INTEGRATION OF WEB 2.0 TECHNOLOGY INTO INSTRUCTIONAL PRACTICES AT HIGHER EDUCATION LEVEL: POST-PANDEMIC SITUATIONAL ANALYSIS

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ABSTRACT

Thesis Title: Integration of Web 2.0 technology into Instructional practices at Higher Education Level: Post-Pandemic Situational Analysis.

The present study was a post-pandemic situational analysis to investigate the integration of Web 2.0 technology into instructional practices at the higher education level. In addition, other objectives were the exploration of the availability and use of Web 2.0 technologies in institutions of higher education, the analysis of the influence of key factors such as *will, skill, tool,* and *pedagogy* on the use of Web 2.0 technologies, and the exploration of the barriers and challenges faced by the faculty in the adoption of Web 2.0 technologies. A mixed-methods approach with parallel convergent design was used. A total of 340 university teachers of social sciences, management sciences and basic sciences were included in the sample. Teachers' Attitude towards Computer (TAC v. 6.1) (Christensen & Knezek, 2009), Teachers' Professional Self-Assessment scale TPSA-C21 (Christensen & Knezek, 2014), Concern Based Adoption Model Level of Use (CBAM-LoU) scale by Griffin and Christensen (1999), Stages of Adoption scale (Christensen, 1997), and the Apple Classroom of Tomorrow (ACOT) teacher stages scale (Dwyer et al., 1994) were adapted. Semi structured interviews were conducted with seven participants. Percentage, mean and structure equation modelling (SEM) were used to analyze the data. Additionally, thematic analysis was used for an in-depth study. Findings revealed that the integration of technology by the faculty was moderately high. Moreover, results showed that there was enough availability of tools, among which Power Point, Google Meet, and WhatsApp were the most used tools, whereas blogs were less used. Findings showed that *will, skill, tool,* and *pedagogy* have a significant direct effect on technology integration. Internet connectivity and electricity issues were the major challenges. It is recommended

that HEC introduce the training workshops and allocate funds to provide better technology facilities to the universities as well as upgrade the total infrastructure for the digitalization of education.

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LIST OF ABBREVIATIONS

Abbreviation	Full Name
AGFI	Adjusted Goodness-of-Fit
App	Application
CFI	Comparative Fit Index
GFI	Goodness-of-Fit Index
NFI	Normed Fit Index
RMSR	Root Mean Square Residual
RMSEA	Root Mean Square Error of Approximation
TLI	Tucker-Lewis Index
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
ICT	Information and Communication Technology
EFA	Exploratory Factor Analysis
AVE	Average Variance Extracted
HTMT	Hetero Trait Mono Trait
F&L	Fornell and Larcker
CR	Composite Reliability
COVID-19	Corona Virus Disease of 2019

APPENDICES

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I owe a tremendous amount to Almighty Allah the one who gave me the chance to put my efforts to complete this huge task. It is only the sanctification of the Omniscient being to give upon us His Sacred Prophet (Sallallahu Alaihay Wa'alihi Wasalam) who has kept all ground of information. Now, I would like to thank Dr. Wajeeha, Head of the Department of Educational Sciences, for her sound professionalism in giving me the opportunity to perform this project. I owe my most profound appreciation to my supervisor Dr. Aisha Bibi for her sublime direction amalgamated with her warmth, responsibility and sweet bar, without which I would have not had the option to attempt the current review. The glow and sincerity with which she directed me all through the exploration obviously evokes submerged feelings of appreciation that can't be communicated satisfactorily in any language. I am also thankful to all my teachers including Dr. Allah Bakhsh, Dr. A.R. Saghar, Dr. Sajid Ali Yousuf Zai and especially Dr. Farkhanda, Dr. Jameela, Dr. Maryum Din and Dr. Shazia for their benevolent direction and backing. I owe a lot to my mentor Dr. P. A. Shami for inspiring me and providing me with moral support and everyday reassurance particularly during moments when I felt weary and unmotivated. My warmest and heartfelt thanks to my elder brother Saleem and my siblings Dua and Mujtaba, my nephew Ammar, my class fellows, friends Ayesha and Musarrat who supported me during the whole session. I am also thankful particularly to Ayesha Nousheen as without her ethical help and consolation nothing was conceivable.

DEDICATION

To

My late Parents,

Dua, Mujtaba

and

Respected Dr. P. A. Shami

CHAPTER 1

INTRODUCTION

Context of the Study

The human journey in various eras has been full of accomplishments, and the current predominant challenge is a shift towards a competitive global knowledge-based economy and society. The means to cope with these challenges are widely considered to be an improved system of education in general and higher education in particular, focusing on new technologies. Consequently, information technology has gained ground in education. In this post pandemic digital age, it is the need of the hour that teachers equip themselves with modern technologies and pedagogical techniques. In view of Singh and Sikka (2022), the COVID-19 epidemic has resulted in the worst disruption to the world's educational systems in recorded history, forcing almost 1.6 billion students across more than 190 nations on all continents to pursue their education online.

There have been times when the teacher used to provide students with transparent water in a glass. On blowing, that turned white, inferring there is carbon dioxide when humans exhale. After generating information, the students stored that information in their notebooks. Unfortunately, its reader was only a teacher. In computer technology era, we follow the same steps, but now the beneficiary is a larger segment of the population. Initially, it was a static digital platform known as Web 1.0, and then the world observed a paradigm shift to a dynamic and interactive stage, naming it Web 2.0. In education, Web 2.0 technologies are gaining importance, and the reason behind this increasing importance is twofold: one is the latent ability to enrich teaching practices, and the other is the necessity of developing 21st century expertise in students such as critical thinking, communication, and collaboration in this rapidly fluctuating realm (Gomes, Figueiredo & Serrano, 2017). These tools have gained more importance because of their increasing use during the pandemic.

Generally speaking, the phrase “Web 2.0” refers to various internet tools that let users communicate with others globally and help them create things collectively (Dinger & Grover, 2019). Certain of the most widely utilized Web 2.0 advancements involve online journals, wikis, and long-range interpersonal networking sites. Uys and Douse (2022) posit that the advent of technologies at the tertiary level is unavoidable, leaving an open field justifying further investigation about their integration in instructional practices, specifically during pandemics.

It is assumed that by using web technologies in education, the performance of instructors, administrators, and students can be improved, as can the quality of education (Haitan, 2022). Sweeney and Winsett (2020) expressed that by implementing and utilizing these technologies properly and aptly, there is a possibility of making student-centered culture a certainty with the help of these technologies through encouraging activity-based learning. Technology demands that educational processes be included together with appropriate pedagogical usage of ICT tools (Zarabanda, 2019).

The teacher has a fundamental role in the actual incorporation of technology while teaching in the classroom. Technology integration depends greatly upon the attitude of teachers (Christensen & Kenezek, 2016), technological competence (Tiede et al., 2015), access to technological tools (Sánchez-Prieto, 2019), and pedagogy (Hosseini & Kinnunen, 2021). Getting the required training may improve understanding and abilities in progressive technologies that help teachers in the application of such technologies (Project Tomorrow, 2010). That is the reason the National Professional Standards for

Teachers (2009) put the necessary emphasis on information and communication technology for teachers to get equipped with knowledge and skills to utilize all instructive and informative innovations to excel in the field (Standard 7.b).

Technologies such as Web 2.0 provide various resources and applications for education (Brink & Ohei, 2019). However, there are some arguments against the application of such tools and services in higher education systems, among which is the total reliance of teachers on such tools, which leaves them devastated in the event of a power failure and leaves them unable to teach the class. Grave apprehensions exist about the quality and credibility of the material being published, especially in developing countries that are not accredited with adequate standards of education. Furthermore, security and privacy issues are common concerns associated with social network implementation (Du et al., 2018). Literature emphasizes some flaws, including the inadequate infrastructure for online education, the incompetence of academics, the knowledge gap, and the complexity of the home environment (Murgatrotd, 2020).

The momentary shutting down of higher education institutes because of the pandemic was globally recognized, and face-to-face instruction had stopped in most nations. According to an assessment from the International Association of Universities and UNESCO (2020), since April 2020, institution closures because of COVID-19 have interrupted the normal learning habits of over 1.5 billion higher education students across 185 nations. Additionally, two-thirds of higher education institutions in those nations claim that they must switch from in-person instruction to online education.

Small investigation considerations have been given for documentation and analysis efforts of teaching and learning processes operating on a large scale as well as on a quick shift to offer online learning while the entire schools and universities are shut down (World Bank, 2020). UNESCO is also conscious of the transformation to online learning as a largely complicated and intricate task and reckons it a major need (UNESCO, 2020). Certainly, it is evident that the pandemic caused extra complications not only in tertiary education world-wide but predominantly in Pakistan because it faced the challenges of development without excellence, discrimination in access, and the continuous drop in open funding (UNESCO, 2020). This study investigated the teaching faculty's technology integration practices in universities, attitudes, competencies, access to web 2.0 tools, and challenges faced following the COVID-19 epidemic in Pakistan.

1.1 Rationale of the Study

Both internal and external factors impact teachers' adoption of technology; learning from and colleague demos are essential for sustaining active adoption stages (Zheng et al., 2019). Many factors have been researched so far that may affect the technology adoption of teachers, some of them are individual factors like teacher's beliefs (Pischetola, 2020), performance expectancy and support (Dindar et al., 2021), technology attitude and personal interest (Cviko et al., 2012, Shehzad, Tariq & Naeem, 2021), behavioral intentions (Kung-teck et al., 2012), technology apprehension (Wood et al., 2005), teacher's self-efficacy (Buchanan, Sainter & Saunders, 2013), ecological factors (Ngai et al., 2007), pedagogy, stages of concern and accessibility (Burke et al., 2018),teacher's professional identity (Kimmerl, 2020), teacher's digital skills (Arif & Mehmood, 2012, Tran et al., 2020), and pandemic fear (Al-Maroof et al.,2020).

External factors like lack of access towards technology tools (Ramzan, 2009), lack of funds, support, training, positive mindset (Shaikh,2009), level of internet use (Arif & Mehmood, 2012), institutional assistance, instruction and guidance (Balash, Young, & Abu, 2011), culture at the school and career growth (Lai, Wang and Huang, 2022), continued technical assistance and appropriate training (Hall & Higgins, 2005), quality of the user interface, individual creativity, and perceived educational benefit (Sumak et al., 2017), worldwide needs and educational infrastructure (Tran et al., 2020) are studied. Moreover, influences of others, external expectations, conditions that facilitate technology use, etc. are utmost elements that may influence the objective of the person to utilize tools (Teo et al., 2019). On the other hand, there is disagreement on precisely which elements would be most crucial in the educational use of computerized innovation in the field of advanced education as well as whether these characteristics might affect learning results (Lacka et al., 2021).

The COVID-19 pandemic has led to a shift towards distance education, highlighting the importance of Web 2.0 in managing online learning. Before understanding the role of Web 2.0 it is interesting to know that the Web has had multiple fairly short-lived generations. The robust pace of technological advancement has enabled the Web to evolve in a continuous manner.

The initial iteration of the Web, known as Web 1.0, or" read only" emerged in the 1990s and is considered to be its foundational period. Web 1.0 is distinguished by being a read-only version of the Internet, where users are limited to viewing material on the web pages they browse and take on an inactive position (Almeida, 2017).

Between 2000 and 2009, the Web's second phase—also referred to as Web 2.0 or "read-write" emerged. The social network revolution, high levels of interaction, and user involvement in content creation arrived with Web 2.0. a number of well-known websites at the time established, including Wikipedia, Facebook, YouTube, Twitter, and Instagram. Websites started to function as interactive tools that encouraged user interaction and offered feedback. Mobile web browsing has increased dramatically (Almeida, 2017).

The third stage of the Web, also referred to as Web 3.0 or the Semantic Web runs from 2010 to 2019. Web 3.0 or “read-write-execute” web aims to streamline user searches and content viewing. Using user history, interests, and preferences as a basis, the aim is to optimize and personalize internet searches. Many writers have referred to Web 3.0 as the "intelligent Web" because of its features, which go beyond those of conventional search engines. For instance, Web 3.0 ads can be tailored to the interests and behaviors of individual users (Almeida, 2017).

Web 4.0 or “read-write-execute-concurrency” web refers to the artificial intellect used in widely launched chatbots and robots to improve the efficiency of operations (Kaplan & Haenlein, 2019). These gadgets have been designed to behave emotionally and cognitively similar to a human being. They have been trained to carry out routine duties based on orders in addition to economic activities. They enable workers in their companies to be more productive and distinctive, produce better-tailored products, and work more efficiently (Boltonet al., 2018).

The decentralization of Web 5.0 occurred in 2017, a concept built on the Symbiont web. In this case, a private server (PS) was not necessarily feasible, and individuals might communicate with one another using smart connectors such as augmented reality gadgets and virtual reality objects (smart glasses). Headgear and gadgets with AR and VR capabilities can improve the experience of users with Web 5.0 (Duy et al., 2020). Even if Web 3.0, Web 4.0, and Web 5.0 are now widely available, there are still good reasons to do post-pandemic research on Web 2.0, particularly when considering how higher education teaching is conducted. The following are possible explanations:

1-Social networking, collaboration mediums, and content-sharing tools are examples of Web 2.0 technologies that are still in high demand and have a global following.

2-It is possible to gain insight into the efficacy of these instruments within the current infrastructure by investigating their use after the epidemic.

3-Learning about Web 2.0 guarantees inclusive teaching methods.

4-Comparing them to more recent technologies that could still be developing allows researchers to assess their stability and long-term effects in learning environments.

5-Examining Web 2.0 in the aftermath of a pandemic might reveal user perceptions and possible adoption roadblocks.

Consequently, there is a need for pedagogical guidelines and proposals (Salcedo et al., 2020). Many scholars have searched the views of teachers regarding Web 2.0 products' suitability for use in education (Caliskan et al., 2019). Abbasi et al. (2015), Imtiaz and Maroop (2014), and Teo and Zhou (2014) have probed in this field. In Pakistan, Web 2.0 technologies have been studied in university libraries' adoption practices (Shah, 2016), teachers' competencies (Soomro et al., 2015), and students' usage (Saqib et al., 2019). However, higher education teachers' perspectives need investigation (Adnan & Anwar, 2020).

Understanding barriers to Web 2.0 technology use in educational methods is crucial for better incorporation in education (Soomro et al., 2020). Knowing the factors associated with the incorporation of computer technologies in a post-pandemic situation might provide assistance in future for improving the use of innovation and Web 2.0 devices in the wake of health emergencies.

The framework used in this study was the Will, Skill, Tool, Pedagogy (WSTP) model of technology integration proposed by Knezek and Christensen (2016). Previously, the model has been studied with computer technology, whereas in the present study the Web 2.0 technology is added, making a new addition to the model in the local context. Although the world is leading towards other web generations such as Web 2.0 and Web 3.0 but the present research has chosen Web 2.0 on account of Pakistan being a developing country where the affordances of Web 2.0 have not been fully explored yet as compared with developed countries.

Previous researches such as that of Morals (2006); Agyei and Voogt (2011); Petko (2012), and Farjon (2019) have used the model without a pedagogy construct, and it was found that effective use of computers in K–12 classrooms was correlated with teachers' attitudes towards them, their level of self-viability, and a general willingness to adapt. As a predictive notion, construct pedagogy (teaching methods like constructivist or behaviourist) has empirical validity (Knezek & Christensen, 2016). Farjon, Smits, and Voogt (2019) extended the Will, Skill, Tool model with a new construct named Experience as the WEST model, which was used for teachers and explained 60% variance in technology integration. This study used the will, skill, tool and pedagogy model for in-service university teachers in post-pandemic situations.

For measuring the technology integration three scales namely Stages of adoption of Technology (SoA) scale, Concern Based Adoption Model-Level of Use (CBAM-LoU) scale and the Apple Classroom of Tomorrow Teacher Stages (ACOT) scale were used because these were used in literature (e.g., Morals, 2006; Mayes, 2014; Knezek and Christensen, 2015) for measuring the integration of tech in the educational field. In view of Hancock et al. (2007), to measure the adoption of new innovations, two constructs, namely Stages of Concern and Level of Use, were used at large scale by the researchers as an analytical frame in the last forty years. Hancock, Christensen and Knezek (2007) when investigating the combined effect of these three indicators found that they produce a reliability of .84 and recommended that these three might be used across different cultures. To the best of researcher's knowledge, there is no study that has utilized these three indices for measuring technology incorporation in the local context.

There was a need to test the model in a higher education context, as previously the school teachers' sample was taken along with their administrators (Christensen and Knezek, 2011, 2014, 2015). The four-component model of technology integration predictive power could be further confirmed by SEM, which might also ascertain whether the capacity to predict may exceed the previously reported 90 percent (Knezek & Christensen, 2008). The scarcity of literature regarding the continuation of teaching learning process followed by the Web 2.0 technology by the higher education system in Pakistan motivated the researcher to probe in the field. Post-pandemic education demands that teachers not only apply technology effectively but also develop skills and competencies to design new educational scenarios (Cardenas, 2022). Similarly, less literature is found about the impact of inside and outside factors on innovation.

This study would be an endeavor to analyze the prevailing situation and related challenges and opportunities for future education. To learn more about how people perceive technological integration, Zirra (2019) suggested a future study employing a mixed-methods approach. Sawyerr (2021) conducted a quantitative study related to technology integration using the WSTP model and suggested a need for a qualitative study in the future. As per the literature, a mixed-methods study was conducted to investigate the integration of Web 2.0 technology into instructional practices at the higher education level.

1.2 Statement of the Problem

In this digital era, success requires people to accept technology and develop the capacity to augment its utility. The dynamic education system demands educators be equipped with the technological knowledge and skills to maximize benefits. Technology integration is a crucial ability for teachers to acquire in order to assist in the attainment of instructional goals and enhance students' learning (Uerz et al., 2018). Eventually, technology adoption will be considered necessary for educational institutions of all levels. The studies revealed that different variables like willingness, expertise, pedagogy, and availability of technological tools, as well as administrative aspects, appear to play important roles in the technology integration process. In the backdrop of the pandemic, it became quite challenging for educators to address this predominant aspect related to instruction and technology. Some sporadic efforts appear to have been made to sort out the application of Web 2.0. However, the question remains as to how the faculty visualized the teaching learning situation in the emerging context and to what extent they managed to integrate technology into instructional practices.

Despite the recognized importance of technology incorporation in education, there seems to be a scarcity of studies regarding the application of Web 2.0 technology in higher education in Pakistan, particularly during a pandemic, which demands proper situation analysis to fill in the gap. Although there are some isolated studies related to ICT, the situation demands further investigation into Web 2.0 technology and its application in the teaching and learning process. For online teaching and learning to be more productive and useful, it is appropriate to identify major issues and challenges to be addressed. Hence, the focus of the study in question is to determine the integration of Web 2.0 technology into instructional practices at the higher education level in a post-pandemic situation.

1.3 Research Objectives

On the basis of the issue statement, the objectives were formulated as follows:

1. To analyze Web 2.0 technology integration (levels, stages, and ACOT) into instructional practices at the higher education level.

1.1 To analyze Web 2.0 technology integration using the Concern-Based Adoption Model Level of Use (CBAM-LoU) scale.

1.2 To analyze Web 2.0 technology integration by Stages of Adoption (SoA) scale.

1.3 To analyze Web 2.0 technology integration by the Apple Classroom of Tomorrow (ACOT) teacher stages scale.

2. To explore the availability of Web 2.0 technologies at the higher education level.

3. To explore the use of Web 2.0 technologies at the higher education level.

4. To analyze the influence of key factors such as *will, skill, pedagogy,* and *tool* on the integration of Web 2.0 technologies into instructional practices at the higher education level.

5. To explore the barriers and challenges faced by faculty in the adoption of Web 2.0 technologies at the higher education level.

1.4 Research Questions/Hypotheses

Q1: To what extent is Web 2.0 technology integrated (levels, stages, and ACOT) into instructional practices at the higher education level?

1.1 To what extent is Web 2.0 technology integrated by the Concern Based Adoption Model Level of Use (CBAM-LoU) scale?

1.2 To what extent is Web 2.0 technology integrated by Stages of Adoption (SoA) scale?

1.3 To what extent is Web 2.0 technology integrated by Apple Classroom of Tomorrow (ACOT) teacher stages scale?

Q2: What is the extent of the availability of Web 2.0 technologies at the higher education level?

Q3: What is the extent of the usage of Web 2.0 technologies at the higher education level?

Q4: Why the integration of Web 2.0 technology at the higher education level directly affected by factors such as *will, skill, pedagogy,* and *tool*?

The following hypotheses were made on the basis of the above question:

H1: There is a direct positive effect of will on technology integration.

H2: There is a direct positive effect of skill on technology integration.

H3: There is a direct positive effect of pedagogy on technology integration.

H4: There is a direct positive effect of tool on technology integration.

Q5: What challenges hinder the integration of Web 2.0 technologies at the higher education level?

