HyFlex: an Instructional Approach of Smart Classroom; Measuring Accessibility of the Course and Learning Outcome

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Supervisor: Dr. Tahira Anwar Lashari

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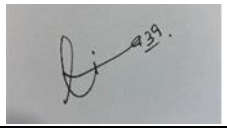
Student Name: Hira Raza Bhatti Signature: 

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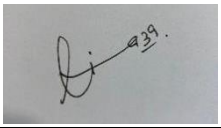
Student Signature: 

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LIST OF SYMBOLS, ABBREVIATIONS AND ACRONYMS

HyFLEX	Hybrid Flexible
AMOS	Analysis of Moment Structures
SPSS	Center for Graduate Studies
SEM	Structural Equation Modeling
RMSEA	Root Mean Square Error of Approximation
RMR	Root Mean Square Residual
GFI	Goodness of Fit Index
NCES	National Center for Education Statistics
UNISA	University of South Africa
AIOU	Allama Iqbal Open University
VUP	Virtual university of Pakistan
HEC	Higher Education Commission
TAPCK	Technology Pedagogy and Content Knowledge
PAF-IAST	Pak-Austria Fachhochschule Institute of Applied Sciences and Technology
OLVSES	Online Learning Value and Self Efficacy Scale
EFA	Exploratory Factor Analysis
CFA	Confirmatory Factor Analysis
NFI	Normed Fit Index
RFI	Relative Fit Index
IFI	Incremental Fit Index
TLI	Tucker Lewis Index
CFI	Comparative Fit Index
AGFI	Adjusted Goodness of Fit Index

PGFI	Parsimonious Goodness of Fit Index
CE	Course Effectiveness
ASE	Academic Self Efficacy
CS	Course Satisfaction
PCLOSE	Probability Close

ABSTRACT

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

Keywords: Distance learning, HyFlex, Online education, Digital, Technology, Smart Classroom.

CHAPTER 1: INTRODUCTION

1.1 Introduction

An innovative method of teaching that blends face-to-face (F2F) and online learning is the HyFlex course form. Students can take part in every class meeting and learning activity in person, asynchronously online, or synchronously online using this teaching strategy (Murphy et al., 2011). No matter where, how, or when students choose to participate in the course, the HyFlex method seeks to give them autonomy, flexibility, and seamless involvement. The HyFlex model's fundamental tenet is that learning is equal regardless of the mode (Amiti, 2020).

Although the HyFlex strategy was created with an emphasis on student flexibility, faculty members can also benefit from it. For instance, some students may "attend" class virtually with the lecturer, while others may join in person from a classroom on campus. With this strategy, teachers must reconsider how students interact with the instructor, the material, and their peers (Kirschner et al., 2006). The curriculum is organized and the course materials are created by the instructor to reflect this framework. Regardless of how they choose to enroll, every participant must have equal access to the course materials, the instructor, and other participants. For everyone to hear verbal exchanges, classroom tactics and/or technology must be used effectively. HyFlex courses frequently also include an asynchronous element that enables students who are unable to participate live or virtually to see a lecture recording later. The main goal of this educational strategy is to make online learning as participatory and interesting as in-person learning, nevertheless (Sanchez-Pizani et al., 2022). For both audiences, active learning is prioritized in HyFlex courses, and the flexibility offered by the methodology ensures that it does not lower the standard of instruction.

In particular, for neurodiverse students or those juggling the responsibilities of family or work, HyFlex courses offer greater opportunities for success. The method gives students flexibility in how they participate in class, greatly increasing their likelihood of engagement and success. Even for students who prefer in-person instruction, life might occasionally interfere. Off-campus students can avoid a long trip through congested traffic thanks to HyFlex, and having the flexibility to log into class from anywhere helps students manage disruptions like medical appointments. HyFlex courses have been available since

roughly 2006, when Brian J. Beatty and colleagues first came up with the concept. The strategy helped keep students safe during the COVID-19 pandemic, but it will also help institutions continue to serve students' needs once the pandemic has passed.

The four guiding principles of HyFlex courses, according to Beatty (2019), are learner choice, equivalence, reusability, and accessibility. Learner Choice refers to the fact that the course offers a variety of engaging participation options and gives students the freedom to select the one that suits them the most. This value recognises that not all students learn in the same way and gives them the option to select the delivery method that most closely matches their preferred learning style. Equivalence suggests that despite their differences, the modes produce similar learning results. In order to learn, it is expected of every student to reflect, offer developing ideas, and engage with others. This principle acknowledges that even though different types of involvement may produce different learning outcomes, all students should have an equal chance to interact with the course material.

Reusability refers to the ability to capture and reuse learning artefacts from each form of instruction. All students have access to online representations of in-class activities (recordings, discussion notes, etc.), and activities created by online students (asynchronous discussions, uploaded files, etc.) link with and assist all students. This value acknowledges that students can benefit from the artefacts created in one mode while studying in another, resulting in a more unified educational experience. HyFlex schooling integrates both in-person and online learning, giving students the option to select the learning style that most closely matches their requirements and preferences. In response to the COVID-19 pandemic, this method of instruction is frequently employed. According to their preferences or the circumstances, students can move between in-person and online training in this hybrid flexible style of learning (Zhang et al., 2024). This approach to teaching strive to be adaptable and meet the various needs of students while preserving a sense of community and engagement in the classroom

HyFlex education is a flexible teaching approach that gives students the option to learn in-person, online, or using a combination of the two. This method of teaching is intended to be flexible and meet the various requirements of students while preserving a sense of community and engagement in the classroom. The HyFlex model often uses synchronous education, which means that classes, whether they are held in person or online, convene at a predetermined time. However, based on their preferences, the students

can attend the session in person, virtually, or a combination of the two. HyFlex training necessitates a lot of thought and preparation on the part of the instructor since they must create a course that is inclusive of all students, regardless of how they choose to attend. To enable online involvement, technology is needed, such as video conferencing, collaborative tools, and online platforms. In response to the COVID-19 pandemic, HyFlex education is frequently adopted because it permits social distance in the classroom while still delivering in-person training. Additionally, it enables students who, for a variety of reasons, are unable to engage in class in person to do so remotely.

Overall, HyFlex instruction is an adaptable teaching strategy that gives students more choices and flexibility in their learning while also taking into account the new normal during and after pandemics.

1.2 Overview of The Study

Hybrid Flexible (HyFlex) Classroom is short for HyFlex. Hyflex is an educational technology that has eliminated the distinctions between virtual learning and traditional classroom training. It allows students to select the most flexible way for them to attend lectures. Not every student in Pakistan has access to the internet, energy, digital gadgets, etc. due to the country's widening digital divide. Thus, educational technology can support instructors and students in attending classes in accordance with their schedule flexibility and needs (Komar et al., 2022). This study attempts to quantify the course's HyFlex accessibility, the degree of learning objectives met, the motivation of the students, and the accessibility of hardware technology (smart classroom). The results from this research will address the gaps in distance learning mode in Pakistan. The proposed method will cater the needs of learners in context of flexibility of accessing the course via face to face or online. This research will help the higher education vertical in adopting right instructional technologies keeping in view the current distance learning practices due to COVID-19. Students can change their attendance method weekly or topic wise. Such course model does not seem to prevail in Pakistan and the research in this area may open doors of innovation and effectiveness in education sector of the country (Pedreira Junior & Pitombo, 2024).

1.3 Background

Globally, teaching and learning practices have undergone tremendous change as a result of the introduction of digital technologies and the changing paradigms in education.

Of these, the HyFlex (Hybrid-Flexible) mode of instruction has come to light as a significant advancement, especially considering its capacity to transform educational environments in a variety of settings, including Pakistan.

1.3.1 Global Context of HyFlex Learning

The HyFlex paradigm, which was developed by Beatty in 2007, has become popular throughout the world as a cutting-edge method of teaching. It offers flexibility and student-centered training by combining in-person and virtual learning. According to Johnson (2019), this paradigm has proven particularly useful in tackling issues in higher education like accessibility and individualized learning preferences (Gjerstad et al., 2023).

1.3.2 The Pakistani Educational Landscape

With a wide range of social, cultural, and geographic elements influencing educational practices, Pakistan's educational system is distinguished by its diversity (Khan & Iqbal, 2021). The nation has several difficulties, such as scarce resources, uneven educational standards, and a digital divide (Malik & Baldauf, 2006). These difficulties emphasize the necessity of inclusive and adaptable teaching methods like HyFlex.

1.3.3 Rationale for HyFlex in Pakistan

The HyFlex approach has the potential to be implemented in Pakistani classrooms since it may provide a personalized learning environment that meets the various needs of students. It is consistent with Pakistan’s continuous attempts to digitize education and improve educational quality and accessibility (Ahmed & Qazi, 2013). Additionally, the paradigm aligns with Pakistani constructivist educational practices, which place a strong emphasis on student participation and active learning (Vygotsky, 1978).

1.4 Research Gap

Although HyFlex's use in Western settings has been well documented, research on its adoption in Pakistani schools is still in its infancy (Miller & Reddy, 2018). Comprehensive research on the viability, efficacy, and difficulties of applying the HyFlex paradigm in Pakistan's distinct educational context is required (Hussain, Dogar, & Azeem, 2018). This thesis's foundation lays the groundwork for a thorough investigation of the HyFlex model of education in Pakistani classrooms. It draws attention to the HyFlex learning model's worldwide context, the peculiarities of Pakistan's educational system, and

the possible advantages and difficulties of using this approach there. This thesis seeks to advance knowledge of flexible learning models in developing nations and offer guidance on how to effectively apply them in a range of educational pedagogical contexts.

1.5 Distance Learning Around the World

In recent years, distance learning—also referred to as online education or e-learning—has grown in popularity globally, particularly in reaction to the COVID-19 pandemic. Online enrolment increased by 3.9% in 2019 and by 9.3% in 2020 in the US, according to Allen and Seaman (2021), demonstrating a considerable move towards online learning. With the use of technology like the internet, videoconferencing, and online learning platforms, distance learning is a teaching approach that enables students to receive an education at a distance. Virtual classrooms, hybrid courses that blend online and in-person instruction, and totally online courses are just a few of the numerous formats that this kind of learning can take (Leijon & Lundgren, 2019). While online education has been growing in the US for a while, the epidemic gave it a significant boost in acceptance. In the autumn of 2018, about 40% of US undergraduate students were enrolled in at least one online course, according to a National Centre for Education Statistics (NCES) poll (National Centre for Education Statistics, 2019). But by autumn 2020, that figure had increased to more than 50%. The way students study has changed significantly as a result of the shift to remote learning, and many colleges and universities have responded by investing in new technology and instructional strategies to enhance online learning.

In Europe, the popularity of distance learning has grown as well, with numerous institutions and colleges providing entirely online degree programmes and courses. For instance, the UK's Open University has been providing distance learning courses for more than 50 years, and currently enrols over 170,000 students (Open University, n.d.). Leading German provider of online learning, the University of Hagen offers degree programmes in computer technology, law, and economics (University of Hagen, n.d.). Online learning options have expanded recently in many other European nations, including France, Italy, and Spain. Asia has seen a remarkable growth in remote learning, with many nations making significant investments in the infrastructure of online education. China, for instance, has invested in new online platforms and programmes as part of a significant drive to increase the availability of online education. With one of the biggest educational systems in the world, India has also been investing in online learning to increase millions

of students' access to a better education. In an effort to increase access to education and raise the standard of instruction, other Asian nations including Singapore and Malaysia have also made investments in online learning (Global Information Society Watch, 2020).

Distance education has been gaining traction in Africa as well, with numerous colleges and universities providing online courses and degree programmes. For instance, the University of South Africa (UNISA) is one of the continent's top providers of distance learning, providing more than 300,000 students with over 1,000 distinct programmes and courses (University of South Africa, n.d.). In recent years, several African universities—including the University of Lagos in Nigeria and the University of Cape Town in South Africa—have also increased the number of online courses they offer.

All things considered, remote learning has grown in popularity and effectiveness as a means of delivering education to students worldwide, particularly in the wake of the COVID-19 pandemic. Even if there are still obstacles to be solved, like making sure all students have access to technology and internet connectivity, distant learning has the power to completely change the way we think about education and open up new avenues for students to develop their skills.

1.6 Distance Learning in Pakistan

The flexibility and accessibility of distance learning, commonly referred to as online or e-learning, has made it a popular method of delivering education in Pakistan. The country's largest remote learning institution, Allama Iqbal Open University (AIOU), was founded in 1974 to offer education to those unable to attend traditional universities (Higher Education Commission of Pakistan, 2020). Allama Iqbal Open University (AIOU) provides a variety of undergraduate and graduate programmes, in addition to certificate and diploma courses. The learning environment at AIOU combines printed study materials, internet resources, and in-person tutoring. Furthermore, other academic establishments in Pakistan, like the Virtual University of Pakistan (VUP), which was founded in 2002, have started to provide distance learning programmes (Virtual University of Pakistan). The COVID-19 pandemic has further accelerated the growth of online learning in Pakistan, with over 80% of universities switching to online learning during the pandemic (Higher Education Commission of Pakistan, 2021).

There are a number of issues with distance learning in Pakistan that must be resolved to guarantee all students receive high-quality instruction. One of the main issues

is that many regions of the nation lack modern infrastructure and technology, especially in rural areas where students find it challenging to access online resources (Higher Education Commission of Pakistan, 2020). Universities and the government must make investments to increase internet access and give students the devices they need to access online materials. Moreover, in order to guarantee that remote learning programmes fulfil the same quality criteria as traditional programmes, more regulation and control are needed (Higher Education Commission of Pakistan, 2020). More cooperation between academic institutions and business is also necessary to guarantee that online courses remain pertinent. Additionally, meet the job market requirements. Distance learning has given students who otherwise would not have been able to attend traditional universities access to education in spite of these obstacles (Song & Kapur, 2017). In Pakistan, there was a 29% growth in the number of students enrolled in distant learning programmes between 2015 and 2019, as reported by the Higher Education Commission of Pakistan (2020). Universities now have the chance to provide courses that are not offered in regular programmes and to experiment with new teaching techniques thanks to distance learning. In contrast to traditional colleges, Virtual University of Pakistan (V.U) provides a variety of courses in cutting-edge subjects like cybersecurity, data science, and artificial intelligence.

To conclude, distant learning has emerged as a significant modalities of education delivery in Pakistan, offering educational opportunities to students who encounter obstacles in accessing conventional colleges. Leading this movement and offering students a flexible and accessible mode of instruction are AIOU and VUP. To guarantee that every kid receives a high-quality education, there are still issues that must be resolved. In addition to more regulation and control of distant learning programmes, the government and institutions must invest in bettering infrastructure and technology. Notwithstanding these obstacles, distant learning gives academic institutions the chance to experiment with new teaching strategies while still giving students access to education.

1.7 Distance Learning Policy in Higher Education

With the goal of providing all students with a high-quality education, Pakistan has a comprehensive policy framework for distant learning in higher education. The regulatory agency in charge of managing the nation's remote learning initiatives is the Higher Education Commission (HEC). The policy framework comprises norms and rules, such as minimal requirements for faculty qualifications, student support services, assessment and

evaluation procedures, that universities offering distance learning programs have to abide by (Higher Education Commission of Pakistan, 2020).

The policy framework places a strong emphasis on universities obtaining HEC certification for their distant learning programs. According to the Higher Education Commission of Pakistan (2020), accreditation guarantees that programs are accredited and that students who complete their courses will earn a degree that is recognized as being of the same caliber as traditional programs. Universities that wish to get government support for their remote learning programs must also be accredited. The policy framework also highlights how crucial infrastructure and technology are to providing high-quality distant learning programs. According to the Higher Education Commission of Pakistan (2020), universities that offer distance learning programs need to have the infrastructure and technology in place to provide online materials such e-books, video lectures, and online evaluations. In order to ensure students' academic performance, the policy framework also highlights the necessity for colleges to offer support services such online counseling, mentorship, and tutoring (Higher Education Commission of Pakistan, 2020).

Furthermore, the regulatory framework underscores the significance of fostering industry-university collaboration in order to guarantee that distant learning programs are industry-relevant and match industry demands. Universities are urged to provide courses in cutting-edge subjects that are in great demand in the labor market, like cybersecurity, data science, and artificial intelligence (Higher Education Commission of Pakistan, 2020). The policy framework also highlights how important it is for colleges to make sure that all students, especially those from underprivileged backgrounds, can enroll in their distant learning programs. In order to guarantee that every student receives a high-quality education, issues regarding the extensive policy framework for remote learning in higher education still need to be resolved. One of the main issues is that many regions of the nation lack modern infrastructure and technology, especially in rural areas where students find it challenging to access online resources (Higher Education Commission of Pakistan, 2020). Universities and the government must make investments to increase internet access and give students the devices they need to access online materials. In order to guarantee that distant learning programs, live up to the same standards of quality as traditional programs, extra supervision and regulation are also required.

To sum up, Pakistan has a thorough policy framework for remote learning in higher education that aims to guarantee all students receive a top-notch education. The policy framework places a strong emphasis on the value of infrastructure and technology, student support services, accreditation, and industry-university cooperation. Still, there are issues that must be resolved in order to guarantee that every kid receives a top-notch education. Increased control and regulation of distant learning programs is necessary, and both the government and universities must make investments in bettering infrastructure and technology.

1.8 Problem statement

Owing to COVID-19, traditional classroom instruction has shifted to online learning, creating a new kind of social inequality in Pakistan known as the "Digital Divide." In order to combat the country's widespread disparity, this research proposes a novel approach to instructional design called HyFlex. The COVID-19 epidemic has caused a major change in the nature of education, with traditional classroom settings giving way to online learning environments. While in some regions this shift has been seamless, in others it has exposed and exacerbated pre-existing socioeconomic injustices. Pakistan is a prime illustration of this, as the country's quick transition to online learning has brought to light a significant digital divide. This gap is not limited to problems with connectivity; it also encompasses differences in digital literacy, access to digital devices, and conducive learning environments, particularly in rural and impoverished metropolitan regions. As a result, a sizable fraction of students is in danger of falling behind, widening the nation's educational and socioeconomic divide. This study suggests using the Hybrid-Flexible (HyFlex) instructional design to combat the growing disparity. HyFlex is a blended learning paradigm that combines in-person and virtual instruction, giving students the freedom to select the method of instruction that best fits their unique needs. This strategy offers several avenues for educational participation, which is especially helpful in a multicultural environment like Pakistan. By guaranteeing accessible for students without dependable internet or digital devices, encouraging inclusion by adapting educational delivery to diverse requirements and circumstances, and increasing engagement due to its adaptable nature, the HyFlex model can successfully close the digital divide.

