMOS for SEM of latent variables. In this study, the two-stage method introduced by Henseler, Ringle, and Sinkovics (2009) was utilized. The initial stage, referred to as the "measurement model assessment," was followed by the "structural model assessment," which is the second stage according to Hair, Ringle, and Sarstedt (2013).
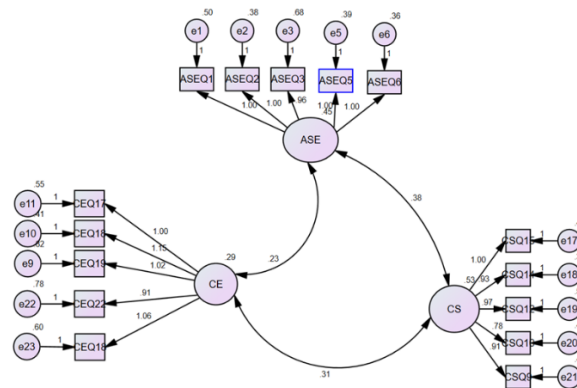
A. Measurement Model

Figure 1: Shows the relationship between variables and their measure

The model fitness of the measurement model presents the baseline comparison as following:

Table 1: Showing RFI, TLI and CFI Values of Measurement model

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.875	.849	.924	.907	.923
Saturated model	1.000		1.000		1.000

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Independence model	.000	.000	.000	.000	.000

The bigger Tucker-Lewis Index (TLI) in Table 1 value indicated better fit for the model. Although values larger than 0.95 are interpreted as acceptable fit. (Schermelleh-Engel and Moosbrugger, 2003; Ding et al., 1995; Gerbing & Anderson, 1992). If the Comparative Fit Indices (CFI) value is greater than 0.95, then the fit is deemed adequate (Schermelleh-Engel and Moosbrugger, 2003). This measuring model has a.923 CFI and a TLI of .907. This indicates the measurement model has acceptable TFI and CLI values.

Table 2: Showing RMSEA value of measurement model

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.070	.058	.083	.004
Independence model	.230	.220	.240	.000

Root Mean Square Error of Approximation (RMSEA) is an index of the difference between the observed covariance matrix per degree of freedom and the hypothesized covariance matrix which denotes the model (Chen, 2007). When the RMSEA score falls between 0.05 and 0.08, it is considered to represent a fit that is nearly decent, however a value smaller than 0.05 can be considered indicative of a convergent fit to the model's analysed data. Hu and Bentler (1999) remarked that RMSEA index smaller than 0.06 would be a criterion that will suffice. This model presents the RMSEA of 0.70.
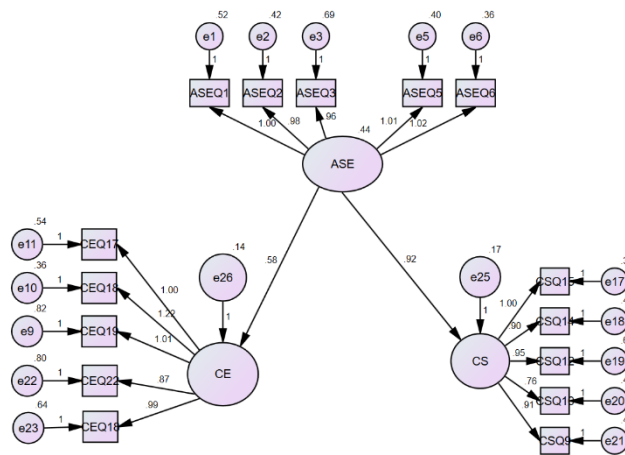
B. Structural Equation Modelling

Figure 2: Shows Structural Equation Model shows the relationship between variables

RMSEA

Table 3: Shows RMSEA of SEM

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.080	.068	.092	.000

Model	RMSEA	LO 90	HI 90	PCLOSE
Independence model	.230	.220	.240	.000

The RMSEA of 0.08 of the SEM put the model in good fit. The model suggests that academic self-efficacy (ASE) and task value are dependent on Course Satisfaction (CS) and Course effectiveness (CE).