1.5 Conceptual Framework

The process of tech incorporation by teachers facilitates the achievement of better learning outcomes along with learners' participation in the digital world (Mayer, 2019). The target of the present study is to analyze the integration of technology into instructional practices, key factors both internal and external that affect the instructor's technology implementation during the pandemic period, and challenges faced by them during this process. For this purpose, the Will, Skill, Tool, and Pedagogy (WSTP) model by Kenezek and Christensen (2016) was adopted as a framework because it addresses most of the internal and external factors related to technology adoption (Fig. 1). Petko

(2012) studied the model and proposed that an additional component, pedagogy might be added. Knezek and Christensen added the component in 2016 and found it to produce 33% of the variance in technology integration. According to Knezek and Christensen (2016), the Will, Skill, Tool, and Pedagogy (WSTP) is a conceptual framework designed from the perspective of experiential study.

Technology integration means the deliberate selection of technological assets to support particular instructional techniques during the teaching and learning processes (Keengwe & Onchwari, 2016). The integration of technology has its link with the theory of diffusion of innovation presented by Rogers (1991). In the process of adoption or rejection of the technologies, some stages presented by Rogers are: innovation-related knowledge, attitude, decision-making process regarding the innovation, implementation, and verdict affirmation.

Likewise, in 1999, Griffen and Christensen developed a scale, namely the Concern Based Adoption Model Level of Use (CBAM-LoU) scale, which has its origins in the work of Hall (1975). It has eight levels from which one can measure the technology integration: Level 0 is for non-use, Level 1 is for orientation, and Level 2 is for use. Level 3: mechanical application; Level 4A: routine; Level 4B: refinement; Level 5: integration; and Level 6: renewal.

Similarly, Russell (1996) identified six stages through which students move during the process of tech integration. Based on his work, Christensen (1999) developed a Stages of Adoption (SoA) scale with six stages: 1: awareness related to knowing how but no use of technology; 2: learning the process related to low self-confidence; 3: understanding and application of the process; 4: familiarity and confidence; 5: adaptation related to the use of technology in different backgrounds, creative application related to its use as an instructional device, used for tech integration measurement.

Dwyer and colleagues developed a level of adoption in 1994 based on the Apple Classroom of Tomorrow (ACOT) study. The five stages 1: Entry related to basic learning 2: Adoption related to the use of basic-level technology; 3: Adaptation using tech for increasing efficiency; 4: Appropriation using tech without effort and 5: Invention developing a novel environment with technology were mentioned in it. For measuring the integration, three self-reported instruments, namely the Stages of Adoption of Technology (SoA), Concern-Based Adoption Model Level of Use (CBAM-LoU) questionnaire, and the Apple Classroom of Tomorrow (ACOT) teacher stages questionnaire, were used.

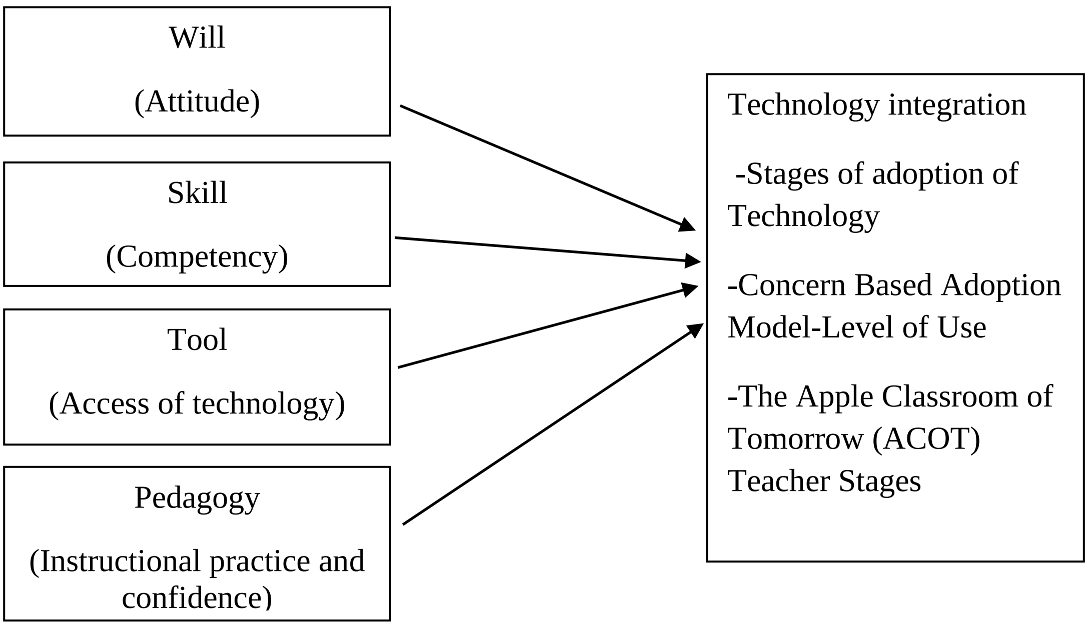


Figure 1: Conceptual diagram (Knezek & Christensen, 2016)

Related to the key factors, there are four independent constructs in the model influencing the integration of tech. Studying the four elements of the model will help not only in understanding the model but also in comprehending the internal and external factors influencing the educator's technology adoption. The four elements are will, skill, tool, and pedagogy.

Will is one of the key elements, which meansa technology attitude plus the motivation of the teacher. In 1975, the Theory of Reasoned Action (TRA) was presented by Fishbein and Ajzen, in which they declared that behavior intention is the predictor of actual behavior, while behavior intention itself is affected by the attitude and subjective norms of a person. They defined attitude as an analytical gauge of positive or negative aspects of behavior and performance. For measuring the attitude Teachers' Attitude towards Computer (TAC v 6.1) questionnaire was used.

The second important element is *skill,* which indicates the technology competencies, practice, awareness, and self-efficacy of the teacher. Bandura (1986) mentions three separate determinants: behavior, environment, and personal factors essential to determining the process of knowledge and skill accomplishment related to innovation and its effective adoption. Bandura (1997) posited that human learning and behavior are shaped by watching others and explicit experiences of oneself. The basis of activity is the efficacy beliefs and individuals' lives are led by them. A person shows certain behavior if he believes that the action will result in useful outcomes, plus he believes in himself that he is capable of doing something with the capabilities he has (Bandura, 1986). For measuring this dimension, the teachers' proficiency self-assessment scale (TPSA-C21) was used.

The third element is *tool,* which is conceived as access, the availability of technology, and the environment. To measure these questions related to home and university access and availability of tools were used.

The fourth element, *pedagogy,* comprises teaching styles and instructional approaches (constructivist and behaviorist) and covers general didactic practices. When the example of integrating technology comes, the instructional method takes in the confidence (self-efficacy) of instructors that they felt in their usage of educational procedures for technological applications to improve pupils' knowledge. Research shows that using tech depends on the way teachers use it in the classroom (Stegmann, 2020). Through the utilization of Web 2.0, it is assumed that pedagogical approaches have their foundations in theories of connectives of learning and teaching (Dumitrescu, 2015). Connectivism is a rational development other than an instructive and constructive philosophy in this age of Web 2.0 (Ryan, 2009). Unlike behaviorists, cognitivists, and constructivists, the only place of knowledge to have seats in is not the brain all alone but rather the environment of networks that might be provided with the internet, databases, or gadgets (Siemens, 2005). This leads towards a pedagogical practice that should endeavor to draw successful networks having self-sufficiency and credibility along with the help in moving towards these networks individually and socially (Downes, 2008). For measuring pedagogy, additional scales included in TPSA-C21 by Christensen and Knezek (2014) were used.

Different researchers found different factors affecting technology adoption in Pakistani university libraries, such as lack of access to technology tools (Ramzan, 2009), lack of funds, support, training, positive mindset (Shaikh, 2009), perceived skill, level of internet use (Arif & Mehmood, 2012), and positive attitude and personal interest (Shehzad, Tariq & Naeem, 2021). All these factors were studied separately, while the Will, Skill, Tool, and Pedagogy model (Knezek & Christensen, 2000) combined most of the factors at one place for technology adoption, which has not been studied previously by university teaching faculty in Pakistan. The Model of Technology Integration is based on the minimal elements that the authors have discovered to be prerequisites for integration across various investigations. Therefore, this conceptual framework was selected for this study.

1.6 Significance of the Study

The present study will contribute to the academic literature. It would add to the literature the benefits, challenges, threats, and opportunities faced by the tertiary education system all through the pandemic, plus the learning strategies in such situations. The model of will, skill, tool and pedagogy were not studied with Web 2.0 technology previously. Additionally, the model was tested for the first time in Pakistan. Previous literature conducted in Western and African countries mostly focused on school teachers, while this will be an addition related to higher education teaching faculty in Asia.

This study's mixed-methods strategy that combines quantitative and subjective techniques will give instructors, heads, and program originators a more thorough understanding of the influences of faculty aims, including a real mix of Web 2.0 innovations along different dimensions. This study will have great significance for all stakeholders in the post-pandemic era. The results of the present study will be beneficial for the Higher Education Commission, as they will be able to better understand the problems of faculty teaching online and may try to take practical steps toward solutions. It would be useful for the administration of the university as they would be able to provide the required technical equipment, facilities, and support to faculty in order to integrate the technology.

The results would be beneficial for trainers, as they would be able to identify areas for improvement for better incorporation of technology. The main goal is to evaluate the general qualities of the different components to assist educational leaders in making decisions regarding professional development for teachers and to acknowledge that every component is important in improving technology-related instruction. The results might be beneficial for the governing bodies, as they would be able to recognize areas that cannot be improved without government support and funds. Its results might be beneficial for teaching faculty to improve their capacity for technology integration along with overcoming the barriers. Curriculum planners may be the beneficiaries in that they may plan such curriculum and pedagogical techniques that would make technology integration easy for teachers in the future.

1.7 Research Methodology

The research design, approach, population, sampling strategy, study instrument, data collection, and analysis are all included in the research methods section. This research followed the accepted research design principles of the mixed-method research paradigm. The endeavor of the research included uncovering usage, the effects of internal and external factors, and challenges in the adoption of technology. Furthermore, in-depth development and validation of the theories and models concerning assimilation and technical absorption were done for the variables and their connections employed inside the well-defined conceptual model.

Therefore, it was determined that the ideal approach for acquiring information was a cross-sectional survey for quantitative data, whereas interview techniques were adopted for the collection of qualitative information. With the survey method, data may be gathered quickly, easily, effectively, and affordably from a wide audience at once (Sekaran & Bougie, 2011). To assess hypotheses, the structural equation modeling (SEM) approach was used. Therefore, from an ontological, epistemological, and methodological perspective, employing the survey as a data-gathering method is legitimate. Additionally, in order to fully comprehend the phenomenon, the interview technique was applied.

Teachers' attitude toward computers (TAC v. 6.1) (Christensen & Knezek, 2009), Teachers' Professional Self-Assessment Scale TPSA-C21 (Christensen & Knezek, 2014), and Concern Based Adoption Model Level of Use (CBAM-LoU) scale by Griffin and Christensen (1999), Stages of Adoption (Dwyer et al., 1994) scale, and The Apple Classroom of Tomorrow (ACOT) Teacher Stages scale were adapted. One self-administered checklist consisted of barriers, and technological tools and support were also used. Two open-ended questions were also included.

The privacy issues were dealt with in a cover letter in which their anonymity was assured along with the purpose of the research. To increase the response number, where possible, the survey questionnaires were collected as soon as the respondents filled them out. In such a manner, it was made possible for respondents to get clarity where they felt ambiguity, minimizing the outliers of research (Sekaran & Bougie, 2011). To guarantee the unwavering quality and legitimacy of the survey questions, content examination by subject-matter experts and a pilot study with possible participants were conducted.

Stratified proportionate sampling was conducted in the study to obtain the answers of the participants. This method of probability sampling was chosen to give every stratum an equal chance. When looking over the total population, the size of each stratum in a proportional stratified random sample is in proportion to the strata's population size, indicating that the sample portion for each stratum is the same (Crossman, 2021). Overall, 400 survey questionnaires were given out to the faculty, of whom 353 were returned, with a response rate of approximately 80% from each stratum. After screening for incomplete forms, 340 completed questionnaires were left for a conclusive examination. SPSS version 21 was employed for analysis, which comprised reliability examination, frequency, percentage calculations, and data screening. The study of structural equation modelling (SEM) was carried out using PLS 3 software. This study adheres to Hair's advice for doing a two-step structural model evaluation (measurement model first along with the structural model afterwards).

1.9 Delimitation of the Study

The analysis of Web 2.0 integration into instructional practices at the university level was the main endeavor in this project. There are a total of sixteen public sector universities (HEC, 2018) functioning in Islamabad and Rawalpindi, spanning over a small geographic region, which makes data collection a convenient process as compared to other regions of Pakistan. Four factors were used to make the decision: 1) The universities must be acknowledged by HEC; 2) only public sector universities were selected; 3) universities must be in general discipline; 4) universities comprising social science, management science, and basic science faculty were selected. As such, six HEC-recognized general discipline public sector universities were selected, including Women University Rawalpindi, Arid Agriculture University Rawalpindi, National University of Modern Languages Islamabad, National University of Science and Technology Islamabad, Air University Islamabad, and International Islamic University Islamabad.

It was restricted to cross-sectional inquiry through self-reported questionnaires and semi-structured interviews about their integration of technology during the pandemic. The reasons for this delimitation were financial and time constraints. It was feasible for the analyst to approach the universities of the mentioned cities as compared to the universities situated in other cities.

1.9 Operational Definition

In view of Gay et al. (2012), operational definitions of variables are beneficial in a variety of ways because they make it easier to express variables in quantitative terms.

Additionally, it aids readers in conveying the specific concepts that the researcher wants to get through. Therefore, the operational definitions in this study are given here.

1.9.1 Web 2.0

An updated version of the World Wide Web, which contains tools and applications for user participation and interaction, is commonly known as Web 2.0. Here, this term is operationally defined, including blogs, Wikis, WhatsApp, Facebook, YouTube, learning management system (LMS), course management system (CMS), Google Meet, Zoom, PowerPoint and Google docs.

1.9.2 Instructional practices

Here the instructional practices are defined as all techniques a teacher may use to fully engage pupils in their studies. With the intention of achieving certain aims of education, a teacher uses these tactics to guide his or her lesson.

1.9.3 Higher education institutions

The universities are defined as the higher education institutions.

1.9.4 Technology integration

This study focuses on the integration of technology as the expertise of teachers in terms of their understanding and application of technology.

1.9.5 Will

Will is defined as the attitude and motivation of the respondents

1.9.6 Skill

Skill is conceptually defined as the capability to utilise and to practice technology plus the self- efficacy along with preparedness to employ tech.

1.9.7 Pedagogy

Pedagogy comprises teaching styles, instructional approaches (constructivist and behaviorist), and general didactic practices and self-efficacy.

1.9.8 Tool

The availability, accessibility, and environment of technology comprised the tool.

Summary

By describing and illuminating the research's background and goal, the foundation for the study was laid in this chapter. This chapter also examined the study's background, breadth, contributions, importance, and research goals. The theoretical framework, delimitations, research technique, and methods are also provided.

CHAPTER 2

LITERATURE REVIEW

The literature review section covers the historical development of the web, its needs, some theoretical models presented about technology integration, and also the literature presented in this regard. It reviews studies on related technology variables. It identifies previous research, its need, and the deficiency in the previous work.

2.1 Historical Development of ICT

Historically, according to Grey et al. (2003), there have been three stages to the use of information and computer technology (ICT) in education. The first phase lasted from 1970 to 1980 and focused on traditional learning, where teachers used to convey knowledge in the form of instructional packages. It was mainly teacher-centered, a form of conveying information also known as computer-assisted learning. The second phase started in the early 1990s, when traditional computer-assisted learning was supported by emails and discussion groups, which gave rise to consulted awareness (Gaimster & Gray, 2002). By the end of 1990, a third phase emerged, leading to a virtual learning environment. Pakistan also ventured into this environment by establishing a virtual university in 2002 (Kundi & Nawaz, 2014).

In view of Roblyer (2016), the revolution in information technology and computer-aided education trend came forward in the early seventies, when microcomputers and teleconferences were introduced for the first time. For educational establishments, these novices' reasonably priced personal computers appeared to be fairly providential. While acting upon governmental advice, a lot of money was invested in these personal computers and education-related software, which was selling up in retail. In those days, academic worth and achievement started to be measured as productive and efficient when the institution possessed the ability to reach more learners, and the computers in the institutions were considered the best means for this delivery.

Computers were introduced in schools by the late 1970s and the term “computer education” came to be known. In the 1980s, the name ‘computer’ was substituted by ‘IT’ (information technology), suggesting a move from computer tech to the competence of collecting and retrieving facts (Pelgrum and Law, 2003). Following this, the term ‘ICT’ (information and communication technology) was introduced in 1992, as soon as the common people could access email.

The term IT was used when secondary devices such as printers, disc drives, scanners, and cameras were introduced with computers. Following the internet, WWW (World Wide Web) search engines introduced the terminology of ICT. The term ICT covers numerous technologies by means of which one can get and exchange information with other people. Information signals in the atmosphere can be detected, interpreted, and communicated to others with the help of ICT. In short, ICT consists of a complete range of electronic devices that not only help in gathering, recording, and storing information but also facilitate exchanging and disseminating it (UNESCO, 2010). It comprises computers, the internet, and devices that are used in electronic information displays such as radios, televisions, and projectors, which are extensively used in education nowadays. Teaching, learning, and assessment are the fields in which ICT is playing its part more progressively. ICT has played a significant role in educational improvement and refinement (Grabe & Grabe, 2007).

From its inception, ICT was used in the educational field but was not so common at that time (Hepp et al., 2004). According to Pelgrum and Law (2003), despite the fact that traditional subjects were not taught using computers, in the beginning interest in computers increased due to the commonly accepted reality that the main aim of education was to prepare lifelong learners. Lowther et al. (2008) declared that ICT is capable of lifting up educational value and creating links between learning and the real world. Learning is a continuing, long-term process where learners modify their prospects, looking for awareness that deviates from the conventional procedure (Weert & Tatnall, 2005). In due course, novice education sources must be found willingly. The crucial precondition for such learners would be their skillfulness and dexterity in using ICT.

According to Harasim (2006), following this revolution, the decade beginning in 1980 and ending in 1989 triggered the latest learning method of linked-up classrooms, elevating the use of the net as a didactic helper and executing online collaborative learning (OCL) as the primary element of the online course. According to Roblyer (2016), learning institutions progressively took a turn and left behind the microcomputers and adopted network systems, a modification that encouraged the progress of systems for integrating learning (ILS), which is defined as the system of the basic program of study usable for many learning institutions. Meanwhile, it was a common belief that each and every student must be provided access to new technology, as it had the capacity to take into account each student's demands and preferred learning style. According to Craig (2013), the expression virtual reality (VR) was invented by Lanier in 1987, when his corporation became known for the development of virtual reality gear.

The years after 1990 could be called years of knowledge exploration and computer interactions, dominantly with the fame and ease of use of internet-based facilities, for instance, online correspondence. Subsequently, the educators became more interested in using technology to improve students' results, seeing that as a justification for their interest. The association between schools, education, and technology provides the basis for any kind of debate about technology in schools. According to Mevarech and Light (1992), initially, when computers were introduced in the schools, there was a false impression about the possible use of computers that they would replace the teachers' jobs. Nevertheless, the application of ICTs in the educational background could be split up into two large types: ICTs for instruction and ICTs for instruction. The former indicates improvement, particularly in relation to instruction and learning intention, while the second refers to the implementation of tools in educational practices.

According to Crompton (2013), the first cell phone was made by Motorola and came into the retail sector after nearly ten years, but it paved the way for the mobile learning mode of the coming millennium. In the meantime, the requirements of the administrative centers began to evolve. In view of Howard and Mozejko (2015), the demand for manual jobs slowly started decreasing, whereas the need for problem solutions and key capabilities increased, and IT skillfulness was considered a promising driving force. Additionally, computers appeared to have the complete capability to support personalized instruction by modifying education according to the requirements of each student. Consequently, it was expected from educational institutions to provide computer-literate students with command in software development and design, a prerequisite that spotlights the systematization of students' opportunities to use computers, and so the student-computer ratio turned out to be a key valuation feature for educational associations (Roblyer, 2016). In addition to ICT expertise and experience, the perspectives of both instructors and students are crucial in integrating ICT into the educational system. ICTs are essential for achieving the enterprise's success in the areas of employment, health, education, and social development (Barakabitze, 2019).

Many associations like Technology Education Design (TED) started up, which encouraged the utilization of educational technology (TED Conference, 2018). The earliest entirely digital courses were launched at the college level, facing some issues but being successful in general. The execution of the extensive digital courses as well as the attainment of the credentials were made possible via the initiation of the net and the internet before the 1990s. On the other hand, the US Air Force pilots got the opportunity to do virtual training, in which they experienced an engagement in simulated, computerized settings.