To address the issues caused by the digital divide, the HyFlex concept should be used in Pakistan's educational system. More research is required to assess the HyFlex

model's efficacy in closing the educational gap made worse by the epidemic and to adapt it to Pakistan's particular educational and cultural setting. With an emphasis on the challenge of the digital divide in Pakistan and an introduction of the HyFlex model as a potential solution, this condensed synopsis offers a coherent narrative of the issue and the suggested solution.

1.9 Research objectives

The objectives of the research will be:

1. To explore the HyFlex course model in Pakistani classrooms using TPACK Framework
2. To measure the effectiveness of the HyFlex course model through accessibility of the course, achieved learning outcomes, student learning motivation and the availability of hardware in the form of smart classroom technology (Kakeshita, 2021)
3. Propose an effective instructional technology in Pakistan to bridge the digital divide and increased access to course

1.10 Research questions

This research is based on following research questions:

1. Does HyFlex mode of instruction attain higher academic performance?
2. How satisfied students are with course in HyFlex mode of Instruction?
3. How effective HyFlex mode of instruction is in course effectiveness?
4. Does HyFlex mode of instruction affect hardware accessibility?

1.11 Research hypothesis

Hyflex course increases academic self-efficacy and task value among students with greater course satisfaction and availability of the hardware.

1.12 Conceptual Framework

This study is based on the following conceptual framework. Academic self-efficacy and task value are independent variables whereas Access to the course and availability of hardware technology, Course Satisfaction and Effectiveness of HyFlex course model are dependent variables

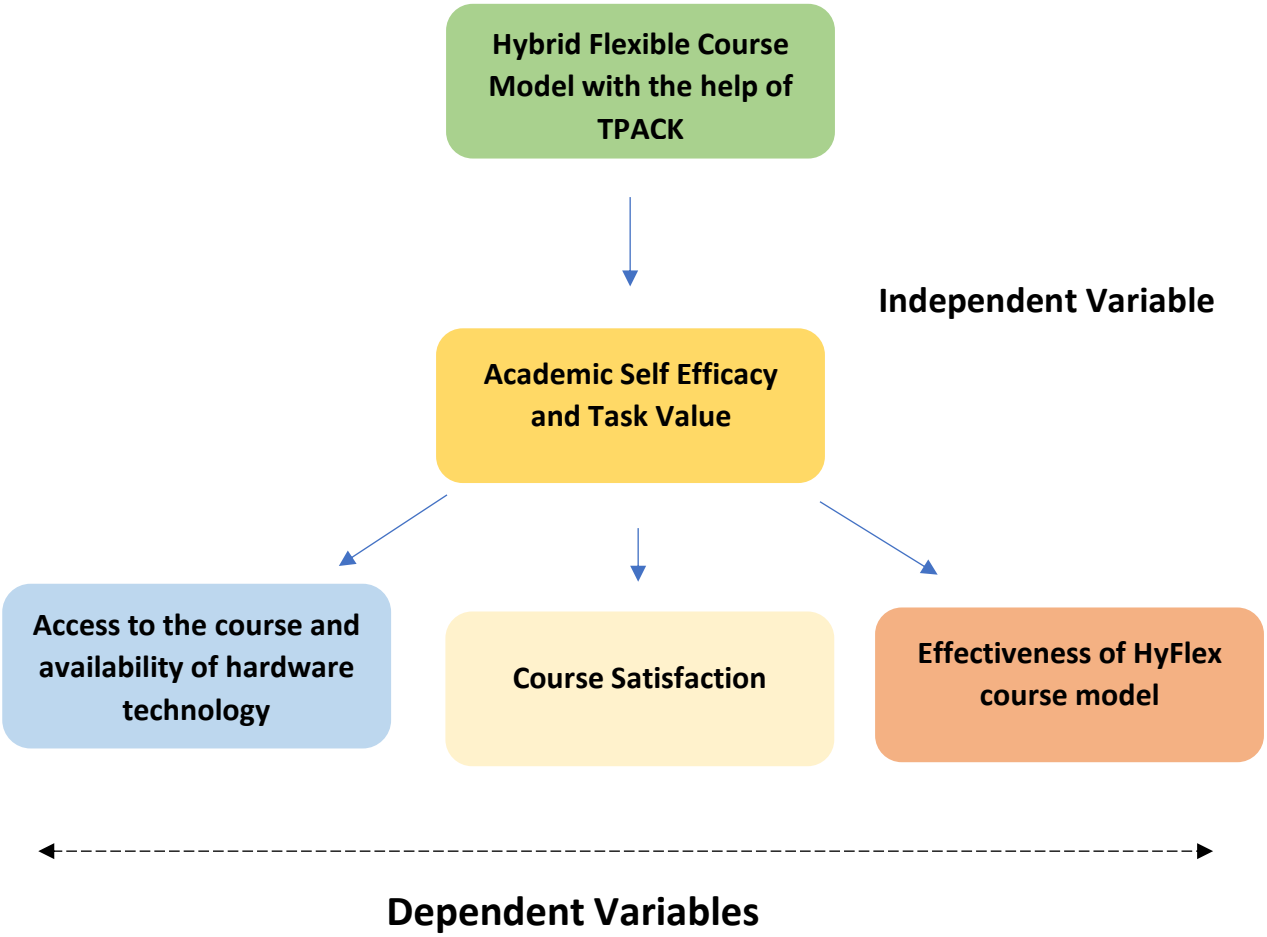

Fig 1.1: Conceptual framework

1.12.1 Academic Self Efficacy and Task Value

Academic self-efficacy is a person's confidence in their capacity to excel in the classroom. It is the conviction that a student has in their own capacity to study, comprehend, and excel in academic assignments. One of the most important indicators of academic motivation and success is academic self-efficacy. Students are more likely to work more, endure through challenges, and produce higher results when they have confidence in their ability to perform well on academic assignments. On the other side, task value describes how important and relevant a task is thought to be. It is a person's opinion about the value or practicality of an activity related to academia. Students are more likely to participate in and exert greater effort in a task when they believe it is significant and pertinent to their long-term objectives. Task value and academic self-efficacy have a complicated relationship, but in general, students who feel that a task is useful and have a high level of academic self-efficacy are more motivated and involved in it. They have a

higher propensity to persevere in the face of obstacles, which may improve their academic achievement.

In conclusion, task value refers to a person's perception of the value or usefulness of an academic task, and academic self-efficacy is a student's belief in their capacity to perform academically. Both are significant indicators of motivation and academic achievement, and students who exhibit high levels of both are typically more engaged and motivated in their academic work, which can improve academic success.

1.12.2 Access to the course and availability of hardware technology

Two significant elements that can affect the success of distant learning are hardware technology availability and course accessibility. When we talk about access to the course, we mean that students should be able to log in and use the readings, lectures, and assignments. Students will not be able to complete the assignments or participate in class if they do not have access to the course. This can be a major obstacle for students who don't have digital devices or internet access, or for those who live in distant places with spotty internet service. The term "hardware technology availability" describes the accessibility of digital devices—like laptops or tablets—that are required for students to access course content. Students might not be able to participate in online classes or finish homework without access to certain devices. For students from low-income families or those who live in isolated places without easy access to digital gadgets, this can be a major obstacle.

The availability of hardware technology and course access can have an impact on students' academic achievement and their capacity to engage in distance learning. Addressing these obstacles is crucial to ensuring that remote learning is inclusive and available to all students. This can be done by giving those who require it access to digital devices and internet connectivity, as well as by providing alternate ways for them to access the course materials.

1.12.3 Course Satisfaction

The term "course satisfaction" describes how happy students are with a specific course. It serves as a gauge for how effectively the course satisfies the requirements and expectations of the learners. A student's level of engagement and interaction with the

course, the effectiveness of the training, the caliber of the course materials, and the instructor's level of support are all variables that can impact how satisfied they are with the course. Student motivation, engagement, and academic achievement can all be impacted by course satisfaction, which is a crucial sign of the course's overall quality. Better academic results may result from motivated students who are satisfied with the course and are more likely to participate and finish it. One way to gauge student satisfaction with a course is by using focus groups, surveys, or student evaluations. With the use of these techniques, students can offer feedback on the course and teachers can pinpoint areas in which the course needs improvement.

The effectiveness of the training, the degree of involvement and assistance from the teacher, and the caliber of the online resources can all have an impact on how satisfied students are with their distance learning experience. It is crucial for instructors to create and deliver a course that is inclusive, interesting, and meets the needs of the students if they want to guarantee that the students are happy with the course. To make sure that students feel supported and inspired to finish the course, teachers should also offer sufficient assistance as well as frequent chances for contact and feedback.

1.12.4 Effectiveness of HyFlex course model

Numerous studies have looked into the efficacy of the HyFlex course approach, which blends online and in-person instruction. These studies have produced a mixed bag of results. While some have found no discernible difference between the HyFlex approach and traditional in-person or online education alone, others have indicated that the model significantly improves student engagement, motivation, and learning outcomes. The HyFlex model's ability to be flexible and meet the various demands of students is one of its key benefits. Students' motivation and engagement may increase when they are given the freedom to select the learning style that best fits their requirements and preferences. Furthermore, and this can be helpful during pandemics, the HyFlex model enables students to transition between in-person and online training based on their preferences or the circumstances. The HyFlex type does, however, also come with certain difficulties. The requirement that the instructor put in a lot of planning and preparation is one of the biggest obstacles. It takes a high level of skill and knowledge on the part of the teacher to develop and deliver the course in a way that is inclusive to all students, regardless of how they choose to attend. In order to enable online participation, the HyFlex model also involves

the use of technology, which might be a barrier for some teachers and students. Examples of this technology include online platforms, video conferencing, and collaboration tools.

In general, the environment and the particular model implementation determine how effective the HyFlex model is. The HyFlex model necessitates meticulous planning, preparation, and getting assistance from the teacher, in addition to having access to the required tools and technology.

1.13 Significance of Study

Pakistan has seen the emergence of a new form of social inequality known as the "Digital Divide," which is attributed to the shift in educational practices from traditional classroom settings to online learning environments. This study recommends a novel approach to instructional design, called HyFlex, to combat the nation's widespread inequity. Both instructors and students will benefit from this course approach, which allows for flexible scheduling that meets their needs.

Chapter 2: Theoretical Framework And Literature Review

2.1 Introduction

The theoretical foundations and a survey of pertinent material about the HyFlex (Hybrid-Flexible) form of instruction and its implementation in Pakistani classrooms are presented in this chapter. A growing number of people are realizing the potential of the HyFlex model, an educational strategy that blends in-person and virtual instruction, to meet the requirements and preferences of a wide range of learners. This chapter discusses the HyFlex model's theoretical underpinnings, looks at its local and global (Pakistani) implementation, and analyzes the model's problems and efficacy in relation to Pakistani education.

2.2 Theoretical Foundation

In recent years, distance learning has grown in popularity as a method of instruction. A flexible substitute for traditional classroom-based education is provided by distance learning, which is becoming more and more popular as people want to manage job, family, and other obligations. However, the underlying theories and principles that guide this method of instruction must be carefully considered in order for distance learning to be successful.

2.2.1 Social Learning Theory

Social learning theory is one of the most well-known theories that underpins remote learning. This theory holds that people pick up knowledge by seeing and imitating the actions of others. According to social learning theory, students can benefit from peer-to-peer learning through online discussion boards, group projects, and other social interactions when learning remotely. The social learning theory emphasizes the value of feedback in the learning process and recommends that teachers give students timely, helpful feedback in order to help them perform better.

2.2.2 Constructivism

Constructivism is another important idea in the realm of remote learning. According to this view, people build their own conceptions of the universe through their interactions and experiences with it. Constructivism advises educators to design learning spaces that promote inquiry, active learning, and discovery in the setting of remote learning. This could

entail utilizing case studies, simulations, and other interactive teaching tools that let students connect meaningfully with the subject being covered in class.

2.2.3 Cognitive Load Theory

Another significant theory in the area of distant learning is cognitive load theory. According to this hypothesis, learning occurs most effectively when an individual's finite capacity for information processing is not exceeded. Cognitive load theory recommends that teachers create learning materials for distance learners that maximize intrinsic cognitive load—such as by posing difficult problems or piquing curiosity—and minimize extraneous cognitive load—such as by streamlining complicated concepts or minimizing distractions. By doing this, educators can support students in processing and remembering the material they are learning more successfully (Dikmen & Demirer, 2022).

2.2.4 Self-determination Theory

Lastly, the theory of self-determination highlights the role that motivation and autonomy play in the process of learning. This hypothesis states that people who feel in control of and autonomous from their learning process are more likely to be motivated to learn. According to self-determination theory, teachers should allow their distance learning students the freedom to select their own learning activities, define their own learning objectives, and get feedback on their progress. Teachers can encourage students to feel more involved and invested in the learning process by doing this. To sum up, distant learning is an intricate and diverse approach to education that necessitates a close examination of the guiding theories and concepts. A selection of the several theories that can guide the development and implementation of remote learning initiatives include constructivism, social learning theory, self-determination theory, and cognitive load theory (Martela, 2020). Teachers can assist in developing interesting, successful, and fulfilling remote learning experiences for their students by putting these beliefs into practice.

2.2.5 Technology, Pedagogy and Content Knowledge (TPACK)

A framework known as Technology, Pedagogy and Content Knowledge (TPACK) highlights how to integrate technology, pedagogy, and content knowledge to support efficient teaching and learning. In order to create technologically advanced learning environments that enhance student learning and engagement, educators have come to widely recognize this framework (Koehler et al., 2013). The significance of comprehending

the connections among technology, pedagogy, and subject knowledge is emphasized by the TPACK framework. Fundamentally, TPACK contends that knowledge of how to use technology to improve the pedagogically sound delivery of subject matter knowledge is necessary for both effective teaching and learning. According to TPACK, successful technology integration necessitates both a thorough comprehension of the ways in which technology can be utilized to support particular pedagogical approaches and learning objectives as well as the acquisition of particular topic knowledge (Mishra & Koehler, 2006).

Pedagogical knowledge, as used in TPACK, is the comprehension of how to effectively and engagingly support learning. Understanding various teaching methods, learning theories, and assessment techniques may be necessary for this. Conversely, content knowledge denotes a profound comprehension of the subject matter being taught (O'Connor et al., 2023). This could entail having a solid understanding of the fundamental ideas, theories, and guidelines of a given subject of study. Lastly, knowing how to use technology to enhance teaching and learning is referred to as technological knowledge. Understanding various software programs, hardware components, and other technologies that can be applied to enhance learning may be necessary for this. The TPACK framework's emphasis on the value of teacher knowledge and expertise is one of its main advantages. Teachers need to have a thorough understanding of the subject matter in addition to knowing how to use technology to improve student learning in order to integrate it into teaching and learning. In order to effectively integrate technology into their teaching practice, TPACK encourages instructors to reflect on their own knowledge and skills and identify areas where they may require further development. The TPACK framework's emphasis on the value of cooperation and teamwork is another asset. A team-based strategy involving cooperation between educators, instructional designers, technology professionals, and other stakeholders is necessary for effective technology integration. In order to create technologically advanced learning environments that enhance student learning and engagement, TPACK places a strong emphasis on collaboration.

According to the TPACK framework, it is best to use certain technological tools (hardware, software, applications, associated information literacy practices, etc.) to guide and instruct students toward a deeper and better understanding of the material. As a result, the three knowledge categories—TK, PK, and CK—are integrated and recombined in various ways within the TPACK framework. Technological content knowledge (TCK)

describes the connections and intersections between technology and learning objectives, while pedagogical content knowledge (PCK) explains the same ties and interactions between pedagogical techniques and particular learning objectives. The links and interactions between certain educational practices and technology tools are described by technological pedagogical knowledge (TPK) (O'Connor et al., 2023). TPACK illustrates the links between the three regions and acknowledges that teachers are employed in this triangulated domains, then, comprise the complex environment.

To sum up, teachers who want to incorporate technology into their lessons can find great use for the TPACK framework. Through the emphasis on the connections among technology, pedagogy, and content knowledge, technology-rich educational environments (TPACK) offer a valuable foundation for creating learning environments that effectively enhance student engagement and learning. The TPACK framework will be an invaluable tool for educators who want to stay at the forefront of innovative teaching and learning as long as technology plays a significant role in education.