Table 4: Baseline Comparisons of SEM

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.852	.823	.900	.879	.899
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

The results on the SPSS AMOS shows that the model has good fit based on the cut off criteria. All measured variables have significant loadings on their corresponding latent variables, suggesting that the latent variables are adequately representing the measured variables. The model suggests that self-efficacy is an important predictor of course satisfaction, course effectiveness and technology use in an online course. These results may help identify areas to improve student success and engagement in online learning environments. The model's suitability for understanding the intricate interactions between latent and observable variables is demonstrated by the model's fit against predetermined cutoff criteria. This is a noteworthy accomplishment because it supports the validity of the theoretical framework that has been put out for analysing student participation in online learning settings. The fact that all measured variables have significant loadings on their corresponding latent variables shows that the variance present in the observable indicators is effectively captured by the latent constructs. This demonstrates the measuring model's precision and strengthens the dependability of the findings.

This study's main contribution is the realisation that self-efficacy is a strong predictor of numerous aspects of student involvement. The findings indisputably highlight how important self-efficacy is in influencing how learners perceive and behave in online courses. In line with earlier research that shows the beneficial effects of self-belief on academic achievement and engagement across educational settings, self-efficacy has a significant impact on course satisfaction, course effectiveness, and technology use. These results support the claim that learners who have higher levels of self-efficacy tend to be more satisfied with the course, think it is more successful, and use technology resources skillfully.

The consequences of these studies have significant ramifications for the developing field of online education. The findings from this study can be used by educators, course designers, and institutions to create focused tactics that will improve student engagement and achievement. The development of student self-efficacy appears as a critical intervention. Teachers can foster a positive learning environment that results in enhanced course satisfaction, perception of course effectiveness, and more effective use of technology resources by encouraging students' confidence in their abilities to negotiate the hurdles of online learning. Additionally, the fact that self-efficacy was found to be a predictor highlights how crucial it is

to develop encouraging and empowering learning settings. Regular feedback, individualised support, and the encouragement of self-directed learning are all tactics that could increase self-efficacy and, by extension, engagement.

The outcomes of the SPSS AMOS analysis, in conclusion, point to a model that well captures the intricacies of student participation in online learning. The suggested construct representation is supported by the significant loadings between latent and observable variables. Notably, self-efficacy is found to be a strong predictor of technology utilisation, course effectiveness, and student happiness. This study adds to the academic conversation by providing a nuanced viewpoint on the elements affecting students' engagement in the digital age. The ramifications of these findings go beyond the realm of academia, offering educators and organisations practical advice on how to improve student engagement and success in online learning environments.

CONCLUSIONS

The results show that Hybrid Flexible classrooms are successful based on the certain conditions including academic self-efficacy, course satisfaction, availability and course effectiveness. Hybrid Flexible mode of teaching can be an effective solution in Pakistani classrooms only if there are right classroom technologies. This study can be helpful in making policy decisions in adopting technology in Pakistani universities and higher education. The COVID-19 pandemic has caused an unprecedented movement in education from traditional classroom settings to online platforms, which has changed the educational landscape in Pakistan and given rise to a worrying new societal divide known as the "Digital Divide." This study attempts to close the educational gap that has grown wider as a result of unequal access to technology by proposing an innovative instructional design technique called HyFlex (Hybrid Flexible Classroom).

Due to disparities in internet connectivity, electricity, and digital device availability across various population groups, Pakistan, which already has difficulties in guaranteeing equitable access to education, has faced heightened difficulties as remote learning has proliferated. The HyFlex instructional design concept appears as a viable response, dismantling the barriers between online learning and conventional classroom settings. HyFlex encourages inclusivity while meeting the various demands of the student population by giving students the freedom to select their preferred form of participation depending on their unique circumstances and flexibility.

This study, which was supported by a survey of university students in Pakistan, mostly computer science majors, aimed to evaluate the effectiveness of the HyFlex approach across a range of factors vital to efficient education delivery. The evaluation took into account the HyFlex model's accessibility of the course contents, the achievement of learning objectives, student motivation, and the accessibility of necessary hardware technology, including smart classrooms. The survey's results provided vital information about the model's efficacy using AMOS and SPSS.

The findings of this study demonstrate how course satisfaction and effectiveness work together to promote academic self-efficacy, an important factor in student success. This finding is consistent with well-established theories in educational psychology that hold that students' perceptions of their level of proficiency and their general happiness with the educational process are strongly correlated. Even in Pakistan's tough digital environment, the HyFlex strategy promotes student engagement and material mastery, making it an effective tool for fostering academic self-efficacy.

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