Sahin & Yaldrim (2020) declared that by the time the idea of educational use of technology got increasingly popular, the demands on educational organizations and teachers amplified for using the technological devices accordingly. According to Howard and Mojezko (2015), teachers who did not make use of technology in education had to face public criticism and were considered responsible for learners' educational losses. It was the time when the expression of the 'digital divide' got recognition; educational organizations in poor economy regions were unable to meet the expense of new tech requirements both for their students and instructors, which showed the shortcomings of such learners and teachers.

Didactic advancements experienced nonstop growth in the decade of the nineties, using the extension of digital education and the whole educational field. When the attractiveness of the World Wide Web got high attention, it gave rise to different forms of e-learning (Halim and Hashim, 2019). In the words of Roblyer (2016), the phrase 'educational technology' was initiated, which was defined as a system of teaching, mass communication, and automated information systems.

It was made possible for common people to get access to the internet; its facilities appeared unlimited, including hyperlink facilities, info, and data from across the globe, as well as text messaging facilities, emailing, and online chat for communication with other people, leading to cyberspace. After this, the phrase ‘augmented reality’ was created, signifying the superimposition of information with computer simulations. According to Firmin and Genesi (2013), the invention of interactive whiteboards altered the view of lecture rooms increasingly.

Oxagile (2018) argued that the scenario was changed all the more by the introduction of initial LMS like First Class, etc. The utilization of the internet in teaching expanded radically during the mid-90s; virtual classrooms flourished; and blended learning came into existence, which mixed conventional and advanced teaching methods by involving technology (Roblyer, 2016).

Additionally, the step-by-step progress of wireless devices and Bluetooth paved the way for mobile learning in the present millennium. A few of the Web 2.0 technologies that are the most well-known include Wikipedia pages, blogging, and online networks. Other Web 2.0 apps, however, include collaborative word processors, graphics services, messaging services, and other multipurpose software (Sahin & Yaldrim, 2020). These technologies are appealing for usage in academic contexts since they provide several appealing characteristics (Kohler, Newby, & Ertmer, 2017). It was the end of the decade of the 1990s that witnessed the complete use of the Internet in several educational institutions at school, college, and university levels across the globe.

According to Roblyer (2016), the initial standards developed for implementing technology in the educational field encouraged different associations to promote online learning. Free accessibility of important electronic material for the educational zone was made possible by advocating shared participation (Open-Source Initiative, 2012). However, an unusual Internet division continued when only privileged social class students got the opportunity to get the benefit of suitable coaching for efficient use of such technology as compared to students of lower economic backgrounds who did not get such training. Accordingly, the various sorts of the computerized divide are amplified instead of getting less. Roblyer (2016), along with Howard and Mojezko (2015), argued that the unchecked uses of technology, without guides, and for non-academic purposes by learners belonging to lower socio-economic status have become the sources of lower grades.

Regardless of the above-mentioned argument, education witnessed a fundamental change due to the development in the field of technology, which showed the way to the present millennium's 'Information Age.' The 21st century began to outspread, illuminating fresh high-tech resources and teaching methods that helped transform learning through electronic devices and digital affordances. In the first ten years of the present century, the internet as well as the World Wide Web experienced an upsurge, and the expression 'online' was defined as working on a computer with the internet. Web pages were interactive, as it was possible for the users to not only gain information but also edit it. According to Warner (2018), high-speed internet made the broadcasting of auditory and visual material possible. The applications of Web 2.0 technology are expanding daily. The fundamental cause of this is that these technologies make online user engagement, application interaction, and information access incredibly simple. Because of these qualities, utilization in education becomes inevitable (Caliskan et al., 2019).

The second generation of the internet caused the far-reaching promotion of global network technology-enhanced learning. Roblyer (2016) argues that electronic devices were progressively included in the established instructive execution of every academic stage, whereas the web appeared as a unique socializing platform among teachers. According to Ferster (2014), a couple of years after teachers became familiar with YouTube, the course content started being available in video form, which existed only in audio form earlier. As Bates (2014) expressed, finally, the initial Massive Open Online Courses (MOOC) came out.

Subsequent to the advancement of the web and cyberspace, a miscellaneous collection of the latest applications became known, counting cloud computing services, programming languages, electronic books, and above all, handheld computers, which provided the facility of working anywhere. Roblyer (2016) argues that the approachability to digital resources was radically assisted via the latest cordless, portable devices like tablets and smartphones, amazingly improving the implementation of online education on all scholarly platforms. Halim and Hashim (2019) posit that basic computer expertise became the preferred capability in society, equally noteworthy for basic literacy skills, which required reasoning and logical ideas.

2.2 What Is Meant by Web?

The Web is the internet element, which could be called a techno-social system because it interrelates humans based on technological networks. The idea of a techno-social system here means a structure capable of enhancing individual reflection, intercommunication, and interaction. Interaction requires intercommunication, which in turn needs reflection (Patil & Surwade, 2018). According to Callari (2009), the idea of the leading construct of the web was presented for the first time in 1989 by Tim Burners-Lee. The Web and its related technologies have improved a lot in the past twenty years.

2.2.1 Web 1.0.

The vision behind the advent of the web was to produce a universal info room by means of which people could talk and exchange ideas through the distributing of a collection of factual knowledge (Berners-Lee, 1998). Web 1.0 established a central location for information exchange and communication through information sharing (Hiremath & Kenchakkanavar, 2016).

The read-only web, sometimes referred to as Web 1.0, was one-way and fixed, which means no two-way communication was possible in it (Hiremath & Kenchakkanavar, 2016). Many business companies use the web for advertisements like those in newspapers. Most proprietors in online businesses use shopping cart applications in diverse varieties and forms (Suphakorntanakit, 2008). These websites consisted of built-in static HTML pages that were restructured uncommonly. The prime goal of the website was to provide updates for everybody with no time limits and to establish an existence in electronic media. There was no interaction on the websites, and they seemed like brochures. Consumers and customers could barely contribute or leave any kind of impression as they used to visit only; in addition, the linkage configuration was also very feeble and pathetic. The main code of behavior of Web 1.0 was HTTP, HTML, and URI (Patel 2013).

2.2.2 Definition of Web 2.0

Dale Dougherty presented the term Web 2.0 in a 2004 in the conference meeting (Berners-Lee, 1998). According to the definition of Tim O' Reilly as described by Getting (2007), Web 2.0 is the trade uprising in computer manufacturing on the grounds of the shift towards the internet as a platform, in addition to an endeavor to identify with the accomplishment tenets of the novice platform.

Getting (2007) presented the definition given by Tim O’Reilly: Web 2.0 is an endeavor to grasp the rules for survival on that software network as well as a business upheaval in the tech sector brought on by the shift to the web as a platform. The most important one of those rules is to fabricate functions that control net products, which get improved when the public utilizes them.

Version 2 of the Web is known as Web 2.0. It is known as a read-write web. Web 2.0 refers to web-based tools that let people enrich online material with other data (Ucar, 2022). Because of this, individuals have the chance to both create content and receive information. One can read and write on this website, which makes it two-way or bi-directional. In Web 2.0, people do not exercise many of the commands they were facing in Web 1.0, or one may say that Web 2.0 consumers enjoy more communication with a reduced control. Not just a fresh edition, Web 2.0 is supplying network design, inventive recycling, and shared content construction with amendments made easy in Web 2.0. The chief characteristic is to hold teamwork as well as to draw together joint intellect (Korucu, 2015).

Through the potentials of (i) spreading and taking part, (ii) organizing and classifying material, (iii) fostering innovation and pleasure, (iv) improving rich conversation, and (v) building technical knowledge, Magnuson's (2013) findings proved that Web 2.0 technologies boosted learning. The technologies are appealing for usage in academic contexts because they provide several useful functions (Kohler, Newby, & Ertmer, 2017).

Accessibility, permanence, editability, and connection were the four distinct aspects of these technologies that Treem and Leonardi (2012) discovered. Although Treem and Leonardi focused on the workplace, the same advantages are transferable in educational settings. The collective notion about Web 2.0 is that it acts as a platform. One might observe this in web applications like Gmail, Flickr, etc. The main concern of Web 2.0 is providing such internet software that is simple to use and provided without charge. For instance, involvement and discussion in a huge ecological area are made easy by blogs and wikis.

Web 2.0 differs from Web 1.0 in that it can read from and write to sites, showing that it is a socially generated space. Users may interact with other Web consumers through messaging apps, leave comments on blogs, and upload multimedia such as images, videos, and audio files to generate updated content (Ucar, 2022). Creighton (2012) posits that Web 2.0 distinguishes itself from Web 1.0's static features because of its interactive nature. The 21st century's platform for user cooperation is Web 2.0, an engaging and publicly built one. Web 2.0's central concept of collaboration is exchanging ideas and information to achieve shared aims.

Since users interact with the material by labeling, responding, or providing innovative material, two-way communication differs from face-to-face interaction in that users' ideas are exchanged with one another as well as with the content itself. Web 2.0 is much more flexible and consumer-friendly due to its structure than Web 1.0 (Ucar, 2022).

According to Stern (2015), Web 2.0 is a phrase that illustrates the varying progress employed in World Wide Web technology as well as plans that try to develop creativity, buy information distribution, and enhance alliances, along with the improvement of Web performance since people are familiar with it. The modifications are the reasons for the growth and progress of technology.

Jimo Yiannis (2013) lists the following justifications for the use of Web 2.0 tools in online learning: the initial reason is that these tools are compatible with the characteristics of modern education and related theories of mainstream pedagogical approaches, which shift teaching away from conventional methodologies and toward teamwork and collaborative methods. The counterargument would be that Web 2.0 technologies improve students' capacity for critical thought and give them more control over their own learning. Since most students integrate Web 2.0 technologies into their interpersonal and private lives, they are already highly prepared to use Web 2.0 apps.

2.2.3 Types of Web 2.0 Applications

There are several kinds of Web 2.0 applications, which include blogs, wikis, communal networks, basic syndication (RSS) mixes, etc. Well-known among others are Wikipedia, Flicker, Facebook (Aghaei et al., 2012).

2.2.3.1Blogs

In 1999, Jorn Barger initially projected the word ‘weblog’. A blog is a kind of website that consists of special web pages named ‘posts’ that are available sequentially, placing the newest in the uppermost places, like in journal mode. Blogs are text-based and as a result, guests can add their remarks. There are other kinds, like vlogs or videoblogs, podcasts, photo blogs, or photo logs, that allow people to utilize blogs for different stuff like graphics and film (Aghaei et al., 2012).

According to Solomon and Schrum (2007), David Warlick was the creator of Class Blogmeister and used it in the class. They further added that it puts educators in charge of their blog sites for certified periodicals, along with class supervision, projects like circulating the learning material, posting remarks, and pupils’ assignments.

Another widespread blogging web instrument is Blogger, which is a Google subsidiary. Here, templates are provided for teachers to generate a blog for their classes. A good aspect of Blogger is its ability to enable clients to make comments on blogs. For the purpose of making comments, users must have a registered email address and account. This makes it easy for the owner to recognize who is misusing it if it happens.

2.2.3.2 Wikis

A compilation of online pages called a wiki is intended to permit everyone to change on-hand topics otherwise put in their own matter by means of easy markup language, which is utilized for creating collaborative websites. The most famous wiki is Wikipedia. Wiki might be applied within the educational sector to improve the learners' information schemes (Harris & Rea, 2009).

According to Jonassen et al. (2008), the Wiki was initially produced by Ward Cunningham in 1995 and was given the name of Hawaiian lingo "wiki-wiki," meaning rapidly or fast. A wiki is a customized website that enables its users (either individually or in groups) to edit online information anytime, anywhere (Solomon & Shrum, 2007). After the emergence of wikis, these have become popular among students and teachers and have become a shared spot of information exchange for both educators and learners.

PB Wiki is one of the wiki sites that serves as a collaboration area for both. Wiki sites are also recognized as a source of knowledge and knowledge exchange for teachers and students. Several didactic curriculum associations utilize the shared locale for updating and refining the curriculum. This platform put together some other Web 2.0 in its structure to show a joint setting for its users (Solomon and Shrum, 2007).

Wikipedia is the most used website and appeared as an online encyclopedia that could be contributed to and edited by anyone in the world. There are more than 56 million articles in 323 different languages (Wikipedia, 2021). According to Jonassen et al. (2008), a wiki provides learners with an opportunity to collaborate in a community where knowledge is built. When someone edits the wiki information, this is stored in the form of a revision on the computer, making it possible to see what was added and removed from the wiki page. As described by Hemmi et al. (2009), it gives users the facility to review the earlier version, revise, and revert to the work of their preference as they compare information posted by diverse group members. According to Jonassen et al. (2008), wikis, when used in the educational field, contribute to the improvement of writing skills and teamwork.

Wiki Spaces is another free and ad-free website for teachers in K-12. Teachers are enabled here to set their preferences for safety measures and education. Teachers can allow the public to see and alter, only view and not amend, or allow only the members to view and revise (Wiki Spaces: Private Label, 2021). The PBWorks (PB is the abbreviation of peanut butter), which is the latest version of PBwikis, include added Web 2.0 technology along with extra admission, organizing capability, text organization, and cell phone support (PBWorks: Education Features, 2021).

2.2.3.3 Mashups

Mashups are web pages that collect services along with data from several geneses. There are seven distinct categories you can group it into: communication, maps, commerce, cellular, films, searching, as well as sport. The percentage of map mashups is 40 percent among other mashups. Building mashups is a quick and easy process. Building mashups is faster and simpler today as compared to application programming from scrap in an ordinary or traditional manner, and it is the most valuable feature (Aghaei et al., 2012).

2.2.3.4 Social network

A social network makes use of nodes for building a community system in general about institutes or persons that are connected by one or more special types of dependency on each other. Facebook is the leading social network. Twitter is a social network and micro-blog combined that enables users to read and post messages called "tweets." The fastest-growing social network is Twitter (Harris & Rea, 2009).

2.2.3.5Podcasts

A podcast is an online content package (audio and video) that may be downloaded for free from the internet using an RSS (Really Simple Syndicate)-capable piece of software. These digital content files may be played at any moment on a laptop or a portable device by users. The most widely used website for posting podcasts at the moment is YouTube. Three special types of podcasts include enhanced podcasts, double-twist podcasts, and video podcasts, sometimes referred to as Vod Casts. The fact that podcasts may be listened to on a variety of devices, including iPods, cell devices, personal digital assistants, and different portable means, has contributed to their increased appeal (Harris & Rea, 2009).

According to Willams (2007), podcasts serve the purpose of downloading, listening to, and streaming audio along with video collections uploaded by others on the web. Live broadcasting on the computer (mobile, desktop, and laptop) helps with listening to podcasts. According to Williams (2007), automated downloading is one of the distinctive characteristics of podcasts that are offered to RSS subscribers. Updated podcasts are sent to subscribers along with strings of segments from different podcasts present on the web.

There are several ways to utilize podcasts in the educational field, like supplementary mechanisms to improve and endorse courses and activities, to make inquiries, break education-related news, vocational training, and lesson files, on-the-spot video recording along with learning reinforcement (Williams, 2007), and for library endorsement along with revealing the lessons learned (Eash, 2006). According to Williams (2007), podcasts have been uploaded by a few teachers for those students who remained absent for some reason and wanted to review the class lectures.

In view of Williams (2007), it is a plus point of podcasts that students can play them repeatedly, moving them forward and backward to gain understanding. According to Jonassen et al. (2008), students get a wonderful alliance via podcasts; it is possible for them to share their ability with other members of their institution while they could prove their ability with the course benchmarks.

2.2.3.6Virtual worlds

It resembles a machine setting, which enables people to converse with one another across distances. Each user in this setting is represented by an avatar. In certain ways, the user's depiction assigned to him or her may resemble the person. Within these virtual worlds, the avatar may be fully customized, allowing for greater intricacy and customization per the user's tastes. Users may explore the virtual environment, work together to overcome problems, and interact within these endless simulations that are accessible around the clock. The largest virtual world now is Linden Lab's Second Life, which has more than 1.5 million users (Harris & Rea, 2009).

2.2.3.7Web syndication

The idea of displaying material from several online pages on one page is known as web syndication. The Really Simple Syndication (RSS) format can be used to disseminate constantly simplified electronic material, e.g., podcasts, weblogs, and status update feeds (Dorn, 2010).

2.2.3.8Twitter

Twitter is a type of Web 2.0 program that combines blogging and texting (SMS). Mills et al. (2009) said that Twitter was designed with emergency communication in mind rather than high-performance conversation.

Twitter is another social media tool hosted by the United States where users can post information and may attach links, photos, and videos to get more info about the matter posted (http://twitter.com/about, 2011). Myspace is also a social networking site that is also hosted in America and was started in 2004 (MySpace.com Fact Sheet, 2010). Users can use many tools here, like sending messages, music, and videos to their friends. According to this site, there are more than 100 million regular clients all over the globe (MySpace.com Fact Sheet, 2011).

2.2.3.9 Social search engine

These are seen as a part in view that they make use of the joint processing of online communities to increase, by tagging, mainly fascinating or related content. These explanatory tags promote the information set within web pages, theoretically completing the results for specific keywords. Typically, a client will see suggested hash labels for certain research keywords, showing the tags that have been added since then and several editions started together (Rouse M, 2011).

2.2.3.10 Course and Learning Management Systems (CMS, and LMS)

In general, an LMS is an auto system which consists of academic materials to guide the teaching - learning activities by preserving, following, and using student interaction data within the LMS. A CMS provides resources for the configuration, record keeping, and allocation of teaching materials on internet portals; an LCMS combines the elements of LMS and CMS (Dutt & Ismail, 2019).

Course management systems are created on a commercial basis and provided to schools on payment while in Moodle and Joomla many open-source settings are provided without charge. Whilst educational institutions decide on saving funds and conform to adopt no cost open-source management program for coaching of web-based courses, it requires distributing income to arrange a domestic management system to fix problems which may appear while running it (Levy & Stockwell, 2006). According to Blair and Godsall (2006) hybrid courses are introduced in K-12 settings and collaboration among learners has been started over assignments which help in learner preparation for higher education where they must study via the net.

2.2.4 Web 3.0

The third generation of the World Wide Web, known as Web 3.0, and John Markoff first used the term in 2006 (Patil & Surwade, 2018), typically thought to incorporate semantic labeling of material. Also known as the Semantic Web, data integration is the Semantic Web's underlying principle. "Display-only" data may be transformed into information that software agents can show, assess, and send by using metadata. In what is believed to be the future, the web will become more interactive among individuals and eventually develop some form of artificial intelligence (Web 3.0).

2.2.5 Web 4.0

Web 4.0 is known as a ubiquitous web and an ultra-intelligent electronic agent (Patil, 2013). Simply put, this means that computers would be intelligent enough to comprehend the information on the internet and respond by picking what should be done initially, loading pages quickly of higher class and speed, plus creating extraordinarily powerful web applications.

In Patil and Surwade’s (2018) view, the read-write-execution-concurrency web will be present in Web 4.0. It reaches a critical level of involvement in virtual communities that provide transnational accountability, control, dissemination, involvement, and cooperation in important sectors including business, politics, the community, and other groups. Web 4.0, or webOS, will be a gateway that begins to work like an operating system. The webOS indicates a vast web of highly smart connections and will be like the human brain (Patil & Surwade, 2018).

2.2.6 Web 5.0

Web 5.0 is currently a secretive concept in development, and its precise makeup is unknown. Web 5.0 can be thought of as the Symbiont web, which is decentralized. Instead, people try to connect via smart phones, tablets, or personal robots, which can surf independently in the 3D virtual world (Patel, 2013).

2.3 Social Media Sites Research

A social network is just a digital platform where people with similar interests, jobs, life experiences, and pastimes congregate to exchange news, photos, and videos (Salloum et al., 2017). In online communities, people utilize mail and internet chat services that are available through the internet to connect with one another. McEwan (2012) posits that online communities, forums, collaborative projects, multimedia platforms, virtual gaming worlds, and Twitter and LinkedIn are examples of social media applications. Facebook is also an example of a digital networking platform where users may show profiles by adding images, videos, and personal data. Facebook was proved to be a free social website to empower the public to create communities and get closer with each other. Facebook is used by individuals to stay connected with others. It is used for discovering what is happening around the globe as well as for sharing and expressing all that counts. 1.84 billion people visit Facebook daily and are called daily active users (Facebook annual report, 2020). People can upload text messages, photos, multimedia files, and videos on Facebook. People can set limitations on their access to their information.

Facebook groups allow users who are not friends to engage for free while transferring information, videos, and publications, as well as uploading photos (Alghizawi, 2018). The increased accessibility of internet connections, improved software tools, advanced computing, and portable apps are all factors that have contributed to the increasing prevalence and use of social media. The majority of people throughout the world depend heavily on social media for their everyday lives. Additionally, it enhances teaching and learning processes and is mostly employed by instructors and students (Salloum, 2021).