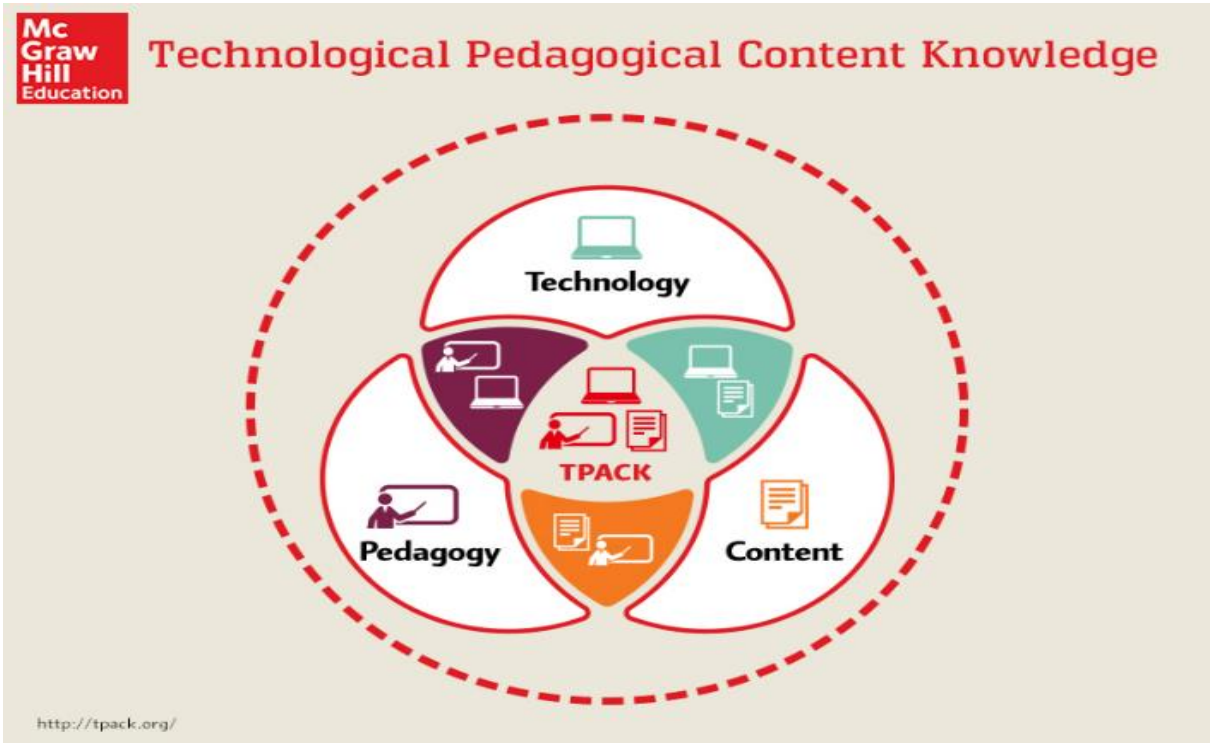

Fig 2.1: Technology, Pedagogy and Content knowledge (TPACK) framework

Source: McGraw Hill

2.3 Related Work on Selected Variables

An innovative approach to education that blends online and face-to-face (F2F) learning is the HyFlex course structure. With this teaching approach, students can take part in all learning activities and class sessions synchronously, asynchronously, or in person (Qazi et al., 2021). The HyFlex strategy seeks to give students autonomy, adaptability, and seamless participation regardless of where, how, or when they choose to participate in the course. Everyone can access learning, regardless of mode, according to the core tenet of the HyFlex paradigm. The primary goal of using flexible education in lieu of remote learning is to guarantee educational access while minimizing expenses and obstacles in day-to-day living (Ann et al., 2023). Teachers can also benefit from the HyFlex technique, despite it being mostly beneficial to kids. For example, some students might "attend" class with the lecturer virtually, while others might do so from a campus room. Beatty (2019). Teachers using this instructional technology must reconsider the way that kids learn and how they engage with information, teachers, and other students (Ann Miller et al., 2021). The curriculum is developed by the instructor and arranged to demonstrate the structure. Regardless matter how they choose to participate, all participants must have equitable access to the course materials, the instructor, and one another. To ensure that all students can hear verbal and nonverbal exchanges, effective utilization of classroom tactics and/or technology is essential. Lecture recordings can be viewed at a later time by distance learners in HyFlex courses, which often include an asynchronous component. Nonetheless, the primary objective of this instructional approach is to make distance learning just as engaging and participative as in-person instruction (Alvarez et al., 2023). Both audiences benefit from the emphasis on active learning in HyFlex courses, and the approach's adaptability ensures that educational quality is not compromised (Wright, 2016). The blended learning model that is recommended for use in postsecondary education is called "hyprhonous." According to Ambe et al. (2024), it combines synchronous, hybrid, and asynchronous processes.

HyFlex courses work well for a variety of learners, particularly those who are neurodiverse or juggling the responsibilities of a job or family. The method increases student engagement and success by granting them the freedom to select how they participate in class (Kakeshitta et al, 2021). Despite their preference, there are situations when students cannot attend in-person classes due to reasons. With HyFlex, students may access their classes from any location, eliminating the need for them to endure a lengthy

commute through congested areas. Additionally, it facilitates the management of unforeseen events like doctor's appointments (abdalmalak et al, 2018). Developed by Brian J. Beatty and others, HyFlex courses have been available since 2006. Even though the COVID-19 pandemic helped to keep teachers and kids safe, the strategy will still help schools meet the requirements of their students when the epidemic is ended. Four fundamental values—Learner Choice, Equivalency, Reusability, and Accessibility—are essential for HyFlex courses, according to Beatty (2019).

According to Miller et al. (2013), learner choice refers to a course's ability to offer relevant replacement involvement modalities so that students can select the one that best suits their needs. This value gives students the option to select the mode that best fits their learning style, acknowledging that not all students study in the same way (Beatty 2019). Equivalency indicates that while the modes are not equal, the learning outcomes they produce are. In order to learn, it is expected of all students to reflect, contribute to the development of concepts, and engage in peer interaction. This principle highlights that all students should have an equal opportunity to participate with the course material, even though the means of involvement may vary. It also emphasizes that the learning outcomes should be equivalent. (Beatty, 2019)

Reusability is the ability to save resources from educational activities in one mode and utilize them in another. All students have access to online versions of records of in-person class activities (discussion notes, recordings, etc.), and online students' own creations (asynchronous discussions, posted file kinds, etc.) connect and encourage all students. This value acknowledges the possibility of utilizing materials created in one mode to assist students in another, resulting in a more integrated learning environment. HyFlex training allows students to select the learning environment that best fits their needs and preferences by combining online and in-person instruction. Under what is known as a hybrid flexible style of instruction, students can alternate between receiving their education online and in person based on their choice or situation. The objective of this teaching approach is to foster a sense of community and engagement among students in the classroom while offering flexibility and meeting their diverse needs (Pedreira Junior & Pitombo, 2024). Whether in-person or online, the HyFlex model usually uses synchronous instruction, which has the class meet at a predetermined time. Nonetheless, based on their preferences, the students can choose to attend the lecture in person, virtually, or a combination of both. Because instructors must organize and deliver HyFlex courses in a

way that is inclusive of all students, regardless of their mode of attendance, a high level of planning and preparation is also necessary for them. To enable online involvement, technology is required, including internet platforms, video conferencing software, and collaborative tools. In reaction to the COVID-19 pandemic, hyflex education—which maintains in-person training but permits social distancing—was frequently implemented. Additionally, it enables students to engage in the class remotely even if they are unable to attend in-person classes for whatever reason, including health concerns (Wilson et al, 2021). Evaluations conducted in the HyFlex mode bear great significance. Students' psychological capacities are now improved through the use of digital exams.

Tonia J. Wilson and Melina Alexander carried out an exploratory case study to look at how students felt about and engaged in HyFlex course delivery. The backward design method was used in the creation of the curriculum for the classroom. This approach was used to create learning objectives, assessments for the classroom, etc. before creating an online version of the course. Positive results regarding the course's adaptability and increased student satisfaction were shown in the case study (Wilson et al., 2021). A set of circumstances and conditions, such as institutional standards, governing documents, etc., are called designs for learning and are used to create learning environments. The teacher's method, or the designs "in" learning, is influenced by the designs for learning. The study found that teachers selected their tactics based on the types of learning environments. In a HyFlex environment, there are three different instructor approaches: room-oriented, online and room-oriented, and room-oriented and online on-demand. Hyflex environments call for a deeper understanding of learning design. Although the HyFlex course allows students to select their preferred modalities of education, there are certain design considerations that must be made. For instance, consistent bandwidth and internet availability for students enrolled in synchronous courses. Five guidelines exist for creating a Hyflex course. Consider creating an asynchronous course and then incorporating elements of synchronous practices. Provide cooperative learning opportunities for students to help them feel like they belong. Take students' formative assessments at the end to make adjustments and improvements.

Belief in one's own ability to excel academically is known as academic self-efficacy. Students' ability to log in and access the readings, lectures, and assignments is referred to as their "access to the course." The ability of students to participate in distance learning and the impact it has on their academic achievement can be influenced by both hardware availability and course access. The degree to which students are satisfied with a

specific course is indicated by course satisfaction. The assessment gauges the extent to which the course fulfills the requirements and preferences of the learners (Du et al., 2023). Quality of the course materials, efficacy of the instruction, degree of involvement and engagement with the course, and degree of instructor support are all factors that might impact how satisfied students are with their courses (Athens et al., 2023). Numerous research studies have examined the efficacy of the HyFlex course concept, which blends online and in-person training. Some research indicates that the HyFlex approach is useful in improving student motivation, engagement, and learning outcomes. However, the results of these studies are not entirely consistent.

A remodeled Hyflex course outlay has been suggested by Tetsuru Kakeshita. Both forms of teaching (online and in-person) will be provided in this improved structure (Columbia Center for Teaching and Learning, 2020), and the students are encouraged to exercise flexibility while choosing their method of attending class. By doing so, several students will be able to complete their education while doing jobs and other important tasks on the side to be financially stable (Francisco and Barcelona, 2020). This model will require the staff to deliver the lectures simultaneously online and in-person. An on-demand online lecture will be recorded and uploaded by the teaching stuff prior to the classes, and students will be required to go through the material on their own time and then attend the classes to discuss the materials and ask any follow-up questions pertaining to the lecture. This will enable autonomy among students and induce sense of responsibility and accountability among them (Garrett, 2008). Moreover, as the educational institutions struggle with providing adequate support staff to each teaching personnel (McCallum, 2021), this model does not entail the requirement of additional support staff except a teacher with sound knowledge of the subject (Allen & Seaman, 2017). This will aid the cost reduction at an organizational level while upholding the quality of education provided to the students simultaneously (Columbia Center for Teaching and Learning, 2020).

Several strategies have been suggested over the years pertaining to enhance the classroom management. According to Lohmann, Randolph and Oh (2021), three main strategies while spearheading a hybrid class are teaching expectations, modelling the desired behavior, and provision of timely feedback.

Setting clear and concise expectations from the beginning of the course is imperative for establishing a safe and effective learning or e-learning environment (Sinclair et al., 2017). It has been shown through research that setting the expectations and enforcing them periodically reduces occurrences of negative behavior among students (Mastan et al.,

2022). The expectations can comprise of values that are important to the teachers, or the organizational values of the school. No matter what the expectations are comprised of, they should be communicated in a manner that is positively enforcing (Gellerstedt et al., 2018). For example, they should focus on the DOs (e.g.: show up on time; wait for your turn to speak, etc.) and not the DONTs (e.g.: Don't be late; don't use mobile phones in class, etc.). Furthermore, the expectations should be clearly, operationally and sufficiently explained to the students (Marsh and Roche, 1997). For example, instead of telling them to "be polite", telling the students to raise their hands and wait for them to be attended by teachers is more precise. Lastly, to avoid saturation and for the students to easily remember the expectations throughout the academic year, the number of expectations should be kept to a minimum of three to five.

Another proposed effective strategy is modelling of the desired behavior by the teachers in front of the students. Modelling the behavior traits that are aligned with the expectations are proven to be more effective among students. For example, if teachers want a decorum of respect to be followed in the class such as not talking over their peers and waiting for their turn to speak, they must first practice not speaking out of turn in front of students. Similarly, if they prefer their students to not chew chewing gum in class, they must refrain from doing so themselves. In Hyflex classrooms, if teachers want their students to show up on time online, they must practice this themselves and be present before the classes start as well.

The last strategy in the trifecta but certainly not the least is the provision of feedback. When teachers witness their expectations and modelling behaviors are not yielding the expected behavioral outcome from the students, they should have a predetermined course of action to put into play. For the purpose of efficiency, teachers must have predetermined communication plans for acknowledging and appreciating the display of desired behavior among students; for facilitating corrective plan of action when students display incongruent behavior; and a response hierarchy that determines the path teachers will take if the negative behaviors are repeatedly occurring among students. To provide constructive criticism, it is recommended that teachers should keep the ratio of 4:1 for positive to negative statements pertaining to the specific or general behavior of the student (Weaver, 2006). Additionally, teachers should use Behavior Specific Praise (BSP) as it has been proven to increase the likelihood of students displaying the said behavior again in future. An effective online tool used for conducting and attending online classes is Flip grid. An online audio/video-based tool developed in 2014, it is used for discussing,

presenting, reflecting, and field-based learning, among others. A study conducted by Keiper et al. (2020) studied the efficacy of Flip grid in HyFlex classrooms and found that it had majority of the votes in favor from students as it provided various uses. Through its community creation and prompted engagement grounded in the theoretical frameworks of Situated Cognition Theory (STC), it was suggested that Flip grid is significantly useful in HyFlex classrooms as it is effective in engagement and retention among students.

A study conducted by Wilson and Alexander (2021) to assess the perception of students pertaining to the flexibility and quality of education provided in HyFlex course found positive correlation among students pertaining to the remodeled course. The curriculum was designed using the backward design method, where the learning objectives and classroom assessments were designed before the online classes were recorded. The outcome suggested positive response from students irrespective of their age for the purpose of continuing their further education and gaining licenses while acquiring quality education on their own flexible schedule.

The research conducted by Leijon and Lundgren (2019) focused on the interaction within physical and virtual spaces in the sector for higher education. It was found that different types of spaces emerge when physical and online classes are blended together. The spaces are placed in the following category: representational, liminal, interactional, and physical. Each space has a designated design for learning that must be followed by teachers to facilitate effective learning and achieve the targeted learning outcome.

Exploratory research by Kohnke and Moorhouse (2021) observes the experiences of nine postgraduate students who underwent HyFlex course for a duration of six weeks. Following the observance, six themes were identified in the thematic map: communication challenges, video conferencing software, determination and affinity to attend HyFlex course in the future, flexibility, return to normalcy, and active involvement in the process of learning. While HyFlex is certainly proving to be a useful model during changing times, it is majorly dependent on a stable internet connection to ensure that the student has access to the learning content from the comfort of their home. Additionally, it increases the already existing workload for teachers, for now they have to prepare one lecture twice (one for in-person classes and another for online classes). Additionally, the students might feel isolated socially while learning their modules online. A suggestion to tackle this is to design exercises that foster collaboration among students regardless of their chosen mode. Last but not the least, as HyFlex is still a work in progress, it is imperative that feedback from

students, parents, and the involved bodies are taken into account when making changes for enhancement and improvement.

Another study by Athens (2023) explored how HyFlex model benefitted the students of an open university enrolled in a four-year qualification course. The students were given the choice to attend their classes as per their preference and convenience. This also gave an opportunity to research how self-regulatory, motivational, and contextual variables impacted and influenced the choice of students. The results showed that 70% of students decided to attend classes online and they made this decision based on the convenience, choice, and the time efficiency that this option provided them. They were also satisfied with the quality of connection with their instructors during this phase. The students were less satisfied with their peer connections, flexibility between the attendance modes, and the technology quality that they were provided with. Overall, for 2020 and 2021 terms, students performed adequately in the HyFlex course with pass rate of 88% and withdrawal rate of 2%. The study also showed that the students who opted for flex mode were enrolled in the first academic year and lived more than 15 miles away from the campus. interestingly enough, first year cohort also comprised majority of the population who failed (Aydemir et al., 2015).

Another study conducted qualitative analysis on 18 students who attended HyFlex mode for one semester to learn web programming. It was found that due to the flexibility provided by the HyFlex, various academic needs of the students were satisfied. It was also found that HyFlex positively impacted the participation and equity among students. However, as with several other studies, it also highlighted how this model was heavily dependent on technology and stable internet connection to be successful (Gomm, 2008). This exploratory study takes experiences of nine post graduate students who toke hyflex course for six weeks. In this study five themes were identified in the thematic map; communication challenges, video conferencing software, motivation to attend HyFlex course in the future, flexibility and return to normalcy and being actively involved in learning.

2.4 Summary

With the HyFlex course model, which combines in-person and online instruction, students can participate in class in three different ways: synchronously, asynchronously, or in person. This structure is made to guarantee similar educational opportunities regardless of how participants choose to participate. Its approach, which makes education accessible

and flexible to meet individual needs, is centered on the importance of learner autonomy, adaptability, and persistent involvement. Researchers like Kohnke et al. (2021), Beatty (2019), and Ann et al. (2023) have emphasized the importance of learner choice, equivalency in learning outcomes, reusability of instructional materials, and accessibility as fundamental components of the HyFlex paradigm. These guidelines guarantee that students have access to common learning resources, may select their preferred form of engagement, and obtain comparable educational experiences in all modalities. During the COVID-19 epidemic, the concept proved very helpful in providing a flexible and safe learning environment. It has helped not just kids who study traditionally but also pupils who are neurodiverse and those who are juggling work and home obligations. Kakeshitta et al. (2021) and abdalmalak et al. (2018) have observed that higher student engagement and satisfaction can be attributed to the flexibility offered by various learning formats.

Research on the HyFlex model has shown that having access to technology and having academic self-efficacy are essential for successful involvement in distant learning. The efficiency of instructional tactics, the caliber of the course materials, and the degree of instructor support have all been connected to course satisfaction (Du et al., 2023; Athens et al. Ensuring consistent internet connectivity, managing instructors' increased workload, and reducing the risk of social isolation for online learners are among the challenges associated with putting the HyFlex model into practice. In order to improve student engagement and retention, the model calls for careful planning and preparation, as well as smart classroom management and the use of efficient online tools like Flip grid.

2.5 Conclusion

In conclusion, the HyFlex course style proves to be a flexible and successful method for addressing a range of student requirements while upholding rigorous academic standards in the modern classroom. Its effectiveness, though, depends on meticulous preparation, the integration of technology, and constant modification in response to instructor and student input.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Research design

This study used a survey method to collect data and had a descriptive, quantitative design. Strongly disagree, agree, neutral, disagree, and disagree were the five possible responses on the Likert scale used to develop the survey. With the authors' consent, four survey questionnaires from previously published research publications were used for each variable. Each of the four subcategories of the survey measured one of the following variables: hardware accessibility, student happiness, effectiveness, self-efficacy and task value, and hardware. Pakistani university students from both public and private institutions filled the survey, which consisted of seven or eight questions per category. For structural equation modeling (SEM), the analysis was performed using SPSS AMOS.

3.2 Sampling Technique

The study's population consists of Pakistani undergraduate university students. The data for this purposive sample was gathered from the public university Pak-Austria Fachhochschule Institute of Applied Sciences and Technology in Haripur. Newports Institute in Karachi; National University of Science and Technology (NUST), Islamabad; and Shaikh Ayaz University, Shikarpur, Sindh. Three hundred pupils made up the sample. The selected colleges were selected due to their hardware technology for Hyflex course models and their ability to serve the several areas of Pakistan, namely Southern Sindh, Northern Sindh, Federal Capital of Pakistan, and Khyber Pakhtunkhwa.

3.3 Instrumentation

A five-point Likert Scale survey has been conducted from the sample and data has been analyzed on the Structural Equation Modelling.

Link to the Survey:

https://docs.google.com/forms/d/e/1FAIpQLSejE8PEIEmgIUP7XKA6wDQkBemaTw_F2pozKEjURGR8DOBUfQ/viewform?usp=sf_link

Table 3.1 Data Collection: Below is the descriptive table of data collection through the survey.

Number of respondents from The Shaikh Ayaz University, Shikarpur	50
Number of respondents from Pak-Austria Fachhochschule Institute of Applied Sciences and Technology	100
Number of respondents from National University of Science and Technology	100
Number of respondents from Newports Institute of Communications and Economics	50
Total respondents	300
Number of male respondents	216
Number of female respondents	84

72% of respondents were male and 28% were female. 33% of the sample respondents were from Pak-Austria Fachhochschule Institute of Applied Sciences and Technology and the same percentage of 33.3% were from National University of Science and Technology. 16.6% respondents were from The Shaikh Ayaz University, Shikarpur and the same percentage were from Newports Institute of Communications and Economics.

3.4 Validity And Reliability Of Each Of The Tools

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)

While Fleiss (1986) and Cicchetti (1994) presented ranges defining good and outstanding reliability, Nunnally (1978) advocated 0.7 as a minimal threshold for fundamental research. In their 2015 study, Portney & Watkins classified data as follows: 0.5–0.75 = "poor to moderate," 0.75–0.9 = "good," and >0.9 = satisfactory for clinical assessments. The range established by scientists and specialists indicates that the instruments used in this study are good, with outstanding validity and reliability (Dai, 2021).

3.5 Ethical Considerations

The study ensured ethical compliance by using survey tools with the original authors' permission. Data confidentiality and its use strictly for academic purposes were also emphasized to protect participant privacy.

3.6 Summary

This study used a quantitative and descriptive methodology, utilizing a survey method with 5-point Likert scale questions that were approved from earlier research. Students from several universities in Pakistan were given the survey, which focused on hardware accessibility, student satisfaction, effectiveness, and self-efficacy and task value. SPSS AMOS was used for structural equation modeling (SEM) analysis. Using purposive sampling, the study selected 300 undergraduate students based on their technological readiness and geographic diversity from the following institutions: Pak-Austria Fachhochschule Institute of Applied Sciences and Technology, Haripur; National University of Science and Technology (NUST), Islamabad; Shaikh Ayaz University, Shikarpur Sindh; and Newports Institute, Karachi. 28% of respondents were women and 72% of respondents were men. According to standards established by a number of experts, including Nunnally, Fleiss, Cicchetti, and Portney & Watkins, the survey instruments' validity and reliability were verified as good to exceptional. The survey instruments were utilized with authorization, and the data was kept strictly confidential and used only for academic reasons. All ethical issues were carefully followed. The study's methodological robustness and academic integrity are guaranteed by this approach.

CHAPTER 04: ANALYSIS & DISCUSSION

The survey conducted from various universities of Pakistan was run on SPSS for Exploratory Factor Analysis (EFA) and Analysis of Moment Structures (AMOS) for Structural Equation Modelling (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). The chapter that looks into and discusses results is the vital core of this study. It tries to understand the challenging parts hidden in the data collected from different university students all over Pakistan. This study's primary focus is on how Academic self-efficacy and Task Value work together as separate things that can change and impact critical things like being able to take the course and having the right equipment for it at hand. Satisfaction with what students learn during this kind of class or program is also an essential factor covered in this research, along with whether the HyFlex teaching style works well when all these factors come into play and will be successful based on their relationship. In trying to figure out the complex parts of how things connect in education, the study used SPSS for numbers and stats. The study also looked at AMOS, which helps show complex structures. Using SPSS and looking at the numbers in detail again, the study tried to find out the connections between how sure students feel about their abilities in school work and its worth concerning accurate results like getting into different classes, having enough devices such as computers or tablets available when they need them most, feeling good throughout all these experiences what could make this even better? This type of schooling is also called HyFlex.

At the same time, the study used AMOS's power for structural equation modelling (SEM) to understand better the basic structures controlling what the study observed. This high-level analysis tool made it easier to judge how well the model worked and showed the complex paths and links between the things the study looked at. As the study goes through the maze of numbers in this study, the chapter will clarify the story hidden within these facts. It will give a deep look and helpful discussion that cuts apart what's essential by chance and shows how it might matter in real-life situations for future searches. The following parts will scrutinize the results, showing a mix of complex numbers and a deep understanding of the changing forces shaping Pakistan's modern education scene.

4.1 Data Analysis Steps

The data was analyzed on SPSS AMOS in three steps which are given below:

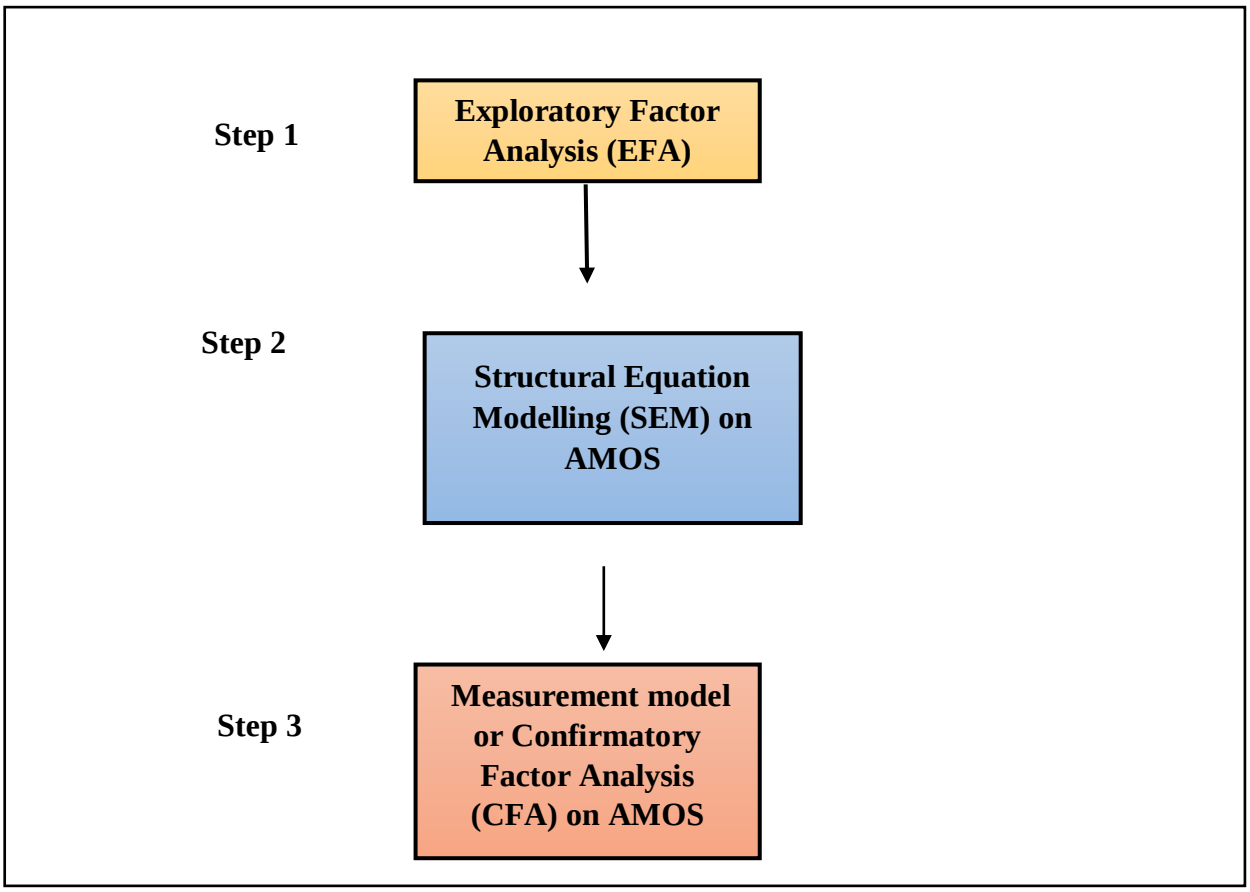

Fig 4.1: Data Analysis Steps

Step 1: Exploratory Factor Analysis (EFA)

Initially, the analysis used Exploratory Factor Analysis (EFA) to identify essential parts from the data the author gathered. This step tried to lower the data size and find hidden things linked with how much a person believes in their skills to do well academically and the value they place on completing school tasks. Before doing the EFA, the author ensured there were no missing values or strange data points in the dataset. This was done to check that the data could be used for factor analysis correctly. The factors linked to belief in one's school abilities and the value of the work were chosen for this step.

Using the right way to get details out (like Principal Component Analysis or Maximum Likelihood), the researcher got critical points based on how different items

relate. The number of parts was found using self-values, view screen checks and easy understanding of the factors.

To make the factors easier to understand, we used a method that rotates them straight or diagonally. This step was taken to make the factor arrangement easier and more understandable. The researcher looked at factor loads, shared features and structure to understand the meaning of each part. The factors were named after the things that showed a lot of weight, which pointed to the main ideas of how well someone considers what they can do in school and why they think it's essential.

Step 2: The use of AMOS to do Structural Equation Modelling (SEM)

The author built a theory model using the ideas learned from the EFA. The links between belief in one's academic skills, how important someone sees a task to be and things like being able to open the course on a computer or use other equipment related to it, liking of said lessons, plus if these make sense for evident in the study model. The made variables work Inside the AMOS system by setting the measuring signs for each hidden idea and the straight paths linking them. The author used the right ways to figure out the SEM model (like Maximum Likelihood). Then, the researcher looked at different scores (like Chi-square, CFI, and RMSEA) to check how well the model matched what was observed in real life.

Step 3: Measurement Model or Confirmatory Factor Analysis (CFA)

Measurement Model or Confirmatory Factor Analysis (CFA) is a way to test if the factors or parts in a measurement tool exist. It helps to understand how well our measures, like surveys or questionnaires, work and if they give reliable results. CFA can also show any changes needed to improve such tools for future use. The researcher did a Confirmatory Factor Analysis (CFA) to check if the measurement model obtained from the EFA and SEM was valid. This step was made to check that the chosen measurement signs showed the hidden ideas well.

The CFA model copied the hidden ideas shown in the EFA and SEM. The loading of each thing on its factor was limited, following the structure set in previous tests. The CFA model was checked using fit signs like CFI, RMSEA and more. A properly working model showed that the chosen signs were good enough to measure what they were designed

for. If the first CFA model did not work well, the researcher looked at modification indices to see how to improve it (Savalei, 2021)S. Changes like allowing similar errors to occur or removing some restrictions on words were made cautiously. These straightforward steps in checking information were made to be sure to get how to believe in yourself for school work, thinking it is essential, and what they rely on are linked. The person doing the study made a plan, starting with taking critical points from the info and then using statistics to see if their idea was right. 4.2 variables

4.2 Variables

The study examines two things that can change: belief in success at school work and its importance. Academic Self-efficacy is when people think they can do well in school tasks and reach their desired goals.

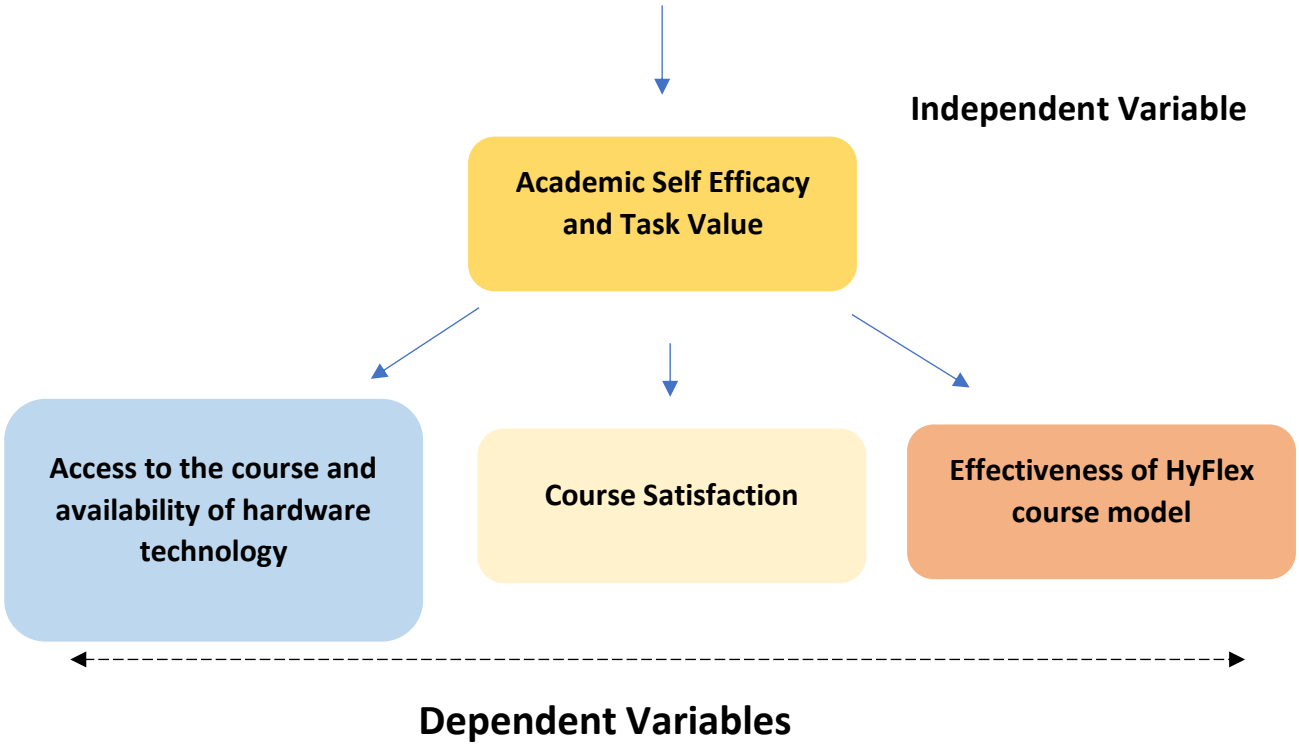

Fig 4.2: This figure shows dependent and independent Variables

This setup works by using a range or group of questions to test how much students believe in their study skills and think they can handle school tasks well. Task Value, in simple words, is how much people think and relate to school work. It includes the inner and outer worth linked to participating in learning activities. It is figured out by using things that look at how students see the importance, fun and link to their school work. The things we are

studying in this study include getting to the class, having tech tools ready and working, how much people like the course and if our way of teaching works well. Getting into the class, participating in it, and going through the coursework are all part of how easily students can access their school subjects. It thinks about getting there in person, using the right tools and how easy it is to follow the rules. We check this by seeing how easy students think it is to get and use course materials, online help, and the general ease of dealing with study stuff. This means it is easy for students to get the tools and machines they need to participate well in their school work. This is studied by using things that check what students have and can use, like computers, laptops, tablets, and internet connection.

Course Satisfaction shows how happy students are with their school classes overall. This covers many parts, such as how things are taught, what is being learned and the whole learning process. We check if students are happy with their courses by asking them to rate different parts based on their feelings. At last, the HyFlex Course Model's power checks how well and fast the mix of flexible styles gives out learning works. This changeable looks at what students think about how well this teaching method can be used and works. We check with things that ask students what they think about how well the HyFlex system works. This includes whether it meets their learning needs, gives them room to make changes, and boosts educational results. These factors make the base for studying the tricky changes in students' school experiences in Pakistan's higher learning environment.

4.3 Statistical Package for the Social Sciences (SPSS) Analysis of Moment Structures (AMOS)

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).

4.3.1 Measurement Model

The measurement model measures the relationship between the variables and their measures.

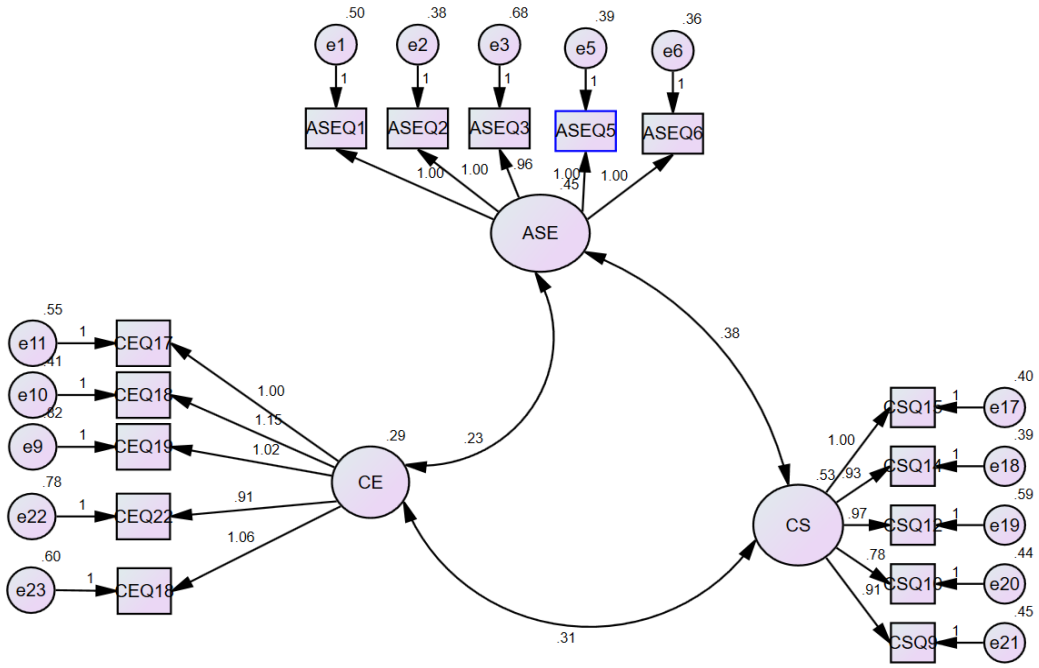

Fig 4.3: The model fitness of the measurement model presents the baseline comparison as following:

Table 4.1 Baseline Comparisons

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
Independence model	.000	.000	.000	.000	.000

The bigger Tucker-Lewis Index (TLI) 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). An acceptable fit is in question provided that Comparative Fit Indices (CFI) value is larger than 0.95 (Schermelleh-Engel and Moosbrugger, 2003). This measurement model has TLI of .907 and CFI of .923. This indicates the measurement model has acceptable TFI and CLI values.