Al-Qaysi and Al-Emran (2017) posit that university education is one of the many industries where social media has attracted researchers' attention. The ubiquity of social media has led to an upsurge in research that examines its function in contexts related to higher education (Al-Qaysi, 2020). Dumpit and Fernandez (2017) found that some of these studies looked at how well social media was received in higher education. Other research (Ors et al., 2016) concentrated on the use of social networks for education and its effect on educational achievements and learners' engagement.

According to the literature, there is still a need for more research into the factors that influence social media adoption, and different angles need to be used while doing so (Rauniar et al., 2014). A theory or model for education was used to assess some of these variables, while some information systems theories or models were used to predict others. Therefore, selecting the most relevant educational or IS theory or model to investigate social media acceptability is still up for debate (Ngai et al., 2015). Social media's acceptability is constrained and affected by several aspects of instructional design (Al-Qaysi, 2020). For many nations and civilizations, these elements vary (Salloum, 2021).

2.4 Web 2.0 in Education

Web 2.0 platforms and applications, including blogs, forums, online discussion boards, Facebook, Flickr, YouTube, Instagram, and many more, are said to have played a crucial part in transforming the teaching and learning system (Halim & Hashim, 2019). As the environment created to ensure an efficient use of the potential offered by the web in education, learning environments, also known as Web 2.0, challenge us. The major characteristic that sets Web 2.0 technologies apart from earlier ones is that users actively contribute to the process of creating material for their educational experiences (Sonmez & Cakir, 2021).

Calskan (2019) conducted a project in Turkey and collected data from 114 prospective teachers, finding that they have an incredibly positive attitude about Web 2.0 tools. Also, no significant differences were found on a gender basis about the usage of these tools. Boza and Conde (2015) in Spain tried to confirm a scale on the teaching, approach, usage, and effect of Web 2.0 in universities. They concluded that training alone is not likely to have an impact on education; it is the attitude towards Web 2.0 and the practice that have more influence on teaching and learning practices.

Hollinderbäumer, Almenara, and Cano (2019) conducted a study in Mexico to authenticate the scale presented by Boza and Conde (2015) in an online survey by university students. They found that the students believe Web 2.0 has a key role in autonomous learning. Lowga (2012) highlights the level of e- learning and its utilization and stresses a few implications for the government and policymakers for universities to utilize technology as effectively as possible. Among them are internet facilities, the provision of hardware and software to all students and faculty, and the provision of alternatives to electricity, among others. Hartz and Ükert (2013) conducted a literature review about Web 2.0 and its use in medicine. Most of the work done on this phenomenon was in the USA and UK. The findings reveal learners prefer the use of Web 2.0 technology. By using these tools, students obtain the necessary skills that will be useful in their future lives.

Faizi (2018) aimed to understand the perspectives and ideas of both instructors and students of tertiary education about the use of Web 2.0 in language education practices, from which he understood that everyone was using them at a greater rate both for personal and educational drives. The use of the tools was greater on the part of the students than the teachers. Despite the appreciative behavior of the faculty members, the usage behavior of these technologies for teaching practices was not that encouraging. Their use of these tools was that of web users' instead of creators, along with means of communiqué.

Torres et al. (2018), in a longitudinal study from 2008-2016, proved that the Web 2.0 elements can be successfully used to create PLEs (personal learning environments) for students. They suggested that the use of a personal learning environment as a tool could enhance learning and skills, support group connections, and improve the management and organization of the learning materials. It was also helpful in showing the hurdles and obstructions, along with potential ways out. The key result of the work was the presentation of rules while adopting PLEs as supportive tools in formal education, both for teachers and students. Cetinel et al. (2022), in their survey of 285 teachers' feelings of Web 2.0 tools, discovered that in-service instructors have positive impressions of adopting Web 2.0 tools. The results showed that while perceptions of teachers did not differ based on gender, subject, or ability, they did vary based on school grade, information literacy ability, and prior experience with distant learning.

Karvounidis et al. (2017) investigated the effects of Web 2.0 learning environment in an experimental study at the tertiary level. During the deployment of a pilot course using technology, the main goals were to recognize the effects of these tools on students' performance as well as identify the factors considered necessary to get the most out of these technologies while installing the course. The findings showed no impact on the performance of learners; among the major features revealed after the study were comprehension, interest, and experience enhancement. These factors served as feedback for the continuous updating of the education system. Huang, Hood, and Yoo (2013) found a difference in the perception and use of Web 2.0 tools between males and females in the USA. Some tools, like Facebook and online video sharing, were found less apprehensive by females. It was suggested that these web tools could be used for learning by females at higher education levels.

In a paper published by Lomicka and Lord (2016), it was sought to examine the theoretical underpinnings of social networking use in language instruction as well as how social networking technologies may be useful for the learning process. In their experimental investigation (Yakut and Aydn, 2017) on 42 students studying foreign languages, the effect of blogs was seen. The participants took a pre-test and a post-test to assess their reading abilities. However, relying just on blogs did not ensure improved reading performance.

In their experimental study (Awada & Diab, 2018) with 81 English as a Foreign Language (EFL) students, over the course of a 6-week training session, Google Earth and wiki dynamics were employed to help the students develop their oral presentation abilities. Three student groups were used in the study: a control group, an experimental group using Wiki, and a group using Google Earth. The experimental research groups received help from the study's findings. On active learning and knowledge acquisition, it was seen that the Wiki and Google Earth groups performed much better than the control group. The outcomes showed that reading instruction improved students' reading abilities. In his quasi-experimental study (Kassem, 2017) involving 60 undergraduate students who were enrolled in English as a foreign language, professional writing ability was tested for the study, and the controlled and experiment groups revealed a substantial performance distinction. These results proved wikis' beneficial effects on the improvement of business writing abilities. Examining the studies on the benefits of wikis and blogs for education reveals that the majority of findings are favorable. However, statistical evidence is needed to back up this assertion (Sonmez & Cakir, 2021).

The old examination system in our universities may be a reason for the lack of validity and postponement of result announcements. Information and communication technology if applied as a campus management system (CMS), might prove an active instrument for integration and automation of the exam process and make the exam more trustworthy and effective, as well as clear and solve the e-governance issues in universities (Akbar & Qureshi, 2015).

Langset, Jacobsen, and Haugsbakken (2018) suggested some benefits of using Web 2.0 in teaching: these tools allow them to use diverse things and services in the classroom, and Web 2.0s give instructors choice. Lectures become more pertinent and beneficial as a result. These technological advancements help educators vary their evaluation outputs. These tools help in the promotion of teachers using the current material in the classroom. Teachers can access the information based on the student-made items by clicking the hyperlinks. Donmus (2022) posits that the use of Web 2.0s as a medium of instruction by instructors and students has made them more popular in the study of education.

McNeill (2012) conducted research over four years to explore the academic practice of assessing high order knowledge where assessment is supported by technologies. The results show that even though the academics had intentions for assessing high-order learning goals, they might make such assessments by mistake, which led the students towards low-order outcomes. This shows that teachers still need some kind of training in this regard if they want to assess higher-order skills through Web 2.0.

Bos et al. (2016), while doing research, found the effect of the use of online recorded lectures by the students on their exam performance and concluded that they got a higher score in the exam than those who did not use the recorded lectures. In a longitudinal study (2008-2012) at a Brazilian university, while examining the benefits of video conferencing for oral exams, the students and evaluators recognized it as an authentic assessment, interactive e-viva, accessible procedure, and real-world testing in terms of interval, exertion, and money (Okada, Scott, & Mendon, 2015). This shows the positive effects of video conferencing on assessment. In a case study at a Spanish university by Manzano et al. (2016), it was proven that advanced response systems (ARSs) increase performance in academic analysis, although with some restrictions.

Javaeed et al. (2020) conducted a study on medical students in Pakistan to see the examination outcomes after the integration of social media into teaching methods. It showed significantly better results after the integration of social media into traditional classroom practices. Among all applications, WhatsApp was the most used tool and proved to be most useful for the students. Social media played a significant part in diversifying the pupils' learning and proved to be a personalized and secure learning environment everywhere. The adverse effect was on the students' attendance in the classrooms, which decreased after social media. The reason might be that when these tools are used, the students become least interested in taking handwritten notes, as they believe they could easily get the notes online or via other recorded sources. This justification might be alarming for the teachers.

2.5 How Teacher Role is Changed

In view of Das (2019), the expansion of learner motivation, the improvement of fundamental skills, and the expansion of teacher technology training are only a few ways that the growth of information technology affects. Information and communication technology is utilized effectively to change curricula and academic subjects and to foster a learner-centered environment. These modifications have forced academic institutions, executives, and instructors to reconsider their positions, methods of instruction, and outlooks in the long term.

Technology change, in view of Knobel and Kalman (2016), which prompts a range of educational transformations and restructuring of educators' duties, is among key differences in the wider society and in educational systems in particular. Global education systems incorporate technology into teaching-learning-assessment procedures and help students build their digital literacy (Porat et al., 2018). However, in view of Harper (2018), integrating technology into education presents teachers with a variety of difficulties, such as creating or acclimatizing computer educational content and evaluating pupils' accomplishments in online settings, in addition to hardware failure, technicalities, and software accessibility. Shamir-Inbal & Blau, (2021) posit that teachers must deal with technological obstacles and devote more effort and time to their profession outside of class time.

The COVID-19 outbreak, which forced a distant educational approach in an urgent situation, highlighted the importance of developing educators' digital competency (Gewerc et al., 2020). Different professionals, like doctors, police officers, and engineers, etc., who use technological tools in their professions are recognized by the outcomes of that profession, but this is hardly true for teaching professions (Ertmer & Ottenbreit-Leftwich, 2010). In a survey in 2015, it was found that the most used technology tool by university faculty was SNS.

It is expected from teachers to make a successful application of technology an excellent example, and it is the same as expected from professionals in other fields of life. The level of technology used by teachers is not appropriate for entering the 21st century. Vongkulluksn et al. (2018) argue that many technology tools have been integrated into education, and different teaching approaches, like individualized learning, have also been adopted. Nevertheless, shifting instructors' beliefs on ICT usage continues to be the biggest obstacle to effective tech learning. Teachers, in view of Ungar (2016), must be aware of the opportunities presented by electronic learning resources and ready to address difficulties and roadblocks in order to use tech effectively and professionally. Ferguson et al. (2017) posit that traditional information transfer from professors to students is gradually being replaced by active knowledge production and cooperation in properly structured technology-enhanced learning.

Baturay et al. (2017) describe how teachers may learn how to implement ICT effectively, support learning and instruction, and get the confidence they need to handle the difficulties associated with doing so in the field. Ironically, in Chow’s words (2015), it seems many technology-using instructors still adhere to a teacher-centered teaching methodology. Haddad (2020) declares that it tends to take a lot of time for instructors to create appropriate educational resources along with their own curricula for multiple teaching approaches like project-based learning (PBL) or machine cooperation. For the 21st century learning requirement, teachers must be given training and helped to realize the facilitative use of technology in achieving purposeful knowledge, which empowers learners to create extensive as well as connected understanding that might be applicable in the state of affairs. Avidov-Ungar, Shamir-Inbal, and Blau (2020) declare that the demands placed on teachers today have increased dramatically, in part due to technological advancements. Teachers are required to use modern technological devices, incorporate their personal curricula as planners, exhibit command of the subject area, and be a part of a professional network. Shamir-Inbal and Blau (2021) posit that when instructors were forced to work from home during the COVID-19 epidemic, this difficulty was especially severe. They emphasized difficulties including incorporating innovative technology, the strict timetable, and the requirements of their regular work (Weisberger, Grinshtain, & Blau, 2021).

Dincher and Wanger (2021) in a survey about determinants of technology during pandemic found that web-based teaching tools were more inclined to be used by instructors who had a greater affinity for digital technology and a better perception of the success of digital distant learning. Additionally, instructors who are female and who are more motivated by their jobs utilise web-based teaching technology far more often. The availability of information technology at the instructors' school and the age of the teachers has no discernible impact on the use of web-based teaching tools.

The National Literacy Trust (Picton 2019) discovered that while most instructors favoured adopting technology, the main obstacle was a lack of training. A quarter (23.3%) lacked any training in the use of technologies in teaching literacy. According to research, Hepp, Fernandez, and Garcia (2015), training is necessary for instructors to properly integrate technology. The proper use of technology, says Hollebrands (2020), in the classroom requires that teachers understand when and how to do so. Success depends on teachers' technical proficiency and flexibility in adjusting the breadth and depth of the programme. Hero (2014) in a case study introduced a curriculum which aimed about global issues while using tech. The basic aim was to analyze if the critical thinking skills could be enhanced or not and the results showed a positive increase in the deliberate kids' ability to reason by using the technology and content within the course. This research however opens the possibility of linking the teaching methods with web 2.0 technology for the enhancement of problem solving.

Kale and Goh (2014) tried to search the factors which influence the teachers' judgment to adopt web 2.0 and found the teaching style does not affect the teachers' choice of web tools for teaching while extra workload, and already decided standardized curriculum proved to be the hindrances in the adoption. It is suggested that infrastructure improvement, work regulation and enhanced training could change in the teachers' choice decision.

In Finland, a traditional face-to-face Project based Learning course was reshaped by integrating Web 2.0 tools with the basic purpose to enhance the meaningful knowledge of the students in Project Based Learning and to empower them for storing and sharing knowledge with other students. In the meanwhile, the teachers watched and provided necessary aid to the students in their individual info examining procedure.

A significant adjustment in practice is needed from many instructors who claim to have had little or no technological training. Change is often implemented in baby increments, examining what succeeds and what does not. However, the Covid-19 pandemic response's rapidity has precluded taking a calm and steady approach. The nature of teachers' jobs drastically changed overnight. It entered an uncharted area in which there were no rules and a lot of what is effective offline might not be effective online; moreover, teachers have found this change tough (Winter et al, 2021).

2.6 Web 2.0 and Teachers' Professional Development

The fact that educators must be fully trained to get help from ICT a study was conducted in Spain on primary school teachers and it was suggested that the training of teachers is usually dependent on Web 1.0 while Web 2.0 and Web 3.0 should also be focused while the initial training process so that the teachers get fully equipped with the modern technologies and the knowledge delivering process might get benefitted (Llamas-Salguero, F., & Gómez, 2018)

Newland and Byles (2014) while doing a research project found that learning of students enhanced after introducing e-resource and showed that the professional development of academics in relation to technology is necessary. It is also suggested for their own specialized improvement for the use of technology. This study has implications for developing countries like Pakistan where many teachers have minimum financial resources for continuing lifelong professional development. A noteworthy connection was found involving the skills of tech and the perception of effective use of these tools for knowledge in a research project by Mahmood et al. (2015) in Punjab. This research shows that those teachers who are competent in technology may use it in classroom practices better than those who are less technologically skilled or less developed professionally.

Shaikh and Khoja (2011) inquired on the usage of ICT at higher education and found the current exercise is about 50 percent and it should be about 75 percent. The reasons they found for non-use are the infrastructure and lack of policy implementation along with the steps not taken by the higher officials. This ramification is for higher officials of policy-making offices to ensure monitoring of the higher education system in order to maintain a check and balance in this regard. Majoka, Fazal and Khan (2013) study to see the way lessons work in the session 2010-11 in seven teacher training institutions. They found that the course was not implemented in most of the cases as it should be, because of the infrastructural issues as well as the inadequate teacher capabilities to use the technology. These studies stress the performance of a continuous certified development agenda at all levels along with continuous monitoring of such programs.

2.7 External Factors

Brown, Englehardt, and Mathers (2016) said exogenous obstacles are relevant to the technology adoption. In view of many authors like Donelly et al (2011), Lowther et al. (2008), one of the external factors which is believed to be an integral part of technology integration by teachers is their access to technology resources (both software and hardware). In survey 60% teachers out of 126 considered the non-availability of technology as an enormous obstacle in the path of assimilating with curriculum (An & Reigeluth, 2011-2012). According to Al-Ruz and Khasawneh (2011) accessibility of technology showed positive association with technology integration in the classrooms.

Petko (2012), Tezci (2011) and Wright and Wilson (2011) asserted the access as well as trustworthiness of high-tech resources and framework being other external factors for technology integration. Computer accessibility defines the Web and software utilization by educators (Petko, 2012). In view of primary school teachers of Turkey owning a computer and having internet access must be the part of ICT enriched school culture. While on the other hand it was empirically observed by Vermillion, Young and Hannafin (2007) that the ownership and access did not act as the must integration factors perhaps, it was the common vision, pedagogical understanding, and training of the educators which play a key role in this regard.

Technical facilitators and instructional support are also influencing factors in technology incorporation (Teo, 2011). Furthermore, other instructors struggled, had preconceived notions about how women should use technology in the classroom, were concerned about their instruction, and believed that there was insufficient outside backing for their work (Xu et al, 2020). As seen by Lesisko et al (2010) wherever the universities allocate funds for hiring the technology support staff the results are positive on student learning. External support from technical support staff, colleagues and the head of the institution also impacts positively on technology usage (Al-Ruz & Khasawneh, 2011). Other influential external resources include access to related content, information from colleagues, and experts from internet forums (Wright & Wilson 2011). In a comparative study of experienced (using tech for instructional purpose before pandemic) and inexperienced (started using technology during pandemic) teachers Dindar (2021) found that support and effort expectancy were the significant predictors of technology acceptance. Moreover, experienced teachers showed more effective use of ICT, classroom management, instructional methodologies, and student participation in online teaching. Teachers have encountered a variety of difficulties throughout the shift to online remote learning, including a lack of technology support and infrastructure, lack of familiarity with digital technologies, and a lack of online teaching expertise (Khlaif et al., 2021). This has significantly increased the stress and load on instructors (Marek et al., 2020)

Institutional policies also play a vital role in tech incorporation. In a mixed method by Chen et al (2019) by health professional educators from Taiwan it was found that school policies which help technology support and provision of equipment proved the leading issue in finding the tech assimilation in the classrooms. Hew and Tan (2016) collected data from students of 16 developed countries to figure out the predictors of IT integration and found that the clear institutional policy on the use of information technology remained one of explicit factor along with the other factors. Opportunity to enter professional training can influence technology integration (An & Reigeluth, 2011-2012). Data was collected from 303 science teachers by Alt (2018) and it was found that the training of the teachers increased their ICT integration in the classroom.

Dlamini and Mbatha (2018) investigated 986 working teachers of South Africa and concluded improper usage of tech in classes were the outcomes of inadequate setting of an ongoing certified growth of educators. It was proposed that while designing the CPD activities the experiences of the teachers and their contexts must be given proper consideration to make the process successful.

Another factor influencing technology integration is supplying educators with enough planning and preparation time in a technologically advanced environment (Hutchison, 2012). Chen (2008) in his qualitative study in Taiwan for reasons of no use of tech in education found that time shortage for planning proved one of the external factors, among others. Faculty teaching load and management routine also affect as external factors (Tezci, 2011).

In view of Sánchez-Prieto and colleagues (2019) educational institutions must be able to give instructors and students the necessary resources, instruction, time, technical assistance, and material to guarantee the effective incorporation of technology.

2.8 Internal Factors

Taimalu and Luik (2019) describe that teachers must purposefully revamp and rethink how they educate when implementing first-time use of technology. In this regard, teacher motivation can be crucial and is seen as a necessary precondition for technological integration. The critical relationship between instructor motivation and frequency has been shown by prior studies.

Beardsley et al (2021) in their survey of schoolteachers’ motivation and confidence in Spain related to pre and post pandemic era, their findings show that instructors are more confident in their ability to use digital tools in the classroom. Along with a rise in teacher enthusiasm to develop their digital abilities and utilise information technology for instruction, teachers' confidence in utilizing technology for lesson preparation, classroom instruction, assessment and feedback, and communication with family members and students has improved. Fauth et al. (2019) declares that teacher motivation might not (only) be seen as a constant trait of teachers but also as a unique condition that fluctuates depending on the context of the classroom.

Self-efficacy has become a key factor in the adoption of modern technologies. Self-efficacy has been viewed as a generic or a focused notion in literature on technology acceptance. Self-efficacy is a term used to describe how competent instructors believe they are at using technology to assist effective educational activities (Tondeur et al., 2020). This viewpoint suggests that self-efficacy refers to instructors' general ICT abilities rather than a single technology (Dindar, 2021). According to Kemp et al. (2019), when viewed specifically self-efficacy pertains to instructors' perceptions about their capacity to use certain technological tools. Barton and Dexter (2020) argue that teachers' ICT self-efficacy, whether general or focused, has typically been found to affect their adoption and usage of technology.

Knowledge and readiness for technology is one of the internal factors (Hutchison, 2012; Petko, 2012). According to Inan and Lowther (2010) increased technological knowledge and readiness significantly correlate and predict the technology usage. In view of Cviko, Mckenny and Voogt (2012) better knowledge has positive correlation with confidence which in turn predicted technology integration. Self-efficacy or confidence of teachers about technology integration was found to be associated with Technological Pedagogical Content Knowledge (TPACK) and its variables like technological knowledge, content knowledge etc. were the self-efficacy indicators (Abbit, 2011). In his work Abbit (2011) explains the need of producing technologically well-prepared teachers having self-confidence about technology integration. No discrepancy was reported in confidence of working and pre-service instructors while it was told by teachers that practical experiences in technology enabled classrooms, guidance from technology savvy teachers and arrangement of online classes could be some steps on the way to be a better educator (Moore-Hays, 2011).