In studying structure and model fitting, the study has used many fitness measures to check if different models can correctly explain the data. The fit measures here are the

Normed Fit Index (NFI), Relative Fit Index (RFI), Incremental Fit Index (IFI), Tucker-Lewis Index (TLI) and Comparative Fit Index (CFI). For the basic plan, which shows the thought-up study structure, NFI is 0.875. This means the model it stands for does about 87.5% of the change in real-seen data. The RFI, which shows how much better the fit is than a model that assumes independence, is 0.849. The IFI, showing how much the fit improves over a primary or independent model, is 0.924. Delta1 and Delta2 are not the same in regular or separate models for NFI and TLI, but rho1 and rho2 do change them. Going to the entire model, where all parts are fully guessed, every measuring tool works perfectly with a score of 1.000. This shows a perfect match, as study would expect in a full model without any forced limits. The idea that no variables are linked, which the independence model assumes, gives fit numbers at their lowest values (0.000). This is a starting point to judge how well or poorly other models compare. Together, these fit measures give a full review of how well the stated models match up with the observed data.

Table 4.2 Root Mean Square Residual (RMR) and Goodness of Fit Index (GFI)

Model	RMR	GFI	AGFI	PGFI
Default model	.053	.912	.878	.661
Saturated model	.000	1.000		
Independence model	.314	.341	.247	.298

The fit scores for the defined models give a way to understand how well they match up with the data we have seen. The standard case shows that RMR or Root Mean Square Residual is at 0.053. This means there's only a little difference between what has been viewed and what was estimated in terms of covariances. The GFI, a measure that tells that how well the model fits the data, is at 0.912. This means almost 91% of the differences study see in measured measurements can be explained using this model. The Adjusted Goodness of Fit Index (AGFI) shows that the GFI is 0.878 after changing how many parameters were guessed. The Parsimonious Goodness of Fit Index (PGFI) is 0.661, checking if the model fits well while considering its simplicity. These numbers together show a pretty good match for the standard model, with RMR saying there's not much left to understand and GFI plus AGFI getting close to 1.000, meaning most of it has been figured out. The complete model, where all factors are openly guessed, shows a spot-on match with RMR at 0.000 and GFI at 1.000.

On the other hand, if we suppose there are no ties between the different factors in the study, a model of this kind will show weak fit scores. For example, RMR is given as 0.314, and GFI stands at 0.341, while AGFI only records 0.247, with PGFI being slightly better at 0.298.

Table 4.3 Root Mean Square Error of Approximation (RMSEA)

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). RMSEA value smaller than 0.05, it can be said to indicate a convergence fit to the analyzed data of the model while it indicates a fit close to good when it produces a value between 0.05 and 0.08. 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. The default model's Root Mean Square Error of Approximation (RMSEA) is 0.070, with a 90% confidence interval range from 0.058 to 0.083%. A lower RMSEA number shows a better fit, and the range gives a reasonably precise estimate. The Probability Close (PCLOSE) number is 0.004, showing that the null hypothesis of close fit cannot be accepted, indicating a meaningful fit for the default model. On the other hand, the model where things are separate has a much bigger RMSEA of 0.230. Its confidence range goes from 0.220 to 0.240, and its PCLOSE number is 0.000, which shows a poor fit for this model. These findings show that the default model fits the data better than the independence model. This is clear from having a smaller RMSEA measure, narrow confidence interval and higher PCLOSE number, which means it fits well enough.

4.3.2 Structural Equation Modelling (SEM) Model

Structural Equation Model is an analysis technique of analyzing the relationship between multiple variables.

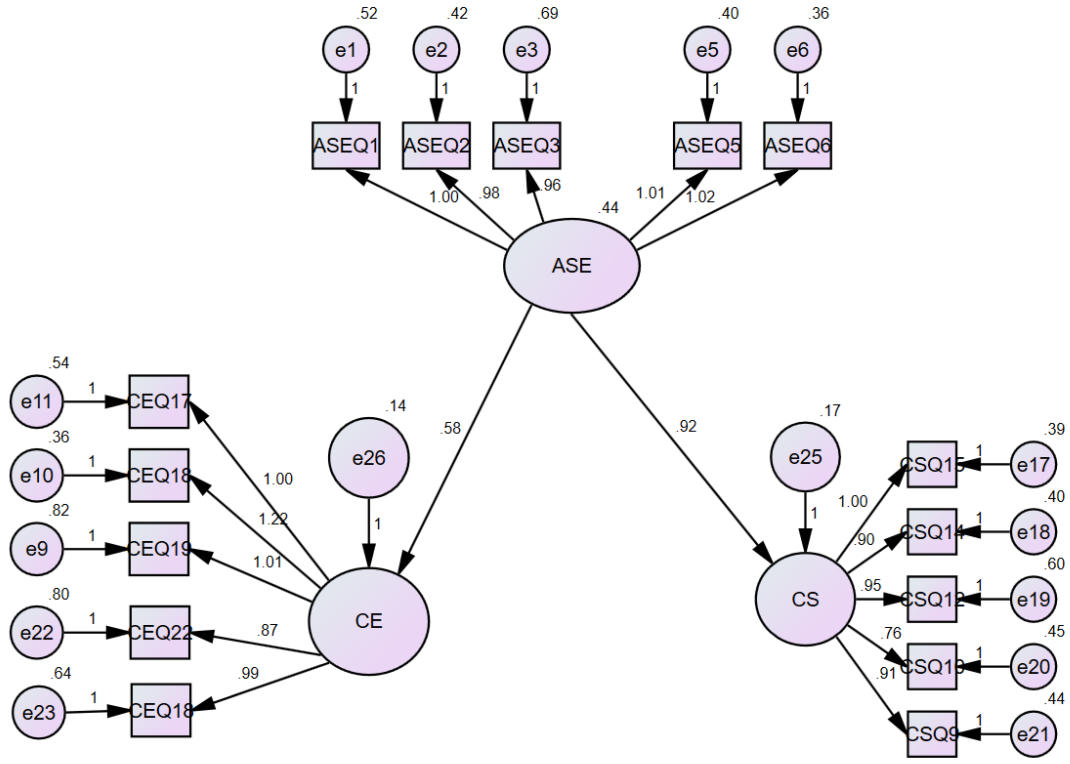

Fig 4.4: This figure shows Structural Equation Modelling (SEM) of the relationship of the variables; Course Effectiveness (CE), Academic self-Efficacy (ASE) and Course Satisfaction (CS).

Table 4.4 Root Mean Square Error of Approximation (RMSEA)

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.080	.068	.092	.000
Independence model	.230	.220	.240	.000

The RMSEA of 0.08 of the SEM put the model in good fit. The default model's RMSEA is 0.080, with a confidence interval of 90% going from 0.068 to 0.092. The Probability Close (PCLOSE) number is 0.000, showing that the researcher cannot accept the null hypothesis of a good fit. These findings show that the default model does not match the observed data very well, as shown by the relatively high RMSEA and the rejection of the hypothesis of close fit. The independent model also has a big RMSEA of 0.230 and a PCLOSE value of 0.000, making the model's poor fit stronger and showing no relationships

between variables. These results show that the default model cannot fully explain the observed data.

Table 4.5 Baseline Comparisons

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 numbers that show how well the picked models explain the data observed give an idea of whether they are good enough. The default model shows NFI values at 0.852, RFI at 0.823, IFI at 0.900, TLI at 0.879 and CFI at 0.899. While these numbers are a good fit, they are not ideally in line. On the other hand, the saturated model, where all values are allowed to be tested freely, gives the optimal fit with scores of 1.000 on all tests. However, assuming no relationships among variables, the independence model gives minimum fit scores of 0.000. This shows that using a default model with set relationships between variables is essential when explaining what is observed instead of having no specified relationship model. Even though it is not perfect, the default model shows a good fit according to these measures. This highlights how well it can understand the main pattern in the given data.

4.4 Survey Results

The results on the SPSS AMOS shows that the model has good fit based on the cut off criteria. The survey had measured various variables as discussed each below in detail:

4.4.1 Academic Self-efficacy and Task Value:

This variable measured the students opinion on the academic efficiency and the value of task through Hyflex course in the classroom. The results to various questions in percentages are shown below:

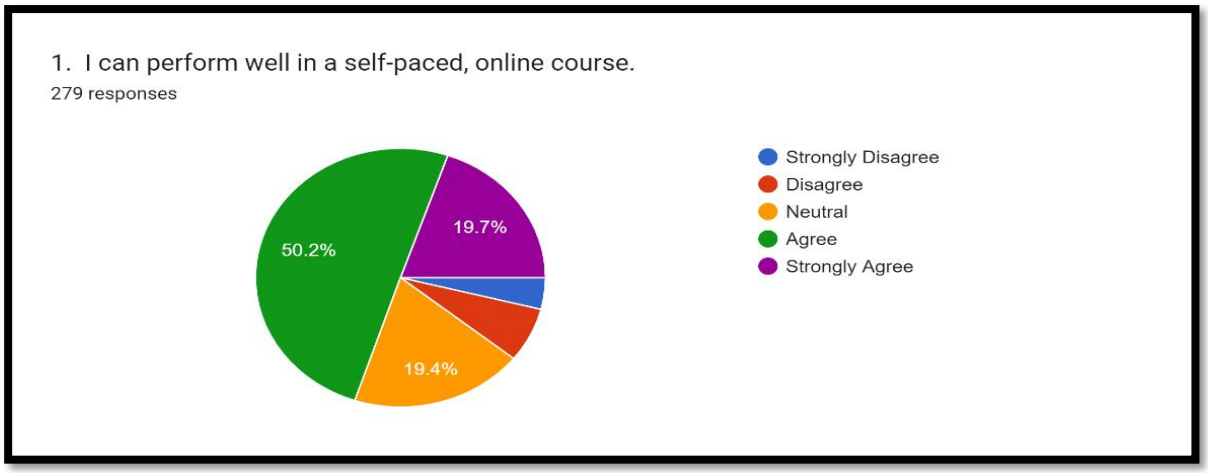

Fig 4.5: Graphical representation of responses collected to the question on performance in self-paced course

Almost 70% of the students said they can perform well in self-paced online course. As Hybrid Flexible mode suggests a self-paced courses.

Implications of High Confidence in Self-Paced Learning:

1 Responsibility and Autonomy: Students who exhibit confidence in self-paced online courses appear to be at ease with a high level of independence. This entails time management, determining their own speed, and accepting accountability for their education.

2 Adaptation to Diverse Learning demands: The HyFlex approach is successfully meeting a variety of learning demands, as seen by the favorable reaction to self-paced learning. This mode is helpful for students who need to balance their studies with other responsibilities or who wish to take their time understanding complex concepts.

3 Digital Literacy and Engagement: Students who succeed in self-paced online courses must also possess a certain level of digital literacy. It implies that students are interested enough to learn on their own, in addition to being capable of using digital learning environments.

4 Potential Difficulties and Support Networks: Although most students are self-assured, a sizeable minority may find it difficult to learn at their own speed. This emphasizes how crucial it is to have strong support systems in place, like peer

support networks, academic assistance, and easily accessible resources (Mozhaeva et al., 2014).

5 Feedback and Iterative Improvement: Teachers should be motivated to keep improving their self-paced courses because they are so confident in them. The effectiveness of self-paced learning can be increased by customizing course materials and teaching tactics in response to regular feedback from students.

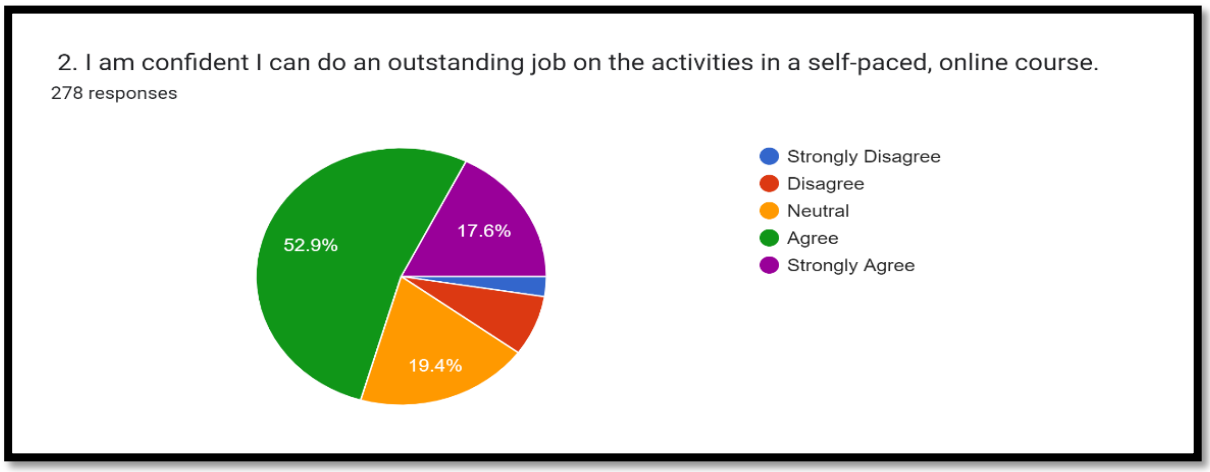

Fig 4.6 Graphical representation of responses collected to the question in performance on activities self-paced course

Almost 70% of people said they really believe or fully believe that they can do well in online courses at their speed using the HyFlex plan. On the other hand, 19% did not have a strong opinion on whether they thought they could do very well in self-guided activities done over the Internet.

1. Self-Directed study Skills: The high confidence indicates that a significant percentage of students believe they possess the time management, self-discipline, and motivation skills needed for self-directed study.
2. Positive View of the HyFlex Model: This response also shows that people have a positive opinion of the HyFlex model, which suggests that the program is thought to be helpful and efficient for self-paced online learning.
3. Adaptability and Flexibility: Students that value flexibility and control over their learning pace seem to connect well with the HyFlex model, which gives them the option of synchronous online, asynchronous online, or in-person instruction.

4. Digital Competency: The participants' assurance in self-paced online courses suggests a certain degree of digital literacy and familiarity with online learning environments.

5. Uncertainty Regarding Self-Paced Online Education: On the other hand, the observation that 19% of participants are unsure about their capacity to succeed in online self-guided activities draws attention to an alternative facet of the learning process:

6. Insecurity or Lack of Experience: This ambivalence may result from a lack of knowledge regarding self-paced online learning or concerns about one's ability to adjust to this type of instruction.

7. Need for More Support: This group could need some extra help and materials, such workshops on study techniques, orientations to online learning environments, or more interactive features in online classes.

8. Diverse Learning Preferences: It also emphasizes how different people have different learning preferences and how crucial the HyFlex model is in providing a variety of learning options to meet the needs of various learner needs.

9. Potential for Course Design Improvement: There may be space for improvement in the way these courses are created and delivered, as seen by the sizeable portion of students who are skeptical of how well they would perform in self-paced online learning.

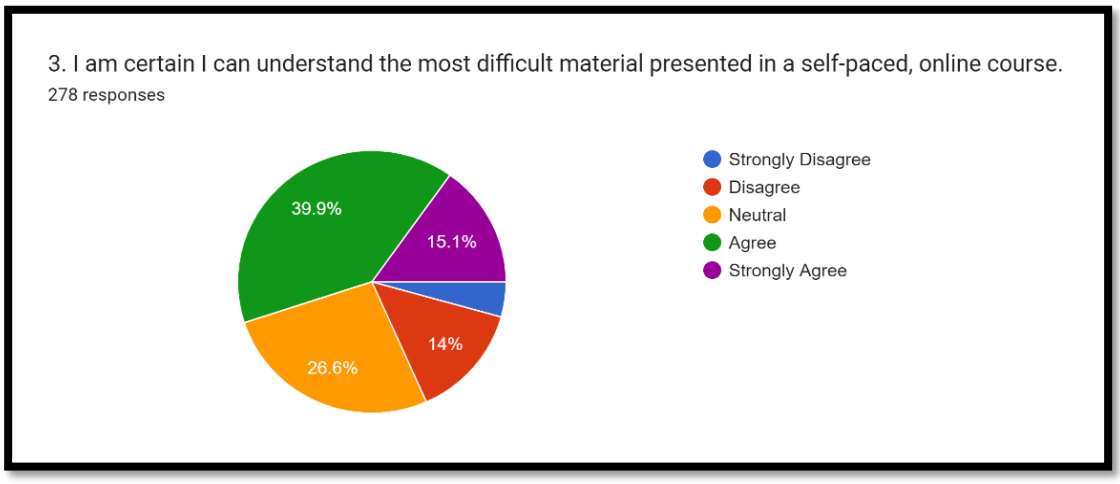

Fig 4.7: Graphical representation of responses collected to the question on difficult presented in a self-paced course

The question of understanding the most difficult material presented in self-paced online course; 55% students responded with agree & strongly agree and 14% responded with disagree. The result show that majority of students agree with the statement in the question. This is a significant insight for several reasons:

1. Effectiveness of Course Design and Materials: Based on the positive feedback, it appears that even in the absence of immediate teacher help, the design and materials of self-paced online courses are capable of effectively communicating difficult ideas.
2. Student Autonomy and Resourcefulness: This measures how well students can use resources like online forums, taped lectures, and supplemental materials to explore difficult subjects on their own.
3. studying Environment Suitability: The answer casts doubt on the idea that complicated and tough subjects are best taught in conventional, instructor-led settings by implying that a self-paced online environment can be appropriate for studying such material.

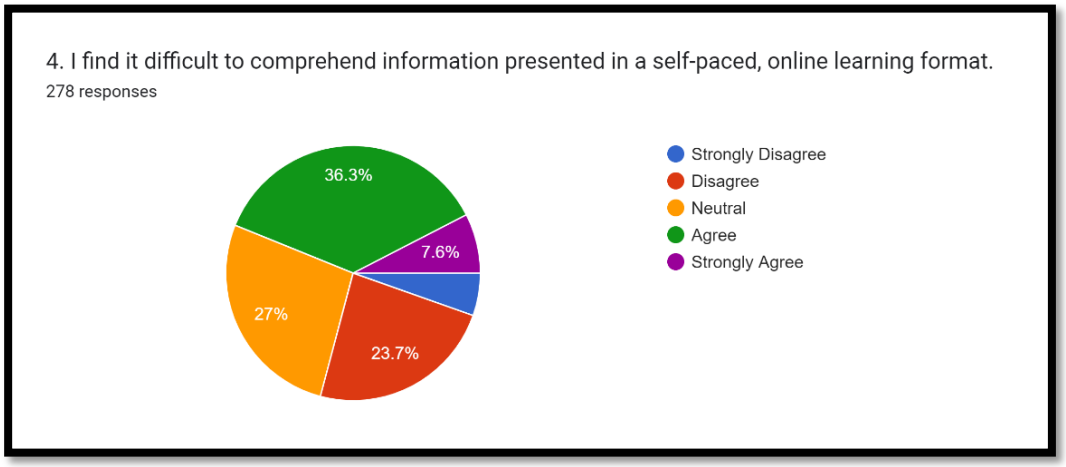

Fig 4.8: Graphical representation of responses collected to the question on difficulty in comprehending information in self-paced course

Only 46% of students said they find it hard or very hard to understand the information given in a self-paced online learning way. This shows that many students 27% feel neutral or 27% against it regarding how hard they learn in this setting.

The data revealing that 46% of students find it challenging to understand information in self-paced online courses is indicative of several aspects:

1. Learning Curve and Adaptability: Given the high proportion of students who report difficulty, it is likely that self-paced online learning has a learning curve. This might be brought about by the requirement for self-motivation, autonomous learning techniques, and adaptability to new technology.

2. Course Design and Accessibility: Almost half of the students experienced difficulties, which suggests that the course design could use some work. This entails improving the readability and accessibility of the course materials as well as adding any additional helpful components, such as interactive lessons or online office hours. Responses That Are indifferent or Disagree: The 27% of students who are indifferent and the 27% who disagree with the statement present opposing viewpoints.

3. Diverse Learning Preferences: A portion of students who are still getting used to the self-paced online format or who may not have a strong preference for or against this way of learning may be represented by the neutral response.

4. Effectiveness for Some Learners: The disagreement with the difficulty implies that self-paced online learning is an effective approach for a sizable percentage of pupils. These students may discover that the online format better suits their preferred learning style or have superior self-directed learning abilities.

5. Importance of Flexibility: The varying answers highlight how crucial flexibility is in learning environments. Some students find self-paced learning difficult, but others find it very beneficial. This underscores the need for flexible educational models like HyFlex that accommodate a range of learning styles.

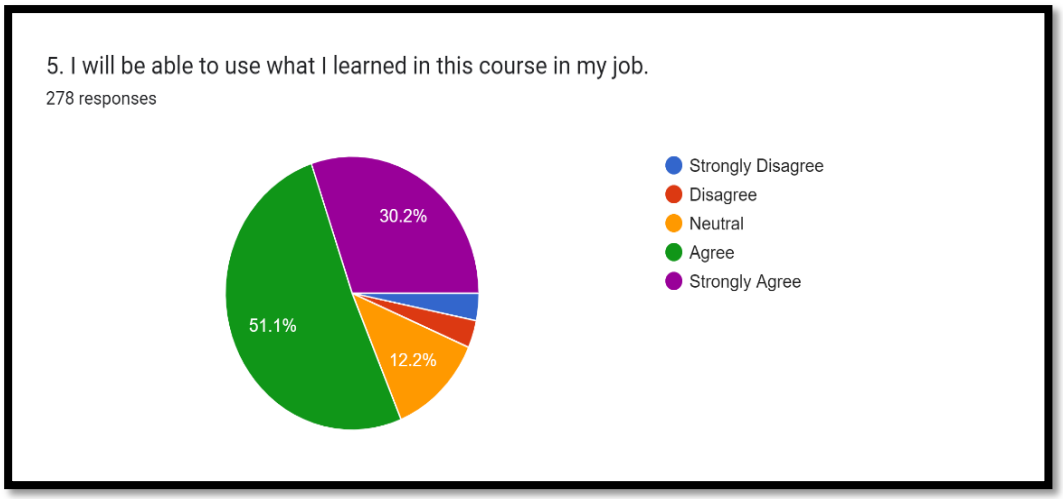

Fig 4.9: This figure shows graphical representation of responses collected to the question on student's ability to use the knowledge from the course in the job

The true essence of learning is when it is applied in the job or real time experience. The result to this question are quite positive as 81% of the respondent strongly agreed or agree to the statement of using learning in my job.

The significant positive response, with 81% agreeing or strongly agreeing that they can apply their learning to their job, highlights several key aspects:

1. Course Content Relevance: There is broad consensus that the material covered in the course has a great deal of practical, real-world relevance. It implies that the program is in line with the information and abilities needed in professional contexts.

2. Effective Learning Transfer: The high proportion also indicates how well the course has worked to support the transfer of knowledge from the classroom to the workplace. This includes developing transferable skills and competences in addition to gaining knowledge.

3. Confidence in Skill Application: The respondents' assurance in using what they've learned in the workplace suggests that they have a great deal of faith in the knowledge and abilities they've recently picked up. This demonstrates both the caliber of instruction given and the students' interest in the subject matter.

4. Career Development Implications: Students' career development may be greatly impacted by their capacity to apply what they have learned in professional

settings, which may result in improved job performance, chances for career progression, and personal development.

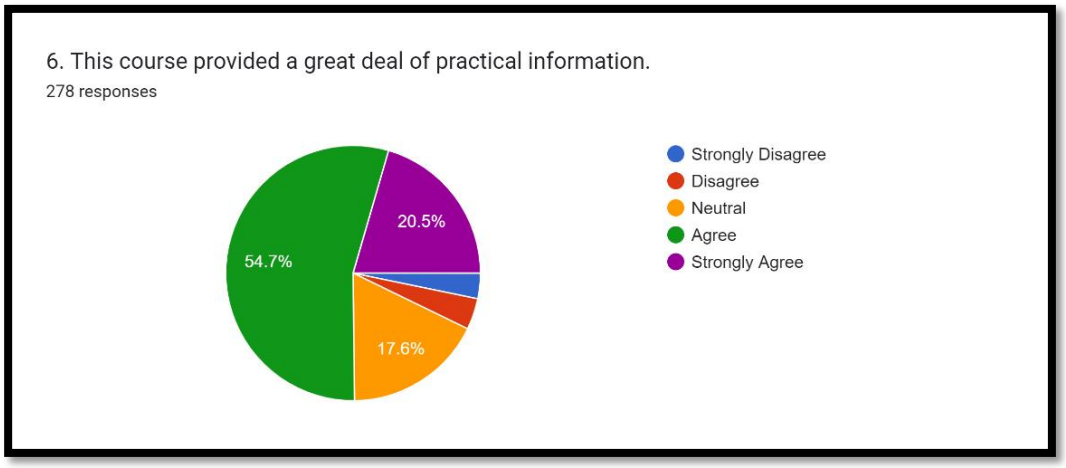

Fig 4.10 This figure shows graphical representation of responses collected to the question on provision of practical information in the course

A significant 75% of the people who participated in the activity felt that it gave them a lot of valuable facts. This shows that most students feel good about how valuable and real-life the stuff they learn in class is.

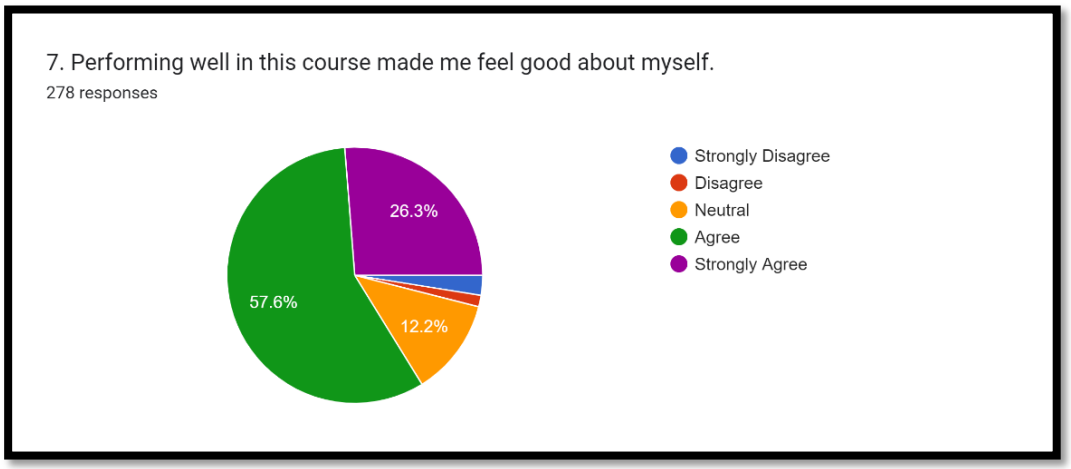

Fig 4.11: Above figure shows graphical representation of responses collected to the question on how well the course made them feel

Nearly all the students, about 84%, said doing well in class made them feel better about themselves. This big answer highlights the vital link between doing well in class and how students feel about their success and value.

The substantial response rate, with nearly 84% of students affirming that academic success boosts their self-esteem, sheds light on several important aspects:

1. Academic Success as a Self-Esteem Enhancer: This response emphasizes how important academic success is for raising students' self-esteem. Acquiring knowledge and abilities is only one aspect of performing well in class; another is the beneficial effect it has on students' self-esteem.
2. Motivation and Positive Feedback Loop: The high percentage raises the possibility of a positive feedback loop in which students' self-esteem is raised by achieving academic success, which in turn inspires them to devote more time to their studies and achieve even greater success.
3. Implications for Student Well-Being: It is critical to attend to kids' overall needs as evidenced by the relationship between academic achievement and self-perception. Instructors and educational institutions must prioritize not just sharing knowledge but also creating environments where learners can form confidence and feeling of value.

4.4.2 Course Satisfaction

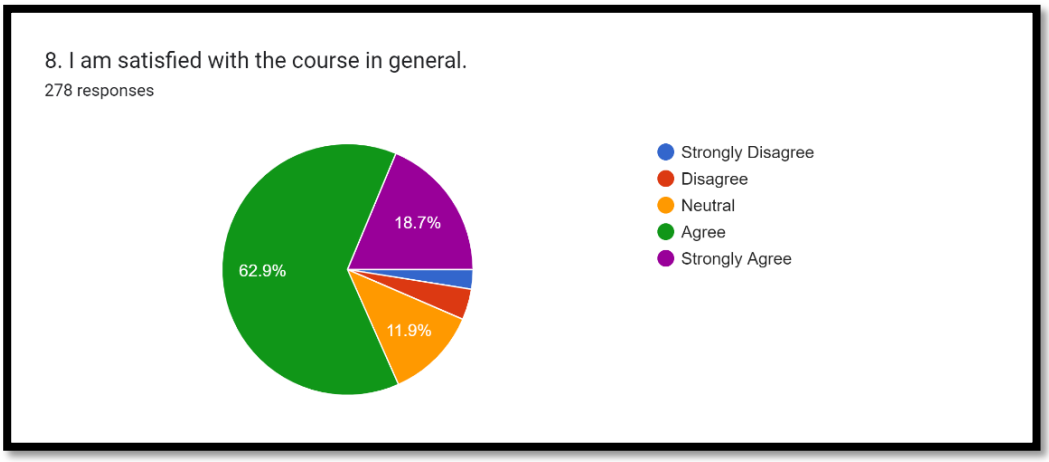

Fig 4.12: This figure shows graphical representation of responses collected to the question on course satisfaction in general

Satisfaction is one of the dependent variables of this research. 81% of respondents are satisfied with their Hyflex course in general. Only 7% respondent were not satisfied.

The fact that a significant majority, 81%, of respondents' report satisfaction with their Hyflex course is indicative of several key points:

1. Effectiveness of the Hyflex Model: Based on the high degree of satisfaction, it appears that a significant number of students' requirements and preferences are being successfully addressed by the Hyflex model, which blends online synchronous, online asynchronous, and in-person learning modalities.
2. Adaptability and Flexibility: The Hyflex model's capacity for both adaptability and flexibility is probably what accounts for the happiness. The ability for students to select the learning method that best fits their schedule, learning preferences, and other unique situations can improve their educational experience significantly.
3. Good Learning Outcomes: High satisfaction levels also suggest that the training is effective in producing favorable learning results. This might be a reflection of how well the course materials, instructors, and learning atmosphere are all done.

The relatively low dissatisfaction rate of 7% also provides important insights:

1. Area for Improvement: Although the percentage of dissatisfied students is low, it nevertheless indicates a portion of the student body whose requirements might not be entirely satisfied by the way the courses are currently structured. Numerous elements, including the course material, the mode of delivery, or technical problems, could be to blame for this.
2. Need for Personalized Learning Approaches: The existence of unsatisfied students emphasizes the significance of always looking for methods to enhance and personalize the educational experience for every student. This can entail offering extra resources, handling technical difficulties, or offering more specialized help.
3. Feedback Mechanism: Encouraging thorough feedback from unhappy students can yield insightful information on how to enhance the course and make sure that the Hyflex model adapts to the various needs of its pupils.

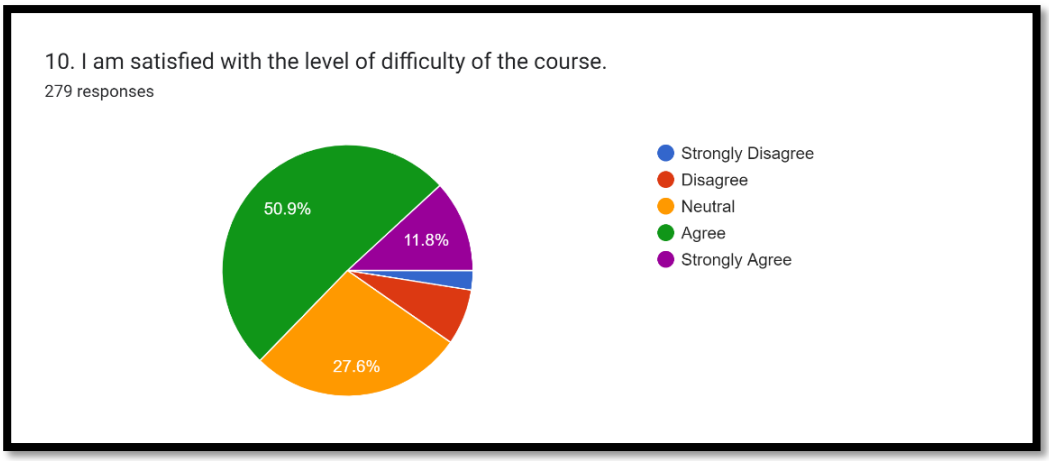

Fig 4.13: This figure shows graphical representation of responses collected to the question on satisfaction with the level of difficulty of the course

About 63% of students said they were satisfied with the course's challenge, while 27% did not have a strong feeling either way, and the rest did not like it. These results show different views on how complex the classes are, pointing out that a significant number of students consider their learning level now to be acceptable.

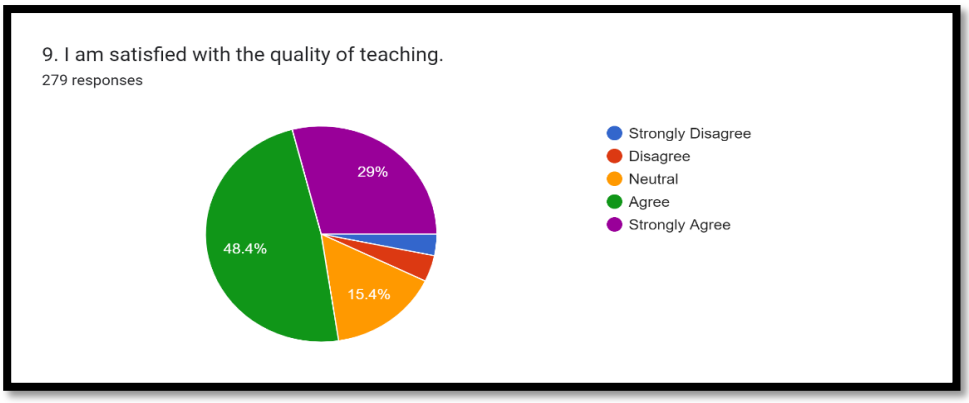

Fig 4.14: This figure shows graphical representation of responses collected to the question on satisfaction with the quality of teaching

The survey's findings, which show that 77% of students are happy with the level of instruction in the HyFlex course, demonstrate how well instructors have managed the model's intricacies. It emphasizes how crucial good facilitation is in hybrid, flexible learning contexts and highlights the necessity of keeping teacher development and responsive teaching techniques front and center. This is essential to upholding the high standards of instruction quality and guaranteeing the HyFlex approach's effectiveness in varied learning environments.