The student-centered way of teaching is another factor and inadequate knowledge of this type of teaching and the way to incorporate tech in it are also considered internal factors (An & Rigeluth, 2011-2012). According to Faulder (2011) some other factors which affect technology usage in teaching are anxiety and fear of having less technological knowledge as compared to one's students, losing class control and staying informed with novice technology.

A teacher's pedagogical knowledge is another internal factor which impacts technology integration (Faulder, 2011) as well as a teacher's knowledge of curricula integration (Keengwe & Onchwari, 2009). Positive attitudes of teachers (Cviko, McKenny & Voogt, 2012) also play a part in technology usage. Xu and colleagues (2020) in their survey findings showed that generic computer instructors in Chinese high schools had a favorable attitude towards taught technologies, respected tech and thus the digital curricula, liked doing so, and were confident in their ability to instruct.

Research by Kemp et al. (2019) has also revealed that emotional qualities like pleasure, happiness, and satisfaction affect how well people adopt technology. For instance, it has been discovered by Chao (2019) that pleasure predicts future intentions to use mobile learning. Additionally, by Mohammadi (2015) it has been discovered that behavioural intention and pleasure both predict actual usage of e-learning settings. The desire of pre-service teachers to employ technology in their upcoming teaching was significantly predicted by repurchase intention. Khechine et al. (2020) declares that students in universities who used LMSs, and e-learning environments reported greater enjoyment and interest.

2.9 Technology Integration

Technology integration, as used by Daniels, Pyle, and DeLuca (2020) alludes to educators' reception of instructive innovations during instructing and learning, like the use of explicit equipment e.g., mobile technology, tablets or software applications (Bakfisch et al., 2021). It is possible (Bakfisch et al., 2021) to understand the type of technology integration used in the classroom on both a quantitative and qualitative basis.

From a quantitative standpoint, integration usually means how often technology is used in the classroom. For instance, this frequency is interpreted by merely calculating the frequency with which technologies are generally employed or which specific technological applications were used during classroom instruction. Quantitative metrics can be used to gauge how much technology is used in education overall, but they cannot gauge how well it is integrated

Two dimensions (Backfish et al., 2020) may be used to operationalize the quality of technology integration: Initially, the degree to which technologies were employed to change and redefine the established learning activities is referred to as the level of technology exploitation. The capacity of instructors to use the unique potential of educational technologies and create a creative learning environment is therefore captured by technology exploitation (Endberg, 2019).

Next, there are specific technological affordances that go beyond these broad horizons of technology use and offer an innovative learning environment that could eventually promote learning. Because information may be given in various and parallel forms, such as text, graphics, audio, and video, technologies, for instance, it enables the use of multifunctional representations. In addition, technologies may be employed to make educational and learning processes more adaptable by allowing formative evaluation or through offering specialized educational programs. Also, by encouraging student cooperation, technology use in the classroom may increase individual and group involvement.

Technology integration is defined differently in literature. According to Tondeur et al. (2009), technology integration refers to the efficient utilization of technology-based information and communication. In view of Davies and West (2014) it means the proper use of educational technologies to achieve desired academic attainment.

2.10 Studies Related to Technology Integration in Asia

In 2009, Ramzan carried out study on the use of computers, library software, online resources, and services in Pakistani libraries. The survey found that universities in Pakistan lack access to technology resources. If library personnel don't use the most recent instruments of technology with a welcoming attitude, IT advantages won't be realized.

Shaikh (2009) found that Pakistani institutes were far behind progressive nations in technology implementation and utilization due to lack of funds, support, training, positive mindset, passion, etc. Arif and Mahmood (2012) conducted a study on the usage of Web 2.0 technologies in Pakistani Libraries, which revealed that social networking websites were popular for sharing and retrieving information. Librarians needed training programs to make efficient use of technological tools. Additionally perceived skill level of internet use and perceived ease of Web 2.0 use has a significant effect on the adoption of Web 2.0 use.

Shehzad, Tariq and Naeem (2021) in their study of private university libraries in Pakistan found that positive attitude and personal interest is a factor which affects technology adoption.Through research and development (R&D), players in the educational field have significantly enhanced instructional technology in developing nations. However, before performing at the same level as contemporary economies in the modern education system, developing countries must use e-learning platforms (Idoga et al., 2022)

Asad et al. (2021) conducted research in a Sindh public university Pakistan in order to provide students access to the Internet and a greater range of knowledge to help them get a global perspective as well as to improve students' capacity to process information for educating and learning in an increasingly effective and efficient manner. The results of this study have shown how interested students are in using ICTs and e-learning in scientific and social science classes. Similarly, the results indicate that students may learn more efficiently using ICT and e-learning resources, which can also help teachers with their teaching processes in this advanced technological age. However, the problem shown by the research is that the university's administration does not encourage the professors to use ICT in their classrooms and practice because of worries about scarce resources and competency gaps.

Jung, Cho and Shin (2019) conducted a study in South Korean elementary and secondary school teachers. The goal was to figure out various correlations between teacher-related characteristics and technology integration. Whether the factors affect teachers' usage of technology significantly based on the level of education was investigated. It was found via the use of structural equation modelling (SEM) approaches that, except for teachers' pedagogical views, supportive culture, teachers' self-efficacy, and teachers' ability significantly affect how well instructors integrate technology. The findings of the multi-group SEM also show disparities across instructors in elementary and secondary schools; although knowledge was the most important variable for middle-school teachers, motivational support had the greatest impact on primary teachers' use of technology.

Ferris et al. (2022) reported on digital poverty in India that the enormous upheaval that followed India's decision to shut down its schools created a new reality that encourages digital connections for managing instruction and learning. Although India is acknowledged as a nation with a strong digital economy, the education sector is particularly affected by digital poverty among women. If future educational goals for sustainable development are to be achieved, digital power must help the education of girls in patriarchal societies like India. Consumer trust in consistent connectivity is undermined by simple challenges like a lack of infrastructure, energy, or internet blackspots. Despite the actions taken by succeeding administrations, very few people have access to modern technologies. According to the 75th National Sample Survey Report, 2017–2018, just 14.9% of rural Indian homes had internet connectivity, compared to 23.8% of urban households. As such many challenges were faced during the pandemic period for continuing the learning process.

Moorhouse and Wong (2022) conducted two-stage qualitative-dominant sequential mixed-method study in Hong Kong which examined teachers' readiness for using digital technologies before the pandemic, how they innovated and developed professionally throughout the pandemic, and what affect the pandemic has had on their pedagogical and technological development. During a survey of English teachers from Hong Kong schools the results show that teacher creativity and growth have been sparked by the COVID-19 epidemic. Teachers innovated in three stages as they reacted to the closings of their schools and adapted to the new virtual era. Teachers took part in both school-sponsored and instructor professional training to encourage their innovation.

The study by Teo et al. (2019) looks at what influences technology use in the Nepali environment. The information was gathered from 126 Nepali school kids. There were significant correlations between perceived enjoyment and behavioral intention as well as perceived enjoyment and computer self-efficacy. Contrary to expected correlations and the empirical literature, we could not detect any association between perceived utility or disposition and behavioral intention.

Idoga et al. (2022) conducted a study to figure out how well-liked e-learning is among lecturers at universities of Nigeria. The study used quantitative method and gathered data from 299 teachers via questionnaires. The study's findings point to the variables that influence instructors' use of e-learning platforms, their behavioral intentions as a result, and, ultimately, the acceptability of the e-learning system in Nigeria. According to the study, teachers' adoption of the e-learning platform in Nigeria was predicted by their behavioral intention, perceived utility, educational quality, and simplicity of use. Additionally, the study's findings showed that using an e-learning platform might provide unique barriers to users.

Ishak et al. (2022) conducted a study to find the teachers' beliefs and challenges about technology use during COVID. In their study of 78 schoolteachers in Malaysia, it was discovered that due to the scarcity of devices for students, poor internet connectivity, and constrained class time, instructors in that area mostly used smartphones to access the internet and conduct lectures.

According to Yeap et al. (2022) in their study related to challenges faced by technical vocational education and training, the findings revealed, problems with web access, learning platforms, syllabus and evaluation content, and the readiness of instructors and students for e-learning were raised as issues during the COVID-19 pandemic. Other issues included stigma associated with it, an absence of academic motivation and career advice, instructor professional competence, and insufficient infrastructure resources.

In their case study Alshehri et al. (2020) on 122 faculty members in Saudi Arabian college it was found that the tools used by the faculty during the pandemic were LMS, Google classroom, Schoology and Zoom. It was found that most of the faculty were happy with technology and thought it was effective. Improvement of technology infrastructure and services for online instruction, and capacity enhancement of servers were some lessons learnt. According to Ali (2020), meta-synthesis reveals that being open to change is a key criterion for effective use of technology since it gives both students and professors the chance to develop and use the necessary 21st-century skills.

Lufungulo et al. (2021) in their qualitative study from 16 Zambia university lecturers about their attitude of delivering online lectures during COVID, found that even while lecturers' original opinions about online education were unfavorable and flawed, they adjusted to it and have now completely accepted it despite its difficulties. The survey also revealed that a variety of problems, from leadership's failure to offer fundamental online teaching-learning tools to students' incapacity to appropriately and completely engage in the online sessions, contributed to lecturers' adverse educational practices.

2.11 Theories that Support Models of Technology Integration

There are few hypothetical approaches underpinning the models of technological integration in education. Among them is the Roger’s (2003) theory of Diffusion of Innovation (DOI) that illustrates aspects influencing a person’s acceptance of novice technology along with creative thinking as well as progressive phases a person moves across, in a group of professionals. Among other socio cognitive ideologies, the Ajzen’s (2012) Theory of Planned behavior And Social Cognitive Theory of Bandura (1980) provide an understanding about the progressive transformation in an individual’s behavior while adoption of technology (Niederhauser & Lindstrom, 2018).

There is a mild difference between acceptance theory and dissemination of innovation theories of technology. In the words of Straub (2009), diffusion theory makes clear the way of spreading an innovation across a populace; while adoption theory sheds light on subjective as well as communal aspects which guide persons for acceptance or rejection of something created with advanced features. Change is resulted after getting engaged with diffusion as well as adoption courses, but when it comes to the adoption of technology, it is nearly impossible to find a cohesive model which could explain the changes educators go through on the way to technology adoption (Niederhauser & Lindstrom, 2018).

2.11.1 Diffusion of Innovation Theory (DOI)

Rogers (2003) presented the theory which was generated to elucidate the way novel concepts and innovation get popular in a social group as well as to deal with the innovation characteristics like comparative strength, accordance, complicatedness, and trustworthiness. The introduction of an invention triggers the diffusion process, which concludes with adoption or rejection of the innovation. The features of the technology affect its adoption rate while including its viewed significant benefit over currently used ideas or technologies, compatibility with the person or organisation, clarity of understanding, ease of communication, and ease of use in trying out or experimenting with the innovation. It also deals with the attributes of end users concerning their level in usage (Franklin & Bolick, 2007). Similarly, it explains the stages in decision making educators pass through while adopting technology like information, reasoning, choice, carrying out, and validation

Lastly, diffusion networks illustrate the way innovation diffusion process occurs through the interpersonal relationship among the social group. Diffusion networks give understanding about moral principles governing behavior in a particular sphere, resources and interrelation held responsible for playing a significant part in the diffusion procedure.

DOI has been used as a framework to check the mobile technology diffusion among university faculty and the dearth of exchange of ideas within and among universities proved to be the reason for lack of use (Foulger et al, 2013). As opposed to that, in view of to Damanpour (1996), DOI cannot be used to understand the interconnected and complex situations where many variables are involved including the attributes of the users, attributes of the innovation and attributes of the milieu, creating complications to find out the root cause of the ultimate acceptance of the innovation.

2.11.2 Theory of Planned Behavior

Social behavior of persons can be positively predicted, guided, and explained through the theory of planned behavior (Niederhauser & Lindstrom, 2018). This theory (Presented by Azjen, 1985) which is a re modification of Theory of Reasoned Action (Fishbein & Ajzen, 1975) purports that intent is the direct precursor of behavior or action. The purpose is found by a person's attitude toward subjective rules and perceived behavioral control (Ajzen, 2012). This theory has its foundation in expectancy-value theory by Fishbein (1965). According to Ajzen (2012) generally, additional positive approach and individual standards endorses better apparent control, confidently manipulating the individual’s intent of performing the actions required.

2.11.3 Social Cognitive Theory

Presented by Albert Bandura (1986) who posited that human learning and behavior are shaped by watching and explicit experiences, on the other hand he also admitted the role of analytical, self-activating and self-recognition processes as well while elucidating individual adjustment and transformation. Bandura considered the individual behavior as a product of vibrant interaction of individual behavior and environmental impacts which results in individual’s behavior capable of informing and altering their surroundings along with psychological aspects responsible for alteration of succeeding behavior (Pajares, 2002).

Environment-related aspects play a crucial part in technology usage. Instructor’s decision of tech amalgamation leaves an impact plus affected by the large and societal environment. Technology access is obligatory but not an ample situation for technology usage in the classroom. As a consequence, technology access manipulates teachers’ readiness to integrate technology and this readiness, in turn, shapes the technology available in the surroundings (Niederhauser & Lindstrom, 2018).

According to Sandholtz (1997) in the project named Apple Classroom of Tomorrow (ACOT) the primary focal point was to supply a technology-rich environment to both the educators and the students. On the other hand, this “saturation strategy” seemed to be quite unreasonable to define the teachers’ way of teaching with technology and soon the stages of learning development of teachers became the focal point of the researchers. It was figured out that while using technology in the education process the educators develop through the three distinct stages namely survival, mastery, and impact. In the survival stage, they succumb to a feeling of incapacity to predict issues that need to be resolved and formulate required alterations. In the mastery stage problem, anticipation starts along with the formulation of required tactics to overcome and avoid such issues while teaching with computers. The impact stage is characterized by the ability of technology integration for aggravating the pupil’s impetus, curiosity plus understanding.

The awareness of foreseeing the student access to technology as well as the study of the feelings, beliefs and attitudes of educators responsible for technology integration prevailed in the decade of nineties which encouraged the growing concern towards continuous professional development programs along with the abstraction and implementation of models focusing straightaway on the contexts within the self-responsible for shaping behavior of the educators.

Hence along with the availability of the technology the intrapersonal aspects and the behavior of the educators were given extra recognition (Niederhauser & Lindstrom, 2018). The significant intrapersonal aspects of social cognitive theory consist of self-efficacy (SE), outcome expectation, as well as awareness.

Bandura (1986) argues self-worth is connected to a person's opinion about the task to be carried out with the capacities one owns. Lent et al (1994) defines outcome expectation as the person's motivation to do a task and it includes predicted results of that task. Teachers' self-efficacy role in technology integration has been focused at large on empirical research. In the decade of the eighties when computer technology was at its starting point as an instructional tool in education, teachers had little or no knowledge about it and their self-efficacy or self-confidence played a great role in deciding its use (Brinkerhoff, 2006).

According to Niederhauser and Perkman (2010), with the passage of time technology awareness increased as well as the confidence of teachers on the technology usage and it put forward the outcome expectation to the front line. All the above-mentioned theories support the technology adoption models which are discussed in the following. These models help in understanding the intricate progression the educators go through while making educational tech usage.

2.11.4 Instructional Theories

According to Driscoll (2000), because of the complex nature of learning, it may be hard to imagine a single theory that is both comprehensive enough to account for all significant components of learning and detailed enough to be helpful for instructional design. When the concept of pedagogy is linked with Web 2.0 two main theories need to be discussed, Social Constructivism and Connectivism. Before discussing it, other theories might be useful to study.

2.11.4.1 Behaviorism

The study of behavior patterns and response mechanisms in animals as well as humans by psychologists in the middle of the 20th century helped to promote behaviorism. According to behaviorism, learning is a reaction to stimuli. That is, both people and other organisms are trained to perform in certain ways in response to specific stimuli, such as salivating when the dinner bell sounds or recalling information from memory to obtain a reward. Thus, instruction and learning are processes that train students to respond appropriately to stimuli. Technology can aid in this training by offering learning incentives like games or other incentives or by offering systems to effectively develop stimulus-response conditioning like drill-and-kill exercises (Kimmons, 2020)

2.11.4.2 Cognitivism

Because behaviorism saw the brain's inner workings as an undetectable black box and did not believe that knowing how the mind functioned was crucial to aiding learning, cognitivism appeared as a rival theory. Therefore, cognitivism centered on the mechanisms by which the brain stores, retrieves, and employs knowledge. Cognitivism for education focused on supporting folks in creating effective instructional and reading procedures to help their cerebrum to make effective use of the information provided by seeing people as judgment machines instead of as creatures to be instructed. Considering the notion, tech may help in delivering information and learning assets that help the mind store and recover data even more actually, like through using mnemonic devices or many modalities (e.g., video, audio) (Kimmons, 2020)

2.11.4.3 Constructivism and Social Constructivism

Constructivism is often promoted as a method for deciding a child's level of knowledge and showing how that understanding may grow and transform into higher level thinking. Constructivism is an educational approach that encourages teachers to consider what their pupils already know and supply them opportunities to apply what they have learned (Mvududu & Thiel-Burgess, 2012). The constructivist approach has two main strands: the Cognitive constructivist view and Socio-constructivist view (Kanselaar, 2002). Considering the examination of Jean Piaget (1977), cognitive constructivism is an individualistic viewpoint. The two main components of Piaget's theory are the phases and ages element, which forecasts what individuals at a specific age can and can’t understand, and the "theory of development," which explains how kids get logical abilities.

In Socio- Constructivist view, according to Vygotsky (1978), the knowledge-making process is influenced by other individuals and is transmitted by society and culture. Piaget thought that learning came before development, while Vygotsky thought the contrary. When it comes to speech development, according to Piaget, children's self-centered dialogue eventually fades by age and is also replaced by social speech. On the other hand, according to Vygotsky, a child's thinking is intrinsically social and their speech transits from being communicatively social to being internally egocentric. Therefore, Vygotsky contends that thinking grows from society to the individual rather than the other way. Kim (2001) declared that according to social constructivists, individuals take part in social activities like interaction and cooperation when they are learning relevant material. As a result, teachers who act as social constructivism facilitators initially offer guidance and aid to students before gradually reducing it so that they may study on their own.

2.11.4.4 Connectivism

A fresh viewpoint on how learning occurs in online learning environments is offered by connectivism. The connectivism viewpoint complements conventional behaviorist, cognitivist-constructivist, and humanist theories of learning in this way. According to Grassian and Kaplowitz (2009) in the behaviorist viewpoint, learning may be quantified by watching for behavioral changes. According to the cognitive approach, learning happens when students reassemble their mental models of their surroundings to include new knowledge and experiences. The humanist paradigm places a strong emphasis on the significance of students' feelings, emotions, and learning goals. Teaching strategies that enable learning through networks can be informed by the connectives' approach and newly developing related concepts of teaching with Web 2.0.

According to the connectivity learning theory, learning occurs when students connect concepts from various parts of their own forms of collaboration, which are made up of various informational resources and technological tools. Connectivism therefore recognizes integrated digital technologies as a crucial part of the learning process. Connectivism asserts that since learners are now permanently linked to sources of information and other materials through their digital equipment, like as cell phones or laptops, the procedure and priorities of studying in a globally connected world are different from those of gaining knowledge in the pre digital world (Kimmons, 2020).

As expressed by Dunaway (2011) making connections between ideas, concepts, views, and viewpoints is the basis for learning, and technology plays a critical role in enabling such connections. Siemens (2004) declared that connecting specialized knowledge sets become the emphasis of learning, and connections that help us learn more are more significant than what we already know. Connectivism's central tenet is that knowledge is embedded in network relationships (Downes, 2007). According to the connectives, edification need not be restricted to mind alone. Instead, to become knowledgeable and capable members of a digital society, learners must set up connections with one another that allow them to use the system as an augmentation of their own body and mind (Kimmons, 2020)

According to Siemens (2004), connectivism's guiding ideas are as follows:

- Connecting specialized nodes or knowledge sources is the process of learning.
- Learning and technology are closely intertwined the moment when hubs and sources of information are made up of digitized internet assets.
- Diversity of viewpoints is essential to learning.
- Central to learning is the ability to see connections between various viewpoints, beliefs, and concepts.
- To promote continual learning, connections must be made and kept up.
- A meta-skill that is used before learning starts is evaluating information before engaging with it. These judgments about whether it is worthwhile to study a certain piece of knowledge describe a learning process.