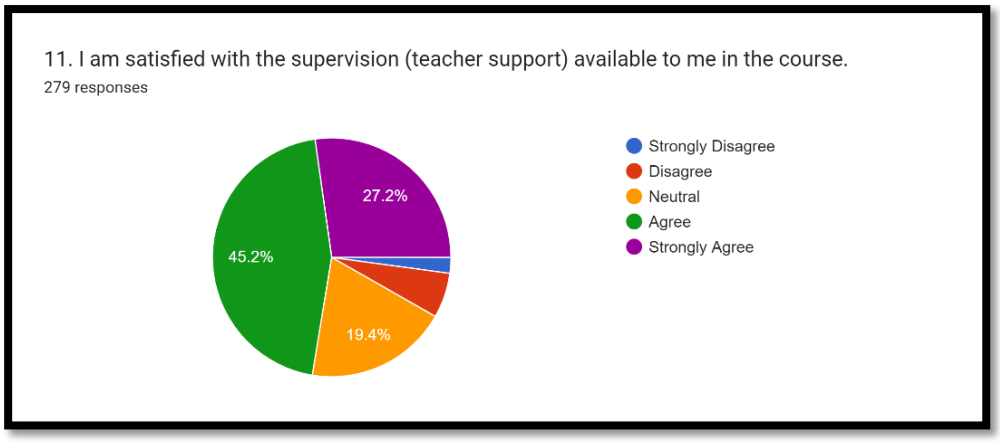

Fig 4.15: Graphical representation of responses collected to the question on satisfaction with the supervision in the course

Almost 3 out of 4 students were satisfied with their supervisor, while 1 in every 5 had no strong feelings either way, and only a few did not like it. These results show that most people feel excellent about the help and direction given by the supervisor, while a small number have some doubts. According to the survey's overall findings, most students are satisfied with the help and direction their supervisor gave them during the HyFlex course. This demonstrates how well the supervisors are doing their job of creating a supportive learning environment. Nonetheless, the existence of a minority that is neutral or unsatisfied points to the necessity of continual assessment and modification of supervisory procedures in order to meet the various demands of every student and provide a consistently excellent experience everywhere.

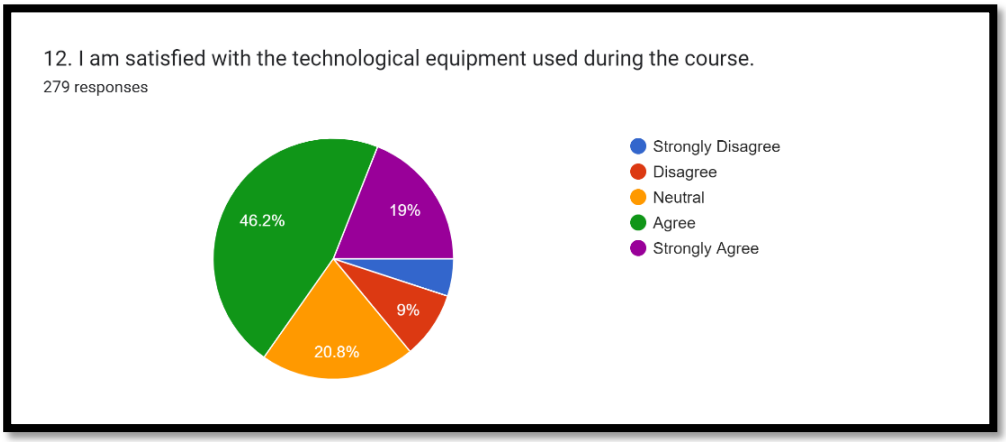

Fig 4.16: This figure shows graphical representation of responses collected to the question on satisfaction with technological equipment used in the course

The course required state of the art technological equipment and internet connections. 68% were satisfied with the technological equipment being used in the course. 20% were neutral about the statement.

The fact that a significant majority, 68%, of students expressed satisfaction with the technological equipment and internet connections in the HyFlex course indicates several key aspects:

1. Sufficient Technological Resources: Based on this degree of satisfaction, it appears that the course has all the required technological resources. Modern hardware and dependable internet connections are essential to the seamless operation of a HyFlex course, which primarily uses technology for both online and in-person learning modalities.
2. Improvement of Learning Experience: Efficient use of technology makes learning easier by enabling smooth access to course materials, engaging in interactive lessons, and efficient teacher-student communication.
3. Technology's Role in HyFlex Learning: The high degree of satisfaction highlights how crucial strong technology support is for hybrid-flexible learning environments. It draws attention to how important technology is to the success and accessibility of flexible learning models like HyFlex for students.

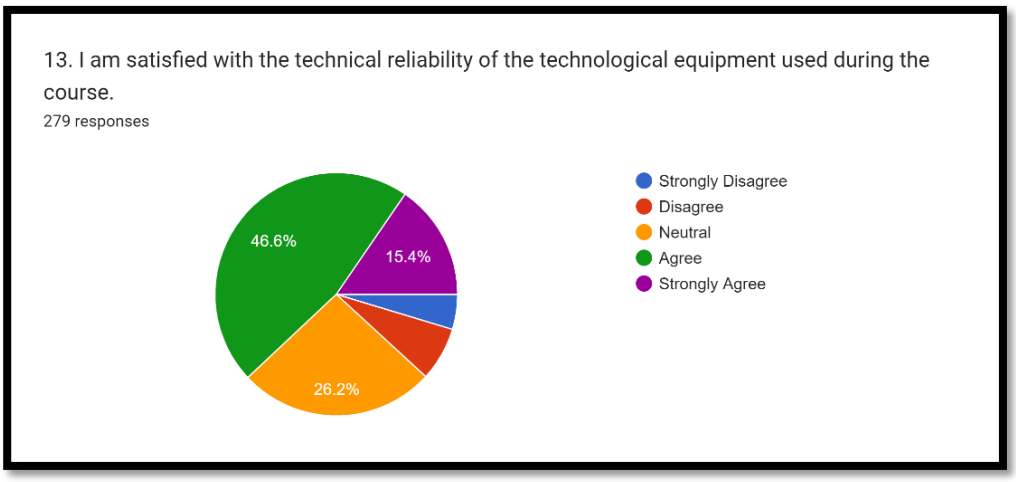

Fig 4.17: Graphical representation of responses collected to the question on satisfaction with the technical reliability of the technology used in the course

Around 6 out of every 10 students said they were satisfied with how well the equipment in their classes worked. Twenty-six per cent more were in the middle, not taking a side, while

fewer disagreed. These results show that most people see the technology setup positively, while a few have doubts or uncertainties.

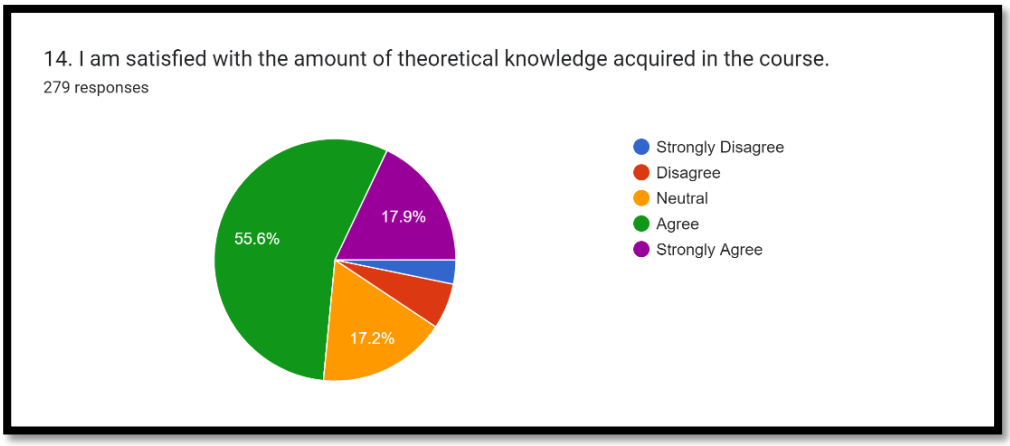

Fig 4.18: This figure shows graphical representation of responses collected to the question on satisfaction with the amount of theoretical knowledge acquired in the course

A significant 73% of students said they were happy with the book learning during the class, while 17% did not care either way, and only a small part didn't like it. These findings show that most people feel optimistic about how well the course teaches theory, but a few have doubts.

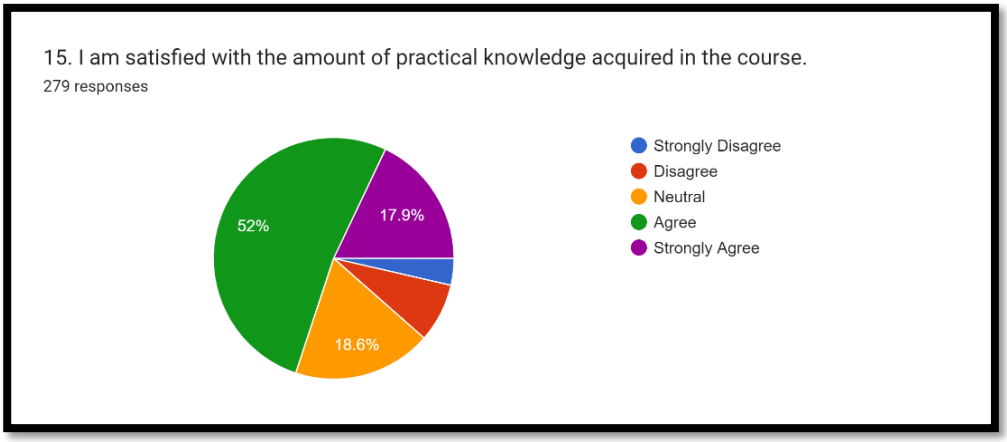

Fig 4.19: Graphical representation of responses collected to the question on satisfaction with the amount of practical knowledge in the course

To both the questions upon theoretical and practical knowledge, around 70% students were satisfied with the both theoretical and practical knowledge acquired in the course. 17-18% of students had neutral response to the above statements.

4.4.3 Course Effectiveness

Course effectiveness in this thesis is measured through various factors.

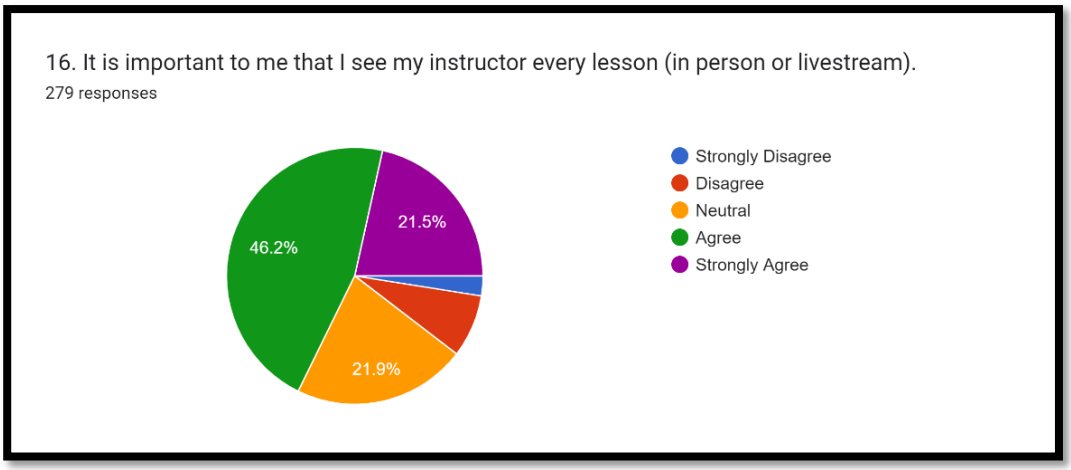

Fig 4.20: This figure shows graphical representation of responses collected to the question on importance of seeing instructor in every lesson

The data showing that a substantial 68% of students desire the presence of their instructor in every lesson, be it in-person or through live streaming, highlights several important aspects of student preferences and learning dynamics:

1. Value of Instructor Interaction: This choice emphasizes how important it is for students to speak with their instructors face-to-face. For many students, having an instructor there is essential to the learning process because of the engaging aspect of live education, the ability to clarify difficult subjects, or both.
2. Expectations for Hybrid Learning: The high percentage indicates what students anticipate from a HyFlex learning environment. The traditional component of teacher-led instruction is nevertheless sought after by a sizable portion of pupils, despite the model's flexibility regarding attendance and manner of learning.
3. Engagement and Motivation: Whether in person or virtually, an instructor's presence can improve students' motivation and engagement. A more dynamic and immersive learning environment can be produced by seeing and interacting with a teacher that is pertinent to maintain student interest and participation in hybrid mood.

The preference for instructor presence in every lesson has important implications for the design and delivery of HyFlex courses:

1. Including Live aspects: In order to accommodate this preference, course designers want to think about including live aspects in the curriculum. This will guarantee

that students, irrespective of the learning style they have selected, have frequent chances to engage with instructors.

2. Flexibility in Instructor Participation: The HyFlex concept is based on flexibility, even though live participation is appreciated. Preserving the course's flexibility means providing taped sessions or other resources for participants unable to attend in person.
3. Technical Support for Live Streaming: It is imperative to provide live streaming capabilities of the highest caliber. This includes interactive technologies that let students connect with peers and the instructor during in-person sessions, as well as dependable technology for streaming lectures.
4. Equilibrium between Synchronous and Asynchronous Components: While addressing the inclination for instructor's presence, it's equally important to cater the needs of learners with the choice of asynchronous learning preferences.

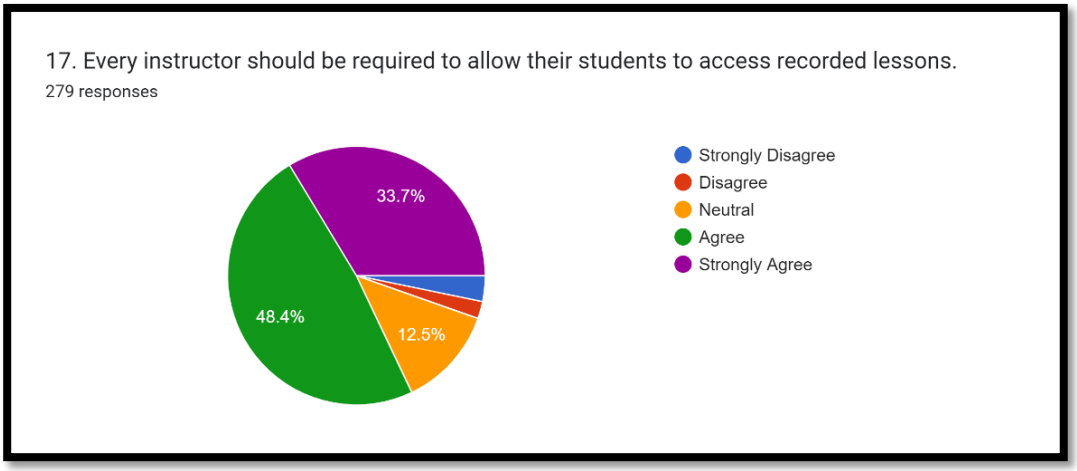

Fig 4.21: This figure shows graphical representation of responses collected to the question on students access to recorded lessons

81% of students believed that the students should be allowed to record the lesson. According to the survey results, students strongly prefer having the option to record lectures in the HyFlex course environment. This emphasizes how important flexibility and resource availability are in contemporary learning environments. The learning experience can be greatly improved by modifying technology and course policies to allow lesson recording. This will accommodate a variety of learning styles and needs. This method fits nicely with the larger trend in education toward more student autonomy and customized learning paths.

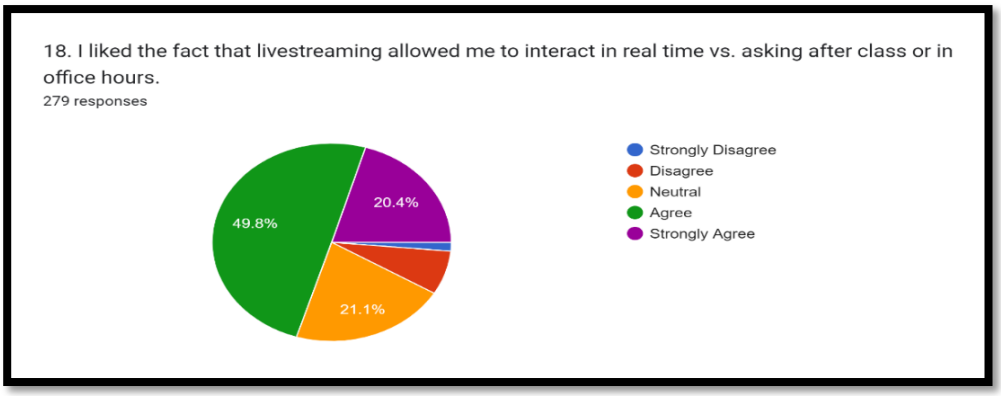

Fig 4.22: This figure shows graphical representation of responses collected to the question on interaction in real time vs asking after class

One of the best thing about Hyflex is the accessibility of the course. 70% students believed that livestreaming helped in after class and interact in real time. The data indicating that a significant majority of students value live streaming for its role in enhancing accessibility and interaction in the HyFlex model underscores several important aspects:

1. Improved Course Accessibility: The popularity of live streaming is indicative of its contribution to increasing the accessibility of course material. Due to scheduling, health, or geographic limitations, students who are unable to attend in-person classes can nevertheless engage in real-time, guaranteeing equitable access to educational opportunities.
2. Real-Time Interaction: Live streaming makes it easier for students and teachers to communicate in real-time, which is important for prompt feedback, answering questions, and taking an active part in class discussions. This interactive element is particularly crucial for developing a dynamic and captivating learning environment.
3. Flexibility and Inclusivity: The HyFlex model's central principle of flexibility is supported by the capacity to live broadcast sessions. Because it accommodates a variety of learning styles and contexts, education is more inclusive and customized to meet the needs of each student.