The connectives approach places emphasis on the notion that information technology is used to store and alter knowledge (Siemens, 2004). In essence, connectivism sees learning as the act of creating a learning network and connecting the concepts contained inside that network. For promoting learning, Web 2.0 and connectivism are therefore inextricably linked because connectivism offers a fresh viewpoint on how learning occurs in digital learning environments, just as Web 2.0 can do. Therefore, from a connective’s viewpoint, the educational goal is to more thoroughly and effectively connect students with each other and to digital materials in a robust manner so that students may use the network to continue solving issues in the future (Kimmons, 2020).

2.12 Measures of Technology Integration

Following measures were used for measuring technology integration in the study.

2.12.1 CBAM (LoU)

The Concerns-based Adoption Model-Levels of Usage (CBAM-LoU) questionnaire developed by Griffin and Christensen in 1999 aims to describe the behaviours of innovation users at several phases, including orienting, managing, and eventually integrating use of the technology. According to Hall et al. (2006) Level of Use (LoU) includes eight stages namely, *Non-use*, *Orientation, Preparation*, *Mechanical Use*, *Routine Use*, *Refinement*, *Integration*, plus *Renewal*. Levels of usage are a notion that also applies to institutions as a whole and to groups. Internal consistency reliability metrics cannot be calculated for data obtained from the Concerns-Based Adoption Model-Levels of Use since it is a single question survey. For elementary and secondary school instructors, test-retest reliability estimates by Christensen, Parker, and Knezek (2005) have been shown to typically fall in the range from .84 to .87

In view of Hancock et al. (2007), to measure the adoption of new innovations two constructs namely Stages of Concern and Level of Use were used at large scale by the researchers as an analytical frame in the last forty years. CBAM put forward a probable sequence of concern advancement consisting of exploratory nature. On the other hand, if the first stages are not dealt with it makes it impossible for higher stages to appear. In view of George et al. (2006), it is developed on educators' contentions related to the innovations, as follows.

Indifferent: slight apprehension or participation;

Informatory: common acquaintance, as well as curiosity about, the invention. Not apprehensive of the invention

Individualistic: Not sure of challenges concerning the invention. The teacher is terrified of his or her competence, plus performance in execution. Evaluate possible gains, function, and problem, along with liability.

Organization: Pay attention to course of action and practice of innovation usage. Considerations are on competence, systematizing, administrating along with development;

Outcome: Impact of innovation on one's students is the point of focus. Considerations are the aptness, on behalf of the pupils, appraisal of students' achievement, as well as the amendments needed to improve student outcomes.

Teamwork: The focal point is coordination in addition to cooperation with other people concerning the innovation usage.

Re-examining: Obtaining other widespread advantages from the invention are the focus, inclusive of the likelihood of creating key alterations in it or bringing change through other influential substitutes of it.

In the words of Louks and Hall (1979) the other aspect of the Concern Based Adoption Model, Levels of Use, brings in focus the individual's transformation on the actions and executions of tasks because of one's familiarity and ability in usage of innovation. Like Stages of Concern, Level of Use has a progressive style.

Hao and Lee (2015) who conducted research using CBAM levels concluded that prominent levels of CBAM are correlated with better educational transformation as well as improved optimistic mind-set of teachers. Similarly, Hall et al (1975) declared that important levels of CBAM are related to integrative teaching along with extra effective usage of teaching methods by educators.

In view of Straub (2009) a positive perspective of CBAM is that modification is dealt with progressive angle or in other words the development of an individual depends upon the processes of enhanced skillfulness while using the innovation. On the other hand, some confines must be seen while technology integration is estimated by the application of CBAM.

As CBAM mainly covers forced change, there is a presupposition about teachers' resistance towards change as well as pessimistic attitude towards innovation. Thus, its effectiveness in clearing up the position of teacher leaders favouring bottom ward along change is somewhat questionable. A few teachers showing resistance towards change might have optimistic behaviour about specific inventions and it may happen together. This point is given concern by Straub (2009) that CBAM ignores this aspect by presupposing that teachers resist change.

2.12.2 Stages of Adoption

A single-item survey called the Stages of Adoption of Technology instrument is used in pre-service and in-service training to assess the effects of information technology training as well as changes over time. It was generated from Russell's (1995) research, which evaluated how well people were learning to use e-mail. According to Russell, there are six stages: (i) *awareness*, (ii) *learning the process*, (iii) *understanding how it is used,* (iv) *familiarity and confidence*, (v) *adaptability to various circumstances*, and (vi) *contributions to the field to new contexts*. The step descriptions in the Stages of Adoption of Technology instrument (Christensen, 1997; Christensen & Knezek, 1999) are broadened such that they apply to each information technology.

Since the Stages of Adoption of Technology instrument only holds one item, it is impossible to calculate internal consistency and reliability metrics for the information obtained using this tool. However, validation studies on Stages of Adoption have yielded strong test-retest reliability estimates (.91-.96) (Christensen, Parker, & Knezek, 2005).

2.12.3 ACOT

Sandholtz (1997) explains that Apple Classroom of Tomorrow was cooperation between public schools, colleges, and Apple Computer, Inc. ACOT describes the 10-year (1985–1995) longitudinal research project conducted throughout the nation. The study's goal was to find out how regular technology use by instructors and students would affect instruction and learning.

The project's overarching goal was to supply instructors the tools they needed to design their own technologically assisted learning and teaching methods, rather than letting the latter dictate what needed to be learnt and how it needed to be taught. For ten years, the ACOT Project examined the effects of complete access to a computer on pupils, educators, and educational procedures in five classrooms across five different American schools, which were representative of the nation's schools with regard to social class, academic rank, and community setting. Each student and instructor received a computer from Apple, together with projectors, printers, broadband, Cassettes, programs, and VCRs. They also gave each school's technology coordinators and instructors lessons on the use of technology. Audio-taped diaries, weekly email updates, classroom observations, and in-depth interviews were used to collect data from instructors.

Technology was employed by instructors during the ACOT research to convert to an electronic medium, rather than revolutionizing education at first. With time, technology gradually aided in the development of educational experiences in which media-rich structure, virtual world, modelling, and simulation were employed as tools for information, where students were more engaged, where there were various kinds of authentic assessments, where interaction was natural and purposeful, and where kids of all skill levels could learn.

The ACOT study discovered that the employment of technology as one of several teaching tactics had a wide range of benefits on pupils. Changes in teachers' perspectives on teaching, student-teacher relationships, and instructional strategies have a significant impact on the rate and orientation of technical innovation in education.

The authors (Dwyers, Ringstaff, Sandholtz, 1990) claim that instructors will reliably advance in using technology through five distinct stages. The five stages 1: *Entry* related to basic learning 2: *Adoption* related to use of basic level technology, 3: *Adaptation* using tech for increasing efficiency, 4*: Appropriation* using tech without effort and 5: *Invention* developing novel environment with tech, were mentioned in it.

2.13 Models of Technology Integration

According to Roblyer and Edwards (2000) technology integration may have a lot of explanation but in simple words it means easing the educational demands with the help of technology while preparing educational modules or programs. According to Sherry (1998) the complexity of integration of technology has been realized by the planners and it was recognized that technology, institution, environment and pedagogy interact mutually during this process. Although there were a lot of theoretical models present for measuring these factors, there was a need to present a new model which could address the teacher factor that was previously ignored in the development of educational use of technology.

Models or frameworks are made to supply comprehension of intricate concepts and procedures via giving simple clarification of an idea, fact, correlation, system, composition and a feature of everyday life. This explanation helps us to concentrate upon the important dimensions relevant to the aspect in existence (Niederhauser & Lindstrom, 2018). In relation to educational technology assimilation, models might be helpful in supporting the educators for understanding and explaining the way of technology usage, allowing them to take decisions about effective use of technological materials, as well as supplying enlightenments which sustain advancement of approaches for more effective and efficient instructional practices (Niederhauser & Lindstrom, 2018).

2.13.1 Will, Skill, Tool, Pedagogy Model

According to Knezek and Christensen (2016) WSTP is an aptitude model which was originally based on three constructs namely will, skill and tool related to teaching learning, and these were taken out from over and above 30 variables considered imperative on behalf of pupil education. Will in the model measures attitude and motivation; Skill gauges the ability, knowledge, self-efficacy and experience; Tool measures availability, accessibility, and environment while Pedagogy deals with instruction as well as instructional performance.

Knezek et al. (2000) pointed that this model was made primarily to spotlight the school life as well as the role of technical incorporation in the classes for better learning outcomes. Petko (2012) found after empirical research that enhanced technology integration is related to a more constructive style of teaching. These findings lead to the addition of pedagogy construct within the original model of will, skill, and tool (Knezek & Christensen, 2016).

2.13.1.1 Will (attitude)

Knezek and Christensen (2016) defined the idea of "will" as "attitude toward and belief in the use of technology in education." A person's inclination to react positively or adversely to an item, individual, institution, incident, or to any other discernible feature of their environment is referred to as their attitude (Ajzen, 1989). Being a latent variable, it can be inferred from measurable cognitive, affective or behavioural responses towards an object. A person's vocal or nonverbal reactions to a certain object, institution, or event might reveal whether they have a positive or negative attitude towards it. These reactions can be cognitive in nature, reflecting the individual's impression of the item or convictions about its probable attributes; affective in nature, reflecting the person's assessments and feelings; or conative in nature, standing for how the person acts or would act regarding the object (Ajzen, 2005). Behavioural intentions can be found through the attitude of individuals (Ajzen, 2012).

The word attitude was a French word and first used in English during the 17th century. Its meaning was the posture of a body at that time. In 1725 Psychologists explained it as a body posture of a man reflecting his mental state. It was changed in 1837 etymologically referring to a viewpoint or emotion towards an entity. In Social Science attitude is studied because attitudes are psychological constructs that shed light on developmental psychology. It deals to a great extent with the motivation and learning processes of human beings. Moreover, it has an association with an individual’s behaviour which influences their attitude. That is the reason we study attitude so that we could understand the behaviour of people (Cooper, Blackman & Keller, 2015). It is defined by different authors differently. One definition says that an attitude is a sensory element's classification across an evaluated axis (Zanna & Rempel, 1988). It means that a brief judgment about an object's significance or value somewhere along a positive or negative axis is what we do whenever we judge it. By another definition, attitude is the strength of an emotion supporting or opposing a particular item (Thurston, 1946). Affect is defined as an emotional occurrence. It occurs during the feeling of joy or sadness. But it may not be the sole factor in how a person judges an object’s attitude. According to some researchers, the attitude idea has fundamental characteristics of affect, cognition, and behaviour (Rosenberg & Hovland, 1960). Seeing that beliefs govern execution; it is crucial to understand the developmental procedure of belief patterns of educators to understand their teaching intentions of implementing technology in the classrooms.

Köroğlu (2022) expressed that the material of the coursework and interactions with learning programmes are some of the elements that have an impact on teachers' attitudes. Prospective teachers often look up to instructors as examples to follow throughout their academic lives. Positive teacher role models are believed to favourably affect student beliefs. Negative teacher models have a similar detrimental effect on teachers' beliefs as good teacher models do.

It greatly relies on an instructor's opinions about whether to use pedagogical practices, technology advancements, or endorse reform processes. The use of technological breakthroughs in the educational setting is seen to be significantly influenced by the views of teachers (Alsuhaibani, 2019). It is said that for the educational integration of technology to be successful, both negative and positive teacher beliefs must be discovered and nurtured. In actuality, the research on teachers' beliefs produced disparate outcomes. Most of the research revealed that instructors' attitudes about utilising technology in foreign universities were favourable; others showed that educators had unfavourable opinions towards technology (Gilakjani and Leong, 2012).

Belief systems consist of a broad-based blend of general principles and guidelines, rationalizations, views, morals, as well as presuppositions which are assembled in approximately an organized manner and these beliefs manipulate the way instructors implement technology in the class (Alsuhaibani, 2019).

Haddock and Maio (2014) argue that attitude has a strong relationship with action; therefore, it can be said, in words of Baumert and Kunter (2006) that it has a significant function in instructional practices of teachers. Keeping this perspective in mind a lot of research has focused on the attitudinal impact in technology integration for example Kenezek and Christensen (2016) and Petko (2012). They have declared that a positive attitude towards technology is a strong predictor of technology integration. While educators having less optimistic attitudes to technology are found to exert less effort in its instructional usage (Bas et al, 2016). Additionally, studies reveal educators' attitudes and beliefs have a significant role in how they plan for and use technology in the classroom (Admiraal et al., 2017).

2.13.1.2 Skill (Competency and Confidence)

Skill is conceptually defined as the capability to use and to practice technology plus the self-efficacy along with preparedness to employ tech (Knezek & Christensen, 2016). According to epistemology, knowledge is defined as skill (Turr, 2015). According to Millar, cognitive and perceptual capacities are themselves forms of knowledge that are either not exercised or are exercised but do not express themselves when knowledge is not gained (Miller, 2009). The idea that at minimum mental and perceptive abilities may be characterised in terms of knowledge seems to be supported by Miracchi's assertion that knowing reflects a capacity to know (Miracchi, 2015). Finally, Stanley and Williamson (2016) suggest that talent is a kind of inclination to know (rather than only cognitive and perceptual skill).

Following Bandura (1997), self-efficacy refers to a conviction in one's skills to organize and execute the courses of action necessary to generate specific attainments. Basis of activity are the efficacy beliefs and individuals’ lives are led by them (Bandura, 1997). Basis of activity are the efficacy beliefs and individuals’ lives are led by them (Bandura, 1997). Beliefs of self-efficacy have the power to control people’s activities, flexibility, opinions, nervousness, despair and achievement (Pajares, 2002). In the real world a lot of difference is found between the work and beliefs of people and that is why individuals' behaviour and their competencies do not tone with each other but with their efficacy beliefs and it dictates whatever they perform with the knowledge and ability they have (Pajares, 2002). Chances of completing the responsibilities increase with the increase of efficacy beliefs and there are possibilities that a person would carry out a task which requires more ability than a person has at that time (Bandura, 1994). Persons at elevated self-efficacy are risk takers, willing to try novice things and do the work they are not familiar with and quite often become successful in their achievements. On the other hand, those who are low self-efficacious often do not carry out a task and could not produce the desired results (Pajares, 2002).

Along with technology information the instructors' confidence of using it in different situations and easing students' learning with it is also vital. This is especially right for beginners in the field of teaching. Technology integration in the classroom occurs more often when instructors feel themselves to be competent or self-sufficient in their use of technology (Li et al., 2018). There is empirical evidence about the new teachers who used technology in the class (e.g., Piper, 2003) highlighting the significance of self-efficacy more as compared to the dexterity and understanding of technology. In another study the number of technologies using educators rating themselves more self-efficacious was higher than the number of technologies proficient educators (Bauer & Kenton, 2005). Implementation of web 2.0 technologies in the classrooms is very well predicted by self-efficacy (Niederhauser & Perkmen, 2008). Beliefs of educators in substantial application regarding adoption of tech in the educational locale may fluctuate from time to time.

Ottenbriet-Leftwich et al. (2019) examined 57 teachers from 26 middle schools and found that self-efficacy of teachers towards mobile technology forecast the technology integration in the classrooms. Teachers with more technical skills felt more confident to integrate technology in the class while gender did not predict self-efficacy. Other studies also reveal that technical skills are the predictors of technology use (Inan and Lowther, 2010). Considering their study Hur, Shannon, and Wolf (2016) found that instructors who strongly believed in the importance of technology integration preferred to employ technology for teaching aims. Their study involved 223 K–12 educators in the United States.

Lin and Chen (2013) posit that technology acceptance and implementation by faculty of Higher education institutions has been considerably impacted by self-efficacy. In view of Lin and Chen (2013) the bond between self-confidence and environmental construction has the impact on the improvement of the course of studies.

In view of Efe (2015) and Kelly (2014) lower-level self-efficacy in information technology proved to be a hurdle for higher education teaching faculty. In view of Wright (2014) instructors' self-confidence and motivation serve as a foundation for choosing the content for technology advancement. Rogers (2003) examined that higher education faculty who viewed themselves not competent enough to meet the technology expert standards seemed to avoid discovering these technologies. According to Wright (2014) since other organizations produced lessons in technology the necessity for acknowledging tech implementation in educational settings was amplified. In view of Doughty (2013) being pessimistic about the technological advancements in the higher education system would ruin the development of the institution and its students.

Santos and Serpa (2017) posit that as scholastic knowledge is achieved by way of formal instruction, technological competence must also be provided through planned educational experiences. For this reason, it is especially important for universities to endorse precise and purposefully figured out digital literacy plans, which merge the up gradation of the expertise of students and teachers equally that they get as consumers, by way of generating the latest skills (Santos & Sepra, 2017).

Bandura (1997) also claims that self-efficacy is a concept that is exclusive to a certain area. Researchers in education like Perera, Calkins and Part (2019) who adhere to Bandura's conceptualization describe that educator's self-efficacy should stand for their confidence in carrying out certain tasks in their teaching practice by incorporating technology. In view of Cheung et al. (2018) a teacher who shows greater levels of technology confidence will experience less dissatisfaction and employ technology more often in the future. On the other side, as described by Alshammari et al. (2016) lack of drive as well as the belief that the Innovation is troublesome plus pointless are associated with lower levels of technology self-efficacy. The COVID-19 problem forces teachers techno-pedagogically confident or unconfident into a teaching situation where technology has become an essential channel, first in the form of remote learning and then in a hybrid mode of teaching (Marshall et al, 2020). Teachers with a high perspective of task self-efficacy together with perseverance to actively overcome the unanticipated and sometimes inevitable problems connected with teaching utilising digital platforms and technologies are those who increase their repertory (Dean, 2020).

2.13.1.3 Tool (access and availability of technology)

Tool is defined as teachers' access and experience to use technology. Teachers using technology are more prone to integrate it in classroom instruction as compared to those who don't have such experience (Kenezek, 2008). According to Morales and Kenezek (2007) tool or ICT use was the strongest predictor of educational use of tech in Mexico. Educators who use innovation for private or professional purposes are more likely to integrate it in their instructional practices (Petko, 2019). The most readily measurable indicator of IT usage is the amount of hardware in school and is usually signified by student to computer ratios. Technology resources including hardware, the Internet, educational software, and Web 2.0 applications must be accessible to both instructors and students for technology integration to be successful (Önalan & Kurt, 2020). How much computer hardware is available for teaching and learning has an immediate impact on how much IT is used for education. A sign of quality and functionality of the hardware is also important. That is, it is important to find the multimedia capabilities of computers and the availability of other computer peripherals such as printers and scanners. To figure out the extent to which it is being used in the classrooms, it is essential to check the availability along with use of digital content in addition to digital learning gadgets (Chief Executive Officers' Forum on Education and Technology, 1997). Technology tools like online classes, multimedia, virtual reality, robotics, and others make the classroom engaging and provide integrated learning settings that help cooperation and inquiry while enabling instructors to gather information on student progress (Abilmazhinova et al., 2021).

Given how much emergency remote education relies on technology, telecom infrastructure, hardware, as well as software must be considered. Blaskó and Schnepf (2020) describe that students in low-income nations are less apt to still have Internet connection than those in rising nations; therefore, some regional and national internet facilities may not be present. Hardware, like computers and mobile devices, may also be needed for use by professors and students. Fujita (2020) argues that global crisis circumstances sometimes coexist with other economic challenges; therefore, it's crucial to give both students and professors access to the technology resources they need to continue their education

Software falls into two categories: general-purpose software and subject-specific software. The integration of computers into the curriculum is directly proportional to their availability. The extent to which general-purpose programs were available is associated with the emphasis on computer literacy as part of the curriculum (Pelgrum & Anderson, 1999). Shraim and Crompton (2020) posit that software issues, such as programme accessibility and applicability to the curriculum and other contextualized demands of an area, must be addressed to fulfil the requirements of all students. Accordingly, Howard and Mojezko (2015) argued that the teachers recognized that the latest applications seemed highly encouraging for the cultivation of analytical reasoning among learners, which was proved by empirical research later that technology incorporation caused learning improvement.

2.13.1.4 Pedagogy (Instructional practice)

Alexander (2004) defines pedagogy as the practice of instruction and the rhetoric that surrounds it. It encompasses different skills and practices; in view of Alexander (2004), to be capable of making and defending the various types of choices that comprise teaching; one must have the knowledge and abilities to do so. Pedagogy comprises teaching styles, instructional approaches (constructivist, behaviourist, etc.), as well as general didactic practices. Teachers' critical thinking skills will be enhanced because of the process of investigating the connection between pedagogy and innovation. Okojie et al. (2006) posit the recognition of educational technology as a kind of pedagogy that is crucial for both in-service and practicing teachers. Teachers must feel comfortable and competent using the technology they intend to employ if they are to utilize it to assist their instruction and regard it as an instructionally beneficial tool (Topper, 2005). It is critical that educators understand the connection between pedagogical decision-making and technology in the classroom. According to Contact North (2020), educators acquire a variety of educational practices throughout their professions. It takes time and helps to reimagine and test different methods in a digital reality.