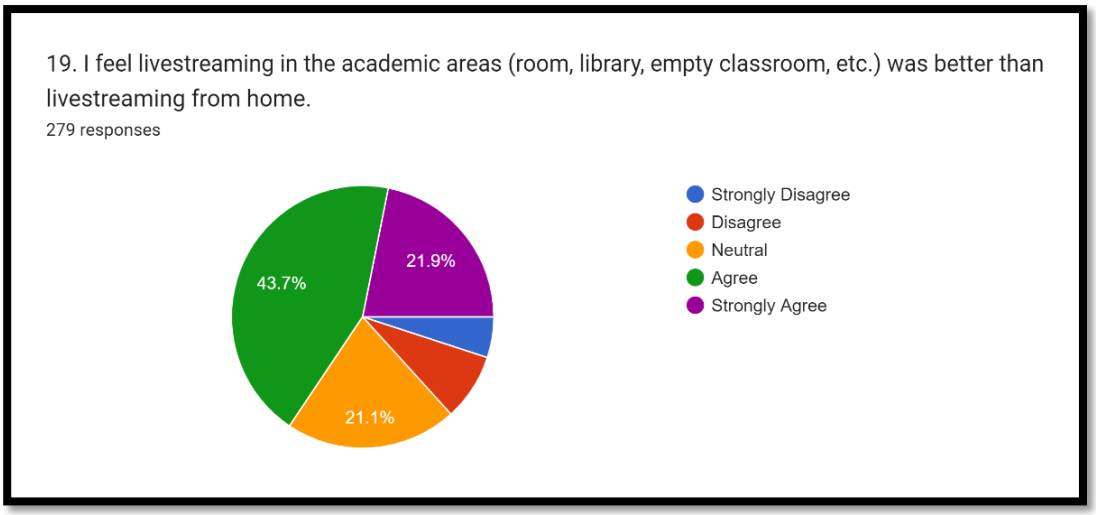

Fig 4.23: This figure shows graphical representation of responses collected to the question on better option of livestreaming in the academics areas or form home

A significant group, 63% of all students, saw live broadcasting from their academic spot, like the library, as better than doing it at home. At the same time, 21% had no strong feelings either way, while a smaller group of people, 16%, did not like this choice.

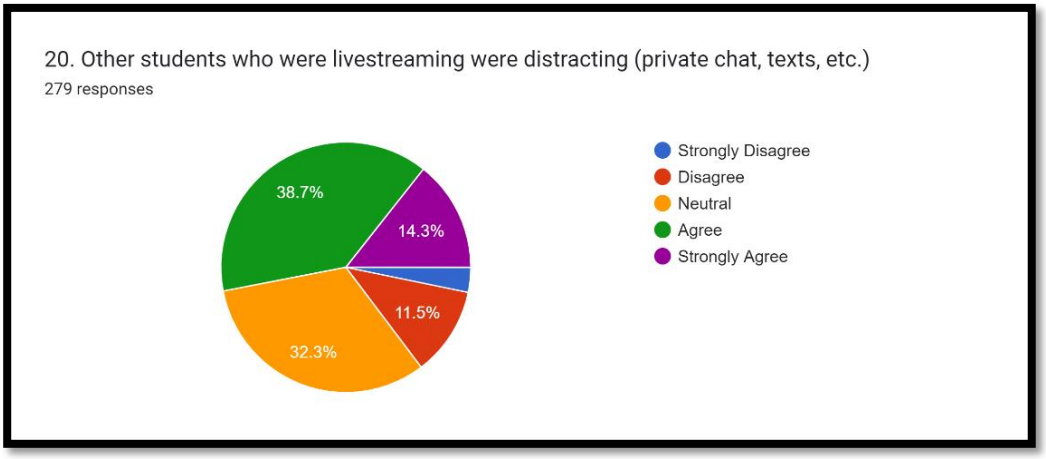

Fig 4.24: This figure shows graphical representation of responses collected to the question on distraction in the livestream by other students

53% of students said they got distracted during live-streaming classes, 32% did not give a clear answer, and 15% said they did not get distracted. This shows that many students have trouble concentrating during online learning, highlighting the importance of dealing with things that distract their attention in internet-based education.

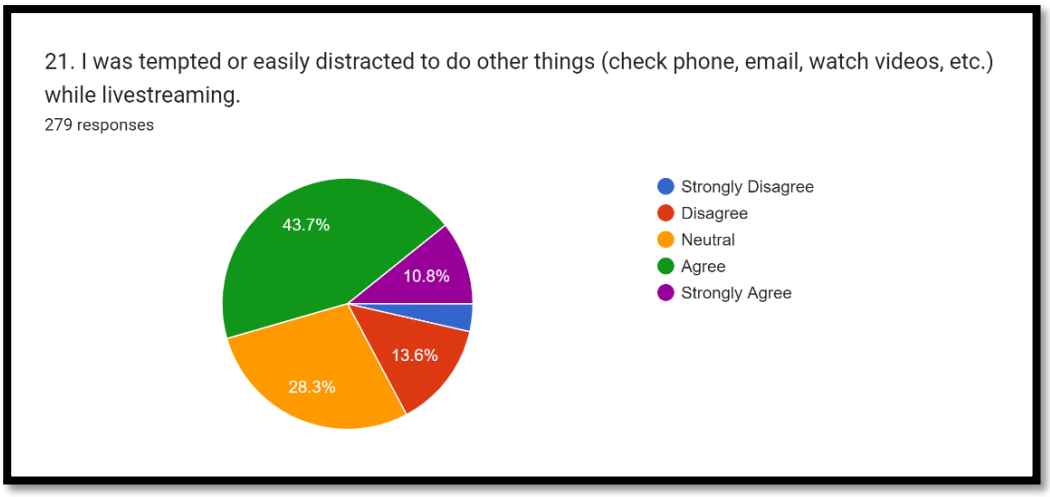

Fig 4.25: This figure shows graphical representation of responses collected to the question on distraction while livestreaming

A significant 50 out of every 100 students said they get easily pulled away by looking at their phones, emails and videos during live-streaming classes. At the same time, 28% had no opinion, and 17% did not agree with feeling easily pulled away. These results show how hard it is to pay attention during live internet classes.

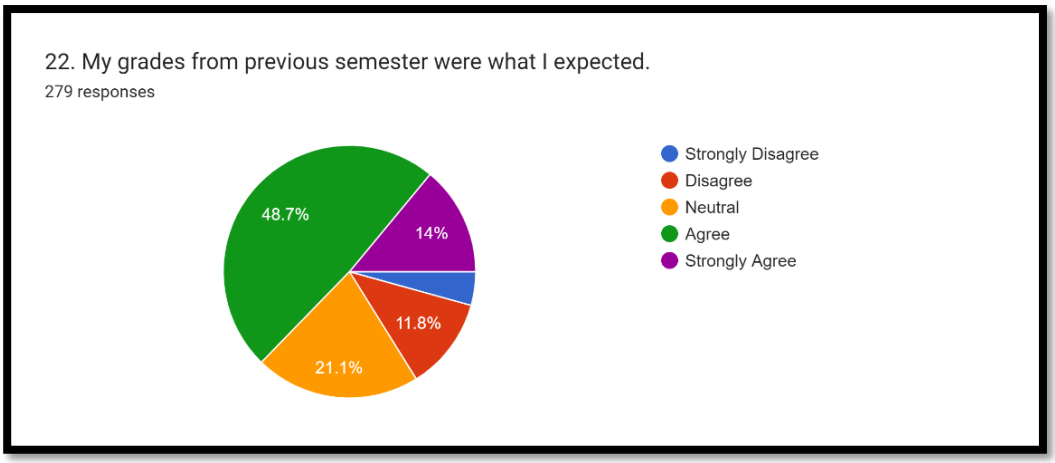

Fig 4.26: This figure shows graphical representation of responses collected to the question on students' expectation of their grade in previous semester

Most students, about 63%, consider that their grades were what they expected. At the same time, 21% did not take sides and did not share negative thoughts. And 16% said they were unhappy with their marks as it was not what they hoped for. Therefore, when looking at the connections in a model for structure equations (SEM), belief in one's school abilities dramatically affects how well the HyFlex course method works (Vitanova et al., 2015). It has a link value of 0.58, showing some essential effects that are not too strong. Moreover,

the link between believing in learning skills and being satisfied with a class students take is powerful. The path number of 0.92 shows that this connection significantly impacts how much students like the course.

The results of the survey regarding the experiences that students had with the HyFlex course model have various ramifications for how HyFlex courses are implemented. Here's a more comprehensive look at these implications:

1. Technology Integration and Support • Robust Infrastructure: Make sure that there are no technical hiccups in the technological infrastructure to allow live streaming, online chats, and other digital engagements. simple Access to Technology: To encourage student participation in the course, give them simple access to the high-quality internet connections and recording devices that they need.
2. Training and Development for Instructors

   Hybrid Teaching Training: Teachers should be trained in hybrid teaching techniques, with an emphasis on concurrently engaging students in-person and virtually. Assistance with Course Design: Provide teachers the tools and encouragement they need to create classes that are equally good in various formats i.e. asynchronous, synchronous, and in-person.

3. Content Adaptation and Course Design

   Flexible Content Delivery: Create course materials that are flexible enough to be delivered in a variety of ways, guaranteeing that learning objectives are met regardless of the format selected. Include Interactive components: To encourage participation, include interactive components in online modules like discussion boards, live Q&A sessions, and group projects.

4. Engagement and Support for Students

   Diverse Learning Preferences: Acknowledge and accommodate a range of learning styles, giving students the freedom to interact in the way that best meets their requirements. Support Services: Provide extensive support services, such as peer support groups, academic counseling, and technological help.
5. A Look at Policies and Accessibility

   Formalize Recording Policies: Set up explicit guidelines for recording classes that protect intellectual property and make it accessible to those who require it.

Accessibility for All Students: By following accessibility guidelines during the course design process, you can make sure that the course is usable by all students, including those with disabilities.

4.4.4 Mechanisms for Evaluation and Feedback

1. Adaptable Assessment Techniques: Use equitable and efficient assessment techniques for all types of instruction.
2. Constant Feedback: To enhance the format, content, and delivery of the course, include systems for receiving regular feedback from students.
3. Talking About Inclusivity and Equity
4. Using All Students in Course Design: When designing an inclusive learning environment, keep in mind that different students will have varying backgrounds and degrees of technology access.
5. Reduce Digital Divide: Make a concerted effort to reduce the digital divide by offering alternatives or resources to pupils who might not have as much access to technology.

4.6 Summary

The integration of HyFlex courses necessitates careful evaluation of student needs, pedagogy, and technology. It all comes down to designing a smooth, fair, and responsive learning environment that meets the many needs of today's students. The HyFlex model can offer a strong and adaptable framework for higher education that can satisfy the demands of the changing educational landscape of today with ongoing adaptation and improvement.

CHAPTER 5: RESULTS

According to the findings, academic self-efficacy, course satisfaction, availability, and course effectiveness are among the requirements that make hybrid flexible classrooms successful. If Pakistani schools have the appropriate technology, the hybrid flexible style of instruction can be a successful approach. Policy decisions on the adoption of technology in Pakistani universities and higher education can benefit from the findings of this study. According to Churcher et al. (2014), the COVID-19 epidemic has led to an unprecedented shift in education from traditional classroom settings to online platforms. This shift has altered Pakistan's educational environment and created the unsettling "Digital Divide" in society. In an effort to reduce the educational disparity that has widened due to unequal access to technology, this study suggests a cutting-edge method of hybrid flexible classroom design known as HyFlex.

Owing to differences in the availability of digital devices, electricity, and internet connectivity across different demographic groups, Pakistan—which already struggles to ensure that all students have equal access to education—has seen more challenges as distant learning has grown in popularity. A potential solution that breaks down the boundaries between traditional classroom settings and online learning is the HyFlex instructional design idea. By allowing students to choose their preferred mode of involvement based on their individual circumstances and flexibility, HyFlex promotes inclusivity while satisfying the diverse needs of the student body (Morell, 1990).

With the use of a survey of Pakistani university students, primarily those majoring in computer science, this study sought to assess the efficacy of the HyFlex approach in relation to a number of crucial elements of effective instruction. The assessment considered student motivation, the attainment of learning objectives, the accessibility of course contents through the HyFlex model, and the availability of smart classrooms and other relevant hardware technology (Sanchez-Pizani et al., 2022). The survey's outcomes provide important details about how well the model worked with AMOS and SPSS. The results of this study show how academic self-efficacy—a crucial component of student success—is promoted by the interaction between course effectiveness and satisfaction (Cebri, 2020). This result aligns with well-established ideas in educational psychology that maintain a substantial correlation between students' overall satisfaction with the educational experience and their perceptions of their degree of proficiency. The HyFlex method is a

successful tool for developing academic self-efficacy since it encourages student involvement and subject mastery even in Pakistan's challenging digital environment (Han, 2021).

As a conclusion, the research examined the efficiency of the HyFlex instructional design at Pakistani universities, particularly for computer science majors. This study examined academic self-efficacy, student experience, course satisfaction, and course success. When analyzed using Structural Equation Modelling (SEM) and a variety of fit indicators, the HyFlex model's ability to address the digital gap after the COVID-19 pandemic is shown. The pandemic has worsened the digital divide. The HyFlex model assessment began with a thorough fit indicator examination. This group contained the Normed Fit Index (NFI), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and Root Mean Square Error of Approximation (RMSEA). When combined, these indices showed that the default model suited the data well, with values that met or exceeded the criteria. Data was compared to the default model. Comparing the HyFlex model against the independence model, which assumed no variables were linked, showed its superiority in explaining observed data. This comparison showed that HyFlex outperformed independence.

The academic self-efficacy research found that students believed they could succeed in self-paced online courses. This was shown throughout the investigation. Note that most responders are confident in their HyFlex success. This shows how adaptable and self-directed this education is. This positive outlook extended to applying classroom concepts to real-world challenges, demonstrating the practical usefulness and importance of students' academic experiences. Course satisfaction appeared as a key factor throughout the investigation. This was because most students liked HyFlex classes. Many participants gave favorable feedback on the challenge, instruction, and technology. Interesting, the research discovered a strong correlation between academic self-efficacy and class satisfaction. This study highlights the importance of pleasant learning experiences in boosting students' academic confidence. The dynamics of HyFlex classrooms were better understood after assessing the course's performance based on teacher visibility, recording permissions, and live streaming (Wilson & Alexander, 2021). According to the research, a variety of flexible and diverse instructional modalities are needed. It was shown that pupils prefer live streaming or in-person professors. Live streaming for post-class interactions and academic site broadcasting were beneficial factors in the course's overall performance (Yıldızbaş & Topuz, 2014).

Addressing distractions during live-streamed sessions and ensuring students were satisfied with both theoretical and practical learning boosted the HyFlex model's effectiveness. The results showed that online learning should reduce distractions and encourage participation to maximize student success. Although the results are positive, the report notes that many difficulties must be addressed. These include online lecture distractions and the requirement for effective engagement approaches. The research also recommends continuous efforts to close the digital gap and provide equal access to technology for all youngsters (Almulla, 2021).

The HyFlex teaching model's flexible and adaptable approach to learning shows potential for Pakistan's universities. Positive links between academic self-efficacy, course satisfaction, and course effectiveness show how these components are interconnected in creating a comprehensive and meaningful educational experience. The HyFlex concept helps educational institutions improve diversity, engagement, and information delivery in the ever-changing digital learning world. Because the model is designed to assist these three elements. In addition to contributing to the conversation on innovative instructional designs, the research gives educators, policymakers, and institutions options for improving digital education accessibility and quality. This is done by offering achievable ideas (Adhikari, 2020).

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APPENDIX - A

Survey Questions

Academic Self Efficacy and Task Value
1. I can perform well in a self-paced, online course.
2. I am confident I can do an outstanding job on the activities in a self-paced, online course.
3. I am certain I can understand the most difficult material presented in a self-paced, online course.
4. I find it difficult to comprehend information presented in a self-paced, online learning format.
5. I will be able to use what I learned in this course in my job.
6. This course provided a great deal of practical information.
7. Performing well in this course made me feel good about myself.
Course Satisfaction
8. I am satisfied with the course in general.
9. I am satisfied with the quality of teaching.
10. I am satisfied with the level of difficulty of the course.
11. I am satisfied with the supervision (teacher support) available to me in the course.
12. I am satisfied with the technological equipment used during the course.
13. I am satisfied with the technical reliability of the technological equipment used during the course.
14. I am satisfied with the amount of theoretical knowledge acquired in the course.
15. I am satisfied with the amount of practical knowledge acquired in the course.
Course Effectiveness
16. It is important to me that I see my instructor every lesson (in person or livestream).
17. Every instructor should be required to allow their students to access recorded lessons.
18. I liked the fact that livestreaming allowed me to interact in real time vs. asking after class or in office hours.
19. I feel livestreaming in the academic areas (room, library, empty classroom, etc.) was better than livestreaming from home.
20. Other students who were livestreaming were distracting (private chat, texts, etc.)

21. I was tempted or easily distracted to do other things (check phone, email, watch videos, etc.) while livestreaming.
22. My grades from previous semester were what I expected.
Course Hardware/Accessibility
23. Do you have an access to any of these devices?
24. Do you have reliable access to internet?
25. Do you face intermittent power outages (load shedding)?
26. How much bandwidth do you currently use from internet service providers?
27. Would you like to use new technologies, which may require new approaches to learning and problem solving

LIST OF PUBLICATIONS

1. Raza, H., Lashari, T. A., & Lashari, S. A. (2023). Relationship Between Course Effectiveness, Satisfaction, Access and Academic Self–efficacy in the HyFlex Mode of Instruction in Pakistani Classroom. *International Journal of Distance Education and E-Learning*, *9*(1), 66-76.

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

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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*