Teachers' subjective presumptions, as described by Rasheed et al. (2020), regarding teaching and learning are known as didactical attitudes. These presumptions are mostly the result of their skills, expertise, administrative regulations, and training. Such positions require time and expertise to develop, so changing them is a task that cannot be done quickly. Brinkley-Etzkorn (2018) posits that one such viewpoint is how teachers view both teaching and learning. They frequently hold the belief that instruction occurs through or by the instructor with the pupils in classrooms where face-to-face interaction between teachers and learners is anticipated.

Some teachers, Lederman (2018) declares, believe that using an online system of teaching as a style of education is less beneficial than face-to-face, conventional real-time engagement. Even worse, they have labelled the usage of technology in the classroom as "supplements" or "deadbeats" that instructors employ to add to their lesson plans. Rasheed et al. (2020) describe that they viewed such applications "as a diversion and disturbance to education.” Such presumptions have been confronted with reality during the Coronavirus epidemic, commonly known as the COVID-19 sickness, which began in March 2020. Many teachers are now forced to accept online education in all its formats as the only means of instruction because the epidemic caught everyone off guard.

For example, a sovereign decree was made in Saudi Arabia to stop face-to-face instruction across all higher education institutions as of Monday, March 2, 2020. Every instructional activity had to be delivered online in a way that matched the standard face-to-face interactions. Just three days were given for this changeover by the Royal Decree, which is a short amount of time. On Thursday, March 5, 2020, classes were scheduled to restart online, and the professors needed to be prepared to conduct all their pedagogical duties online. The Royal Decree served as both a true test for many prevalent educational presumptions and a means of national protection against the ubiquitous COVID-19 (Alhawsawi & Jawhar, 2021).

In view of Hsu (2016), according to instructional belief, instructional practices might be divided into two main sets: traditional and constructive. Constructive instructional practices are equivalent to student-centered tasks involving group work, technology-based learning, discussion methods, teamwork, analysis, and deliberation for developing verified information. On the other hand, the traditional approach involves more directed teaching to make learners learn via a defined procedure and make them capable of producing planned and intended information. The traditional concept stands on a teacher-centered perspective, whereas the constructive approach has its roots in the student-centered perspective. In the earlier concept, activities of educators get importance, whereas in the second concept, student experiences take supreme importance.

In a study conducted by Hsu (2016) in America, using mixed-methods design on a sample of grade 6 teachers to search the association between confidence beliefs along with technology integration in educational settings, it was found that the teachers with a constructivist approach were pro technology users and used two or more methods for getting better learning outcomes. Moreover, the findings revealed that the students' and teachers' lack of technology training, the time shortage for trainers to apply tech-related curriculum and the lack of technical support for teachers proved to be the barriers to the integration of technology.

Deng et al. (2014) established no correlation between traditional instructional attitude and technology usage; however, a strong correlation was found between constructive beliefs, pedagogical attitude, and technology implementation. By using this model, Teo et al. (2008) investigated the connection between instructional attitude and technology implementation within the educational field, discovering that the attitude of constructivist teachers matched up with constructivist as well as traditional implementation of technology. A strong association was also found between educator's cognitive beliefs, instructional belief and tech use (Kim et al., 2013).

In extra elucidation of this association, these scholars established that the more a teacher was well educated and trained, the more he or she had a student-centered conception and had student learning as a well-defined center of attention in place of technology use. In 2012, Ertmer et al. studied to know about the association between teacher values and technology integration; and established that instructors with a student-centered approach employ the tech in student-centered activities and also for improving and transforming their teaching practices. On the other hand, educators who used technology for the implementation of a project-based approach manifested a constructivist attitude and empowered students with the abilities of constructing, peer caching, and self-directing through technology implementation. Such teachers seem to have a conviction that technology provides support to surpass the programme of study, while the teachers who used technology for learners as a tool for skill attainment exhibited a more traditional approach.

Rasheed et al. (2020) said that among many problems affecting instructors' adaption to virtual classrooms are their inadequacy of digital learning and competence, their failure to produce high-quality online films, and electronic operations difficulties. Additionally, explains Alhawsawi (2017), teachers' prior experience and training, as well as the larger social environment in which they have lived, have a substantial impact on how they see teaching, the role of the teacher, the selection of academic tasks, and teaching approaches.

Besides instructional beliefs, there are beliefs that are based on values. Otherwise stated by Alhawsawi (2017), instructors' beliefs concerning technology are characterised by "just in case" they consider technology might help them attain the educational aims they consider of prime significance. As a new instructional procedure or instrument is introduced, instructors philosophise about whether particular method or instrument has relevance to their educational aims. The instrument or method that is given more value by the educators is increasingly exposed to be used. It is especially pertinent in reference to technology. In view of Alhawsawi (2017), teachers are more inclined to incorporate this belief into their teaching, the resources they employ, and the educational tactics they employ when they feel that information is unchangeable and established. On the other hand, if instructors hold the view that information is produced, they are much more likely to act accordingly in their positions and employ various tools and teaching techniques that let pupils co-create information.

Brinkley-Etzkorn (2018) elaborated that working instructors' ideas, which they cling to regarding curriculum, education, and instruction, manipulate the manner in which they come up with personnel improvement, everything they learn from it, as well as the manner in which alterations happen in them. The effects of educators' current beliefs on knowledge attainment in some technology training courses were observed by Tillema in 1995. He found that the learning is better if there is more association between the beliefs of educators and the training syllabus. Martin et al. (2019) found the same results and discovered that novel technology and software are assimilated by teachers if their utilization is in accordance with their existing beliefs.

In view of Boelens et al. (2017), as things considered helpful in meeting learners' requirements have a tendency to be rated highly by teachers, there is a great possibility that technology would be highly incorporated when it matches with teachers' beliefs about addressing main educational goals. The growth of 21st century skills is supported by technology, and the path of technology use is shown by constructivist convictions (Ertmer et al., 2015). Facts indicate that constructivist educators frequently employ technology in their classrooms (Ertmer et al. 2015). The COVID-19 problem forces teachers—techno-pedagogically confident or unconfident—into a teaching situation where technology has become an essential medium, first in the form of remote learning and then in a hybrid of remote and in-person instruction. The situation of COVID related to the sudden shifting or rather quick switchover to (urgent) distant forms of educating and learning became an immensely challenging practice for several educators due to their limited, or inability to acquire, in-depth didactical knowledge with technology adoption and online instruction (Marshall et al., 2020).

2.13.2 WST Model Related Studies

Velázquez (2006) conducted a study on school teachers from Texas and Mexico cities for cross-cultural research and used the Will, Skill, and Tool model in order to check its predictive validity. Results show that the variables of will, skill and tool can predict 90% of the variation in technology integration. *Tool* was the most significant predictor for teachers' incorporation of technology in Maxico, whereas *skill* proved to be the most important predictor of technology integration for teachers belonging to Texas cities.

Agyei and Voogt (2011) tested the model on pre-service and practicing mathematics school teachers in Ghana and found that 43% of variance can be predicted in technology integration by the model. It was found that the most important predictor of technology incorporation was the *skill* of the teachers. There were significant differences in pre-service and in-service teacher anxiety, competence, and access to technological tools.

Petko (2012) used the WST model on Swiss secondary school teachers and expressed that the model can predict 60% variation in class use of technology. He also suggested that the way of teaching (constructive or traditional) also affects the incorporation of technology and highlighted the need for adding another construct to the model.

In 2016, Kenezek and Christensen added a new construct named “pedagogy” to the Will, Skill, and Tool model to enhance the predictive power of the model. Their findings revealed that the pedagogy variable can predict a 30% variance in technology use.

Farjon (2018) used this model with the added variable of technology experience to examine the technology integration of pre-service teachers. The results showed that will, skill, tool, and experience (WEST) predict 60% of the variance in tech incorporation. The variable *will* exhibit the highest influence on tech integration, whereas the *tool* showed the lowest. The influence of *experience* was limited, and its addition did not show any increase in technology incorporation.

Grant (2019) used the WST model with an expansion of demographic variables on teens in the USA to check the effect of variables on internet usage by teens. Findings show that the will, skill, and tool model predicted moderate integration of about 18% by the teens. The variable *will* show the strongest predictive value, whereas *tool* and *skill* showed a moderate predictive value.

Sasota (2021), in her study in the Philippines on mathematics and science teachers using the Will, Skill, and Tool model, revealed that the WST model of educational intervention varies across scientific and mathematics fields, according to the results, notably in terms of which of the elements had the most impact on technology incorporation.

Sawyere (2021) used the Will, Skill, Tool, and Pedagogy model in her research on 92 school teachers. Findings revealed that will, skill tool pedagogy, and technology integration have significant relationships, while these variables show a collective 21% variance in technology incorporation. The tool proved to be the most significant predictor of technology integration.

The "Will, Skill, Tool, and Pedagogy" (WSTP) model is a framework in human resource development and management that helps organizations assess their current state and plan future development. The model considers four key components that affect the ability of employees (teachers) to perform effectively: will (motivation), skill (competence), tool (resources) and pedagogy. In previous studies, the WSTP model has been applied in various education settings to evaluate the current performance of teachers and identify areas for improvement.

In developing countries like Pakistan, the WSTP model can be useful for organizations to assess their current level of human resource development and plan for future growth. However, it is important to consider the unique challenges and limitations that exist in these countries, such as limited access to training and development opportunities, lower levels of education, and a lack of resources. As such, organizations may need to tailor the WSTP model to their specific context to ensure it is relevant and effective.

2.14 Higher Education in Pakistan

Higher education in Pakistan is meant for the age group of 17 to 23-year-old students. HEC is a sovereign organization and is liable for all affairs related to the university. Giving emphasis to the promotion of exploring and examining traditions, the Commission set off numerous striking projects such as providing research payments, and travel funds to scholars and faculty for the presentation of their research articles in conferences abroad, providing monetary help for the conduction of conferences and workshops, seminars, and hiring foreign faculty in universities on a well-paid basis.

In the last two decades, the tertiary education sector has become a point of foremost interest for the Pakistani government. Several courses were introduced to fabricate the country’s tertiary education and competence in awareness, dealing out, and distribution of knowledge and practice. For the upgradation of research and development in the higher education sector, the HEC was given more authorizations so that it could develop, appraise, and support the efforts in this direction.

Higher education institutes are facing the great competition generally and with respect to education in particular. The worldwide digital revolution has started to permeate the field of education. Technology is predicted to change the fabric of academia by reducing the cost and making it accessible since it is quickly changing how pupils experience it (Qureshi, 2021). Technologies work to increase students' knowledge, comprehension, and abilities so that they can succeed both individually and collectively. Through engaging and educational materials, teachers may foster their students' curious minds and intellect, which have been associated with improved student achievement (Mystakidis, Christopoulos, & Pellas, 2022). The most important benefit of digital learning is the capacity to let each student learn at their own pace and in their own way (Qashou, 2021).

In addition, although some students excel in online learning environments, others have difficulty for a variety of reasons, such as the absence of assistance. For instance, a pupil who has already experienced pain in face-to-face situations would suffer far more now. These individuals could have depended on treatments that are no longer offered (Shilpa, Radha, & Movva, 2022). Students who originate from remote, rural places with limited resources and low-income families are often more likely to lag behind. Students with impairments or those whose first language is not English will need more assistance and support (Haleem et al., 2022).

Education services and support need extraordinary consideration (Tsiotakis & Jimoyiannis, 2016). To cope with the challenge faced by higher education institutions, the efficient utilization of social media by teachers is quite essential. According to Doughty (2013), higher education is following a path of drastic revolution because of the uncontrollable role technology plays in the learning system. The process of tailoring the curriculum and instructional methodology with the help of technology can only occur with a pragmatic view of personality. For the production of valuable research as well as for the provision of quality culture, the use of social media has been adopted in tertiary-level institutes of advanced nations, while this is not the case in underdeveloped nations. Web 2.0 technology and its tools such as wikis, blogs, Facebook, and podcasts may help in promoting dialogue, developing communication via networks, and improving alliance and group efforts amongst the shareholders of underdeveloped nations (Aleem, 2015).

Primary users of Web 2.0 can be divided into two flapping clusters. One group comprises those who take notice of novice technology, are aware of its importance, and try to use it, while in contrast, the second cluster comprises those inhabitants who are aware of social constructive teaching as Web 2.0 is considered in supporting them (Armstrong & Franklin, 2008). By creating assignments in class that use online technologies, PowerPoint reports, and interaction, student learning may be made more creative as well as stimulating. Participation can go beyond just verbal exchanges (Bilota et al., 2021).

Saleem (2011) carried out a project to see the relationship between ICT and higher education institutions, and the results show a significant relationship between ICT and organizational performance. The relationship between organizational productivity and ICT was also positive. So, the deployment of technology might enhance the managerial presentation, and the higher education institutions' performance might be increased if the technology is used in a proper way.

The tech in education is quite new, and research shows that faculties possess a fair level of competency but are passive users (Soomro, Zai, & Jafri, 2015). The use of the tools in education, however, is still not measured. Threats of bad effects will take the limelight in the coming few years. This pandemic has also influenced the field of education, as each and every educational institution, including both public and private sectors, got shut down without delay in Pakistan by March 15, 2020 (NERP COVID-19 MoFEPT, 2020).

2.15 Tertiary Education and the Pandemic

By July 4, 2020, there had been 225,283 confirmed cases in Pakistan (NIHP, 2020). It is a critical issue for both industrial and non-industrial nations around the globe. In the UNESCO report, 1.4 billion students (91%) have been badly affected across the world due to the lockdown (UNESCO, 2020). Moreover, there is no news about the restart of global education institutions on account of the gradual deteriorating health conditions. The optimists predict that the situation will last for the next few months, while the pessimists predict one year of odd circumstances for worldwide educational institutions and five years in the case of the university student coming back (INOMICS, 2020).

The massive problem of continuing education for students has been resolved on account of technology in advanced nations, particularly exceptional net services, as well as learners’ reactions. However, in developing nations, the process of online learning is not as successful due to issues with the internet, electricity, and infrastructure along with students’ behavior. Nonetheless, this pandemic has also offered a lot of prospects for the universities to be practical and improve the infrastructure in order to counter the situation in a positive manner for now and in the future (Akram et al., 2020).

In Pakistan, the Higher Education Commission has a great concern about tertiary education, and it has tried to lessen the educational loss of the students during the pandemic lockdown. In the present situation, the universities have turned to e-learning via Web 2.0. According to Basilaia and Kvavadze (2020), there are different types of online learning: knowledge base, online support, asynchronous education, synchronous teaching, and hybrid teaching.

In the knowledge base type of learning, the course is available in print form on the website with instructions to pursue, and no online support is given. Online support system is an improved form of knowledge base, as the support is offered in the form of a discussion forum, a web meeting, or some other means of contact by means of which the learner could seek the required help. In asynchronous teaching, concurrent classes do not take place; however, the learners get the course material on a regular basis. Teachers are assigned and are made responsible for providing the required assistance to the students via email or any other communiqué field. Synchronous teaching is held in real time by the instructor and a moderator, who is not obligatory. The time is set in advance for the participants to log in to the class. The students have the opportunity for communication with both the instructor and their peers. Hybrid learning is a mixture of online and physical contact between teacher and student.

Bervell and Arkorful (2020) declared that universities in Pakistan are now integrating LMS, which is responsible for a change in distance education. However, virtual learning mode (VL) is another way of learning in which the teacher teaches by using software applications or the web in a virtual classroom and does not require their physical attendance (Sarrab, 2019). This mode lets the learners gain knowledge with the help of special tools from any place at any time (Halili, 2018). Martins and Kellermanns (2004) state that by using this method, it is easy for students to retrieve the syllabus, take any kind of guidance from the teacher, share the assignments, and use of discussion platforms. Trowler (2010) argues that it is being extensively used in educational institutions due to the fact that it has been recognized as an essential element of universities all over the world. During COVID, the learners were using Web 2.0 technology to get knowledge from diverse resources. Information devices were the best way to keep the learning environment alive throughout this crisis. From the comfort of their own homes, students were studying (Kostopoulos & Kotsiantis, 2022). During the pandemic, it was the only choice left for continuing the learning process in Pakistani universities.

Summary

The second chapter covers the purpose and related review of the literature and identifies gaps. The chapter started with a brief history of information and communication technologies and then described different generations of the web, explaining different kinds of Web 2.0 and their use in the educational field. The changing role of teachers and the need for professional development are discussed. The effect of teachers' internal and external factors on technology integration was elaborated. Theories that support models of technology integration, the role of instructional theories, technology integration, its measures, and its models, including the will, skill, tool, and pedagogy models of technology integration, were elaborated. Higher education in Pakistan, and its state during the pandemic were discussed as well. A subsequent chapter will discover the methodology of the research.

CHAPTER 3

METHODOLOGY

An elucidation of the nature of the study, and the research design, including the research approach, research strategy, and instrument specifications and dependability, is presented in the chapter. Additionally, it presents a brief overview of the population, sample, sampling methodology, data collection, and data analysis procedures that will be used in the next chapter. Additionally, the technique part includes information about the dependability of the instruments. The project tries to investigate the integration of Web 2.0 in higher education. Further, the study provides a situational analysis of technology integration, its benefits, barriers, and opportunities.

3.1 Research Philosophy

Research philosophies are a collection of beliefs on how the world functions (ontology), how it is comprehended (epistemology), and how it is investigated (methodology) (Guba & Lincoln, 1994). Various paradigms or viewpoints serve as the foundation for social science research. The six categories of post positivism, interpretive/constructivist, critical, transformational, pragmatic, and arts-based/aesthetic intersubjective are proposed as a means of classifying a variety of paradigms (Leavy, 2017).

The philosophy of pragmatism was adopted in this research. The philosophy of pragmatism emphasizes the applicability of concepts. Being pragmatic is a way of life (Creswell, 2013). Charles Sanders Peirce, William James, John Dewey, and George Hebert Mead worked together to create pragmatism as a logical system at the dawn of the twentieth century (Creswell, 2013). Pragmatism incorporates both the situational and inter-relational inquiry that qualitative techniques provide and the valid explanation of quantitative approaches (Hesse-Biber, 2015). Therefore, pragmatists use all of the available techniques to address their research issues rather than limiting themselves to one strategy in their investigations (Alsabbagh, 2019). Pragmatism may be described as a "paradigm of choices," which is a suitable term for mixed-methods research given the variety of choices required in combining qualitative and quantitative methods (Morgan, 2014).

Morgan (2014) argues that pragmatism provides a more conceptual understanding of research, both in terms of the goals it seeks and the methods it employs to achieve those goals. The values of a pragmatic researcher determine the subjectivity and objectivity of the research (Chilisa & Kawulich, 2012). Pragmatists contend that research should begin with a problem that has a practical solution so that its conclusions may be used in the future (Cohen, Manion, & Morrison, 2007). For social research, pragmatism is a technique of inquiry that is generally recommended (Morgan, 2014).

The present study adopted a mixed-methods approach to investigate the integration of Web 2.0 technology into instructional practices at the higher education level. In view of Backfisch (2021), it is possible to comprehend the type of technology integration used in the classroom on both a quantitative and qualitative basis. Quantitative studies can offer some understanding of what strategies for online teaching are most effective, and qualitative research may also shed light on reasons as to why some tactics are more successful than others (McMurty, 2016).

To learn more about how people perceive technological integration, Zirra (2019) suggested a future study employing a mixed-methods approach. Sawyerr (2021) conducted a quantitative study related to technology integration using the WSTP model and recommended the need for a qualitative study in the future. As per the literature, a mixed-methods study was conducted to investigate the integration of Web 2.0 technology into instructional practices at the higher education level.

3.2 Research Approach

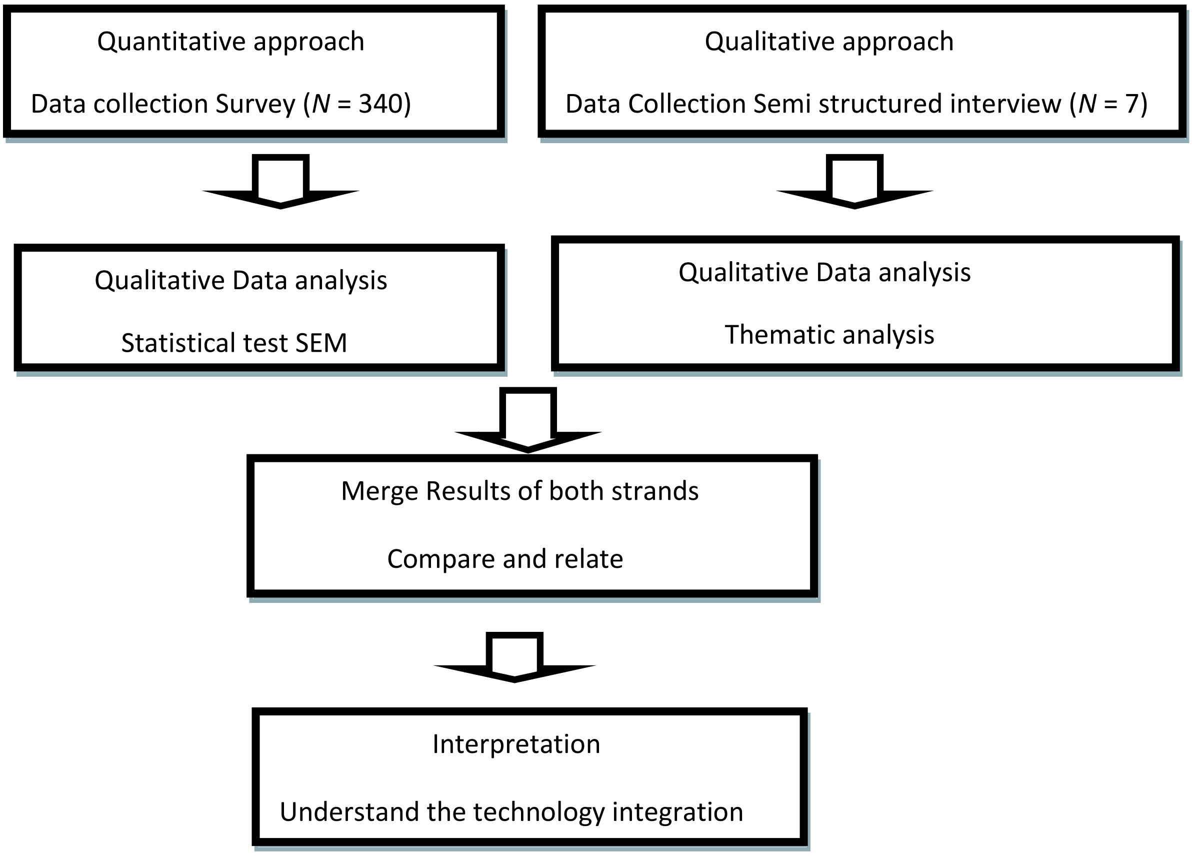
Research approaches are methods and strategies for carrying out research that might range from broad ideas to particular methods for collecting and evaluating data. The approach used in a study could be quantitative, qualitative, or a mix of both (Creswell, 2014). A mixed-methods approach was adopted in this work. It is a research approach that entails gathering and integrating qualitative and quantitative information for analysis in a research project or a long-term investigation (Creswell, 2007). The rationale for using a mixed-methods approach was the benefit of extra understanding to be gained from the blend of both subjective and quantitative exploration compared to using any type alone. Their collective usage offers a deeper comprehension of research challenges (Creswell, 2009).

Creswell et al. (2003) expressed that the primacy of the project was established by both the subjective and quantitative approaches on account of providing in-depth justifications for the study. It encompassed large-scale data collection from several sources and two-tier case scrutiny. The two phases were connected (Creswell, 2005) while choosing seven participants for qualitative data collection. The results of the two levels were incorporated (Creswell et al., 2003) in the debate of the results of the complete research (Fig 3.1).

In brief, the current study's mixed-methods measure was used to uncover technology integration by the university faculty. A selection of university instructors who teach at Islamabad's public higher education institutions was chosen for this reason. Standardized scales for evaluating teachers' will, skill, and pedagogy, as well as technology integration, were implemented with the necessary consent, keeping in mind the strategy and study design.

Fig 3.1

Schematic flow diagram



Pilot experiments were conducted before data collection to evaluate the validity and reliability of the study tool. Research instruments were employed to gather the research data once they tested within acceptable dependability levels.

3.3 Research Design

The overall strategy for integrating the many elements of the study in a consistent and rational manner is referred to as the "research design". This is done to ensure that the research problem is adequately addressed. The investigation map serves as a sketch or road map for the project. Research design is a procedure, guidelines, and layout of research intended to gain solutions to research problems (Kothari, 2004). According to Saunders et al. (2012), research design is a broad strategy worked out in advance to obtain solutions to research problems. It was a descriptive, non-contrived study involving a cross-sectional survey using both types of data collection methods. The origins of mixed-methods are often traced back to the late 1980s; when several publications came together to describe and define the method known as mixed methods. At around the same time, several writers from various fields and nations offer the same notion (Creswell & Plano Clark, 2018). According to Tashakkori and Creswell (2007), a mixed-methods study is described as an investigation whereby the researcher uses both approaches and methodologies within a particular research project to gather and evaluate data, assimilate findings, and draw conclusions.

This study's mixed-methods design is a convergent parallel design (Creswell & Plano-Clark, 2011). It comprises gathering and examining two separate layers of qualitative and quantitative evidence in one step, trying to merge the findings from both layers, and then searching for relationships, discrepancies, or convergences in between the data sets.

3.4 Population

All teaching faculty, including both male and female, of higher education institutions in Rawalpindi and Islamabad described the target populations of the study. There exist 33 HEC-recognized higher education institutions (public and private) in Islamabad, including 27 general, 4 medical, and 2 engineering universities. Only general universities in the public sector were chosen, and medical and engineering universities were excluded. A total of 16 public sector general discipline universities in Rawalpindi and Islamabad comprised the target population of the study (https://hec.gov.pk).

Table 3.1

Description of Population

Sr #	Name	Social Science	Management Science	Basic Science	Total	Percentage (%)
1	Air university Islamabad	36	33	39	108	10.61
2	International Islamic University, Islamabad	97	51	98	246	24.18
3	National University of Modern Languages (NUML), Islamabad	158	94	13	265	26.05
4	National University of Sciences & Technology (NUST), Islamabad	82	62	64	208	20.45
5	Arid Agriculture University Rawalpindi	36	27	36	99	9.73
6	Women University Rawalpindi	30	9	52	91	8.94
	Total	439	276	302	1017	100.00

Teaching faculty of social sciences, management sciences, and basic sciences in six HEC-approved public sector universities were taken as the accessible population of the study. The population exhibited variation in age and academic position, as some were lecturers, some were assistant professors, some were associate professors, and some were professors.

3.5 Sample and Sampling Technique

Proportionate stratified random sampling was applied to calculate the sample. This is a probability sampling technique that ensures generalization as regards the population. According to the sampling strategy at the primary stage in general discipline, six public universities in Rawalpindi and Islamabad were chosen.

At the next stage, full-time faculty members, including men and women of the social sciences, management sciences, and basic and applied sciences, were stratified. At the last step, faculty members who work full-time and are both men and women were stratified proportionally. Traditional sampling techniques use a 95% confidence level (CL) with a 3%, 4%, and 5% confidence interval (CI), respectively (Cohen et al., 2007). In most research, the estimated sample size at 95% CL is within the range of $\pm$3 to 5%. Krejcie and Morgan's sample size chart (1970) was used to double-check the sample size. Given that the projected number of full-time faculty members across all the universities chosen was 1000, using the reference table as a guide, the proposed sample size was 278 at a 95% confidence level with an error margin of 5%. Therefore, the study sample size was deemed appropriate. There were 400 questionnaires circulated, and 354 replies were received back, out of which 12 responses were excluded as being incomplete, and 340 (83% of the total population) responses were considered for the study for analysis. The study sample from the selected universities is shown in the table below.

"There is no clear-cut answer for the optimal sample size," according to Cohen et al. (2007); "it depends on the objective of the study and the type of the population under investigation."

Table 3.2

Calculated Sample Size

Faculty	Total population	Sample size calculated (40%)	Returned response
Social Sciences	439	175	150
Management Sciences	276	110	90
Basic Sciences	302	120	100
Total	1017	405	340(83%)

3.6 Development of the Instrument

3.6.1Quantitative tool

The survey questionnaire comprised three parts; in the initial part, demographics were included. The second section comprised several tools used to assess the factors will, skill, tool, and technology integration. The third section consisted of a checklist in which questions on the available resources, assistance, and obstacles were included (Appendix B).

One measure was used to examine the variable *will*:

1. Teachers' Attitudes towards Computer (TAC) v.6.1 is the latest version, having nine subscales and 51 items on a Likert scale developed by Christensen and Knezek (2009). It has nine dimensions: 1-Interest (5 items), 2-Comfort (5 items), 3-Accommodation (5 items), 4-Email (5 items), 5-Concern (8 items), 6-Utility (8 items), 7-Perception (5 items), 8-Absorption (5 items), and 9-Significance (5 items).

The wording was changed from "computer" to "Web 2.0" with the author's permission (Appendix C). The subscale name of "Email" was changed to "benefits."

2-The Technology Proficiency Self-Assessment (TPSA-21) a Likert-type scale with a total of 34 items was used to assess the variable *skill* and *pedagogy*. This was a 20-item Likert-type scale divided into four subscales, namely email (5 items), WWW (5 items), integrated application skills (5 items), and teaching with technology skills (5 items) initially constructed by Ropp (1999). It was further revised by Christensen and Knezek (2015) with 14 items and two added subscales, namely Emerging Technology Skills (6 items) and Teaching with Emerging Technology (8 items).

The *skill* dimension was measured by four subscales, 1) email (5items), 2) WWW (5 items), 3) integrated application skills (5 items), 4) emerging technology skills (6 items).

3- The dimension of *pedagogy* was measured by two subscales, namely, Teaching with Technology (5 items) and Teaching with Emerging Technology (8 items). In item no. 7, the word “Smithsonian website” was replaced with “any website” to make it more relevant to the local context.

4-To check the variable *tool,* there were three variables included in the actual battery of the instrument: current hour per week using technology, home access to the internet, and computer access at home. Considering the perspective of the current project along with the cultural background of the country 10 items were used in place after consultation with the experts, including satisfaction with internet quality at home, satisfaction with internet quality at university, availability of training, hardware/software access at home, hardware/software access at university, availability of internet at home, availability of internet at university, support from university administration, technical support from the IT department, and access to relevant content. The scale was dichotomous, which included “yes” and “no” options. The items were further analysed through exploratory and then confirmatory analyses. They were subdivided into three subscales: home tools (3 items), university tools (4 items), and satisfaction (3 items) (Table 3.12, 3.17, Fig 3.1).

5- To check the variable *integration,* three questions were used.

(i) Stages of adoption of technology. Christensen in 1997 created this one-item measure, which has six stages: 1: Awareness, 2: Learning the Process, 3: Understanding and Application of the Method, 4: Familiarity and Confidence, 5: Adaptation to Additional Situations, and 6: Creative Applications to New Contexts are the steps of this self-assessment measure. Test-retest reliability was higher (.91), despite the fact that internal coherence and dependability could not be quantified because it was a single item (Christensen & Knezek, 2001).

(ii) Concern-Based Adoption Model Levels of Use (CBAM-LoU) questionnaire. Griffin and Christensen (1999) used Hall, Loucks, Rutherford, and Newlove’s (1975) work to create this single-item measure. The frequency with which this self-assessment is used Level 0 is for non-use, Level 1 is for orientation, and Level 2 is for use. Level 3: mechanical application; Level 4A: routine; Level 4B: refinement; Level 5: refinement integration; and Level 6: renewal. The metric was linked to stages in a good way. According to Christensen and Knezek (2001), adoption has a correlation of.64.

(iii) The Teacher Survey for the Apple Classroom of Tomorrow (ACOT), a lengthy joint scheme including Apple Computer, Inc., public schools, colleges, and investigating organizations that ran from 1985 to 1998, provided the basis for this one-item assessment. It was produced through a comprehensive qualitative study effort involving 32 instructors and 650 pupils across four selected schools (Dwyer, Ringstaff, & Sandholtz, 1990). Dwyer, in 1994, developed the instrument with the help of other researchers (Mayes, 2014). The study findings supported the five stages of development: 1: entry, 2: adoption, 3: adaptation, 4: appropriation, and 5: invention. When the combined effect of these three indicators is investigated, they produce a reliability of.84 (Hancock, Christensen, & Knezek, 2007).

3.6.2 Qualitative tool

For collecting the responses from the respondents, an interview protocol was developed**.** It was a self-developed instrument with 12 questions related to the *will, skill, tool, pedagogy,* and technology integration dimensions (Appendix B). Experts validated the qualitative tool (Appendix G).

3.7 Pilot Testing

In view of Creswell (2008), prior to being used in this study, the questionnaire had to undergo a pilot test to determine its validity and reliability, as well as refine its questions, structure, and scales. Before the real questionnaires were issued, pilot research was conducted at two public-sector universities. The primary goals of the pilot test were to guarantee the clarity and simplicity of the questionnaire and to determine whether the data obtained has face validity and provides answers to the topics under investigation (Presser et al., 2004). To ensure content authenticity, the researcher enlists the aid of academic specialists from the National University of Modern Languages (Appendix F).

Within a two-week period, the questionnaires were given out to a convenience sample of 60 (N = 100) teachers in each university. The sample size for the pilot research should be modest (up to 100), yet representative of the community under consideration (Nargundkar, 2003). 105 of the 120 issued questionnaires were returned, indicating a good response rate (87 percent). Five were incomplete and hence not included. The questionnaire took 18 minutes to complete, which is about average.

The reliability check came after the content validity check. Drost (2011) explains that reliability is the extent to which measurements can be repeated when performed by different individuals under various conditions and presumably using different instruments that evaluate the notion of competence. It can also be referred to as a construct's consistency or reliability. Table (3.15) shows the reliability values ranging from.62 for “tool” to.95 for “Tp Emtech,” which were satisfactory (Taber, 2018).

3.8 Exploratory Factor Analysis

The initial action in the exploratory factor analysis (EFA) is the assessment of the correlation matrix. The adequacy of the correlation matrix for TAC (teachers’ attitude towards computer) is assessed through Bartlett’s test of sphericity. Bartlett’s test of sphericity hypothesizes that the correlation is an identity matrix (null hypothesis). If the significance value of Bartlett’s test of sphericity is greater than 0.05, the null hypothesis will be accepted, i.e., there is no correlation among the items of a scale. On the contrary, if the significance value is less than 0.05 ($p < 0.05$), then we reject the null and the alternative hypothesis will be accepted, i.e., the correlation matrix is not an identity matrix and there exists a significant correlation between the items.

Table 3.3

KMO and Bartlett's Test (TAC)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.74
Bartlett's Test of Sphericity	Approx. Chi-Square	5221.16
	df	127
	Sig.	.00

The values in table (3.3) indicate that there is a significant correlation between the items of the scale, i.e., $p < 0.001$. Moreover, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy also indicates that an adequate sample was selected for data collection (Table 3.3). The principal component extraction technique with varimax rotation was utilised on the 51 items to extract the number of common factors based on Eigen values greater than one. The total variance explained (Table 3.4) indicates that the principal component extraction method extracted nine factors similar to the original scale, having an Eigen value greater than one and explaining 72.326% of the variation in the scale.

The factor loadings obtained from the EFA were analyzed on behalf of the dimensions of the teacher attitude towards Web 2.0 and to eliminate the factor loadings that did not load properly on the respective dimensions (Table 3.5). The principal component extraction technique with varimax rotation was utilized on the 51 items to extract the number of common factors based on Eigen values greater than one. There are multiple thresholds given in the literature ranging from 0.5 to 0.7. However, the current research utilized a relatively strict threshold, i.e., 0.70, as an acceptability criterion to include items in the analysis (Table 3.5).

Table 3.4

Total Variance Explained (TAC)

	Initial Eigen values			Extraction Sums of Squared Loadings						
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Component	Total	% of Var	Cumulative%
1	10.08	19.76	19.76	10.08	19.76	19.76	29	.28	.55	94.24
2	6.46	12.66	32.43	6.46	12.66	32.43	30	.25	.49	94.73
3	4.58	8.98	41.41	4.58	8.98	41.41	31	.23	.45	95.19
4	4.10	8.04	49.45	4.10	8.04	49.45	32	.23	.45	95.64
5	2.89	5.67	55.13	2.89	5.67	55.13	33	.21	.42	96.07
6	2.50	4.90	60.03	2.50	4.90	60.03	34	.19	.39	96.46
7	2.35	4.62	64.65	2.35	4.62	64.65	35	.19	.37	96.84
8	2.17	4.27	68.92	2.17	4.27	68.92	36	.18	.35	97.19
9	1.73	3.39	72.32	1.73	3.39	72.32	37	.16	.32	97.52
10	.91	1.78	74.10				38	.15	.29	97.81
11	.86	1.69	75.80				39	.14	.27	98.09
12	.80	1.58	77.38				40	.12	.25	98.34
13	.80	1.57	78.96				41	.11	.22	98.57
14	.73	1.43	80.39				42	.11	.21	98.79
15	.70	1.39	81.78				43	.10	.20	98.99
16	.64	1.27	83.05				44	.09	.19	99.18
17	.63	1.24	84.29				45	.08	.17	99.35
18	.57	1.12	85.42				46	.07	.14	99.50
19	.55	1.07	86.50				47	.06	.13	99.63
20	.50	.98	87.48				48	.06	.12	99.76
21	.48	.94	88.43				49	.05	.10	99.86
22	.46	.92	89.35				50	.04	.08	99.94
23	.43	.85	90.20				51	.02	.05	100.00
24	.41	.80	91.01							
25	.38	.74	91.76							
26	.34	.66	92.42							
27	.32	.64	93.07							
28	.31	.60	93.68							

The results in the rotated component matrix suggest that the items have met the minimum threshold of 0.70 and are perfectly loading on the respective dimensions as well. The rotated component matrix also suggests a nine-factor solution. The item "concern1" does not show any loadings on the scale. Hence, all the items except "concern1" in the analysis were retained and will be used in further analysis (Table 3.5).

Table 3.5

Rotated Component Matrix (TAC)

	Component									
	1	**2**	**3**	**4**	**5**	**6**		**7**	**8**	**9**
st1	.718						sig1	.751		
st2	.727						sig2	.708		
st3	.836						sig3	.781		
st4	.875						sig4	.834		
st5	.748						sig5	.885		
bnf1		.790					cmf1		.776	
bnf2		.849					cmf2		.895	
bnf3		.871					cmf3		.868	
bnf4		.852					cmf4		.805	
bnf5		.807					cmf5		.766	
per1			.764				acm1			.756
per2			.877				acm2			.758
per3			.884				acm3			.870
per4			.895				acm4			.746
per5			.873				acm5			.758
abs1				.786						
abs2				.740						
abs3				.728						
abs4				.811						
abs5				.833						
con1										
con2					.780					
con3					.713					
con4					.746					
con5					.733					
con6					.893					
con7					.795					
con8					.722					
util1						.722				
util2						.763				
util3						.736				
util4						.884				
util5						.714				
util6						.699				
util7						.750				
util8						.722				

2- An EFA was run to explore the dimensions of TPSA-21 (Teachers' Proficiency and Skill Assessment). Bartlett's test of sphericity hypothesizes that the correlation is an identity matrix (null hypothesis).

Table 3.6

KMO and Bartlett's Test (TPSA)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.904
Bartlett's Test of Sphericity	Approx. Chi-Square	4525.305
	df	561
	Sig.	.000

The significance value of Bartlett's test of sphericity greater than 0.05 will make the null hypothesis acceptable and will show that there is no correlation among the items of a scale. On the contrary, if the significance value is less than 0.05 ($p < 0.05$), then we will accept the alternative hypothesis, i.e., the correlation matrix is not an identity matrix and there exists a significant correlation between the items.

The values in the table (3.6) specify that there exists a significant correlation between the items of the scale, i.e., $p < 0.001$. Moreover, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy also indicates that an adequate sample was selected for the data collection.

The principal component extraction technique with varimax rotation was utilized on the 34 items to extract the number of common factors based on Eigen values greater than one. The total variance explained (Table 3.7) indicates that the principal component extraction method extracted six factors similar to the original scale, having an Eigen value greater than one and explaining 78.86% variation in the scale.

The factor loadings obtained from the EFA were analyzed for the dimensions of the teacher attitude towards Web 2.0 and to eliminate the factor loadings that did not load properly on the respective dimensions (Table 3.8). There are multiple thresholds given in the literature, ranging from 0.5 to 0.7. However, the current research utilized a relatively strict threshold, i.e., 0.70, as an acceptability criterion to include items in the analysis. The results in the rotated component matrix suggest that all the items have met the minimum threshold of 0.70 and are perfectly loading on the respective dimensions as well.

Table 3.7

Total Variance (TPSA)

	Initial Eigen values			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	15.86	46.67	46.67	15.86	46.67	46.67
2	3.49	10.26	56.93	3.49	10.26	56.93
3	2.32	6.84	63.78	2.32	6.84	63.78
4	2.08	6.14	69.92	2.08	6.14	69.92
5	1.60	4.72	74.64	1.60	4.72	74.64
6	1.43	4.21	78.86	1.43	4.21	78.86
7	.81	2.38	81.24			
8	.67	1.99	83.23			
9	.63	1.86	85.09			
10	.55	1.62	86.72			
11	.47	1.40	88.13			
12	.40	1.19	89.32			
13	.36	1.08	90.41			
14	.31	.92	91.33			
15	.29	.87	92.21			
16	.27	.81	93.01			
17	.25	.75	93.77			
18	.24	.72	94.49			
19	.22	.65	95.15			
20	.19	.58	95.73			
21	.17	.52	96.25			
22	.16	.48	96.73			
23	.15	.44	97.18			
24	.13	.40	97.59			
25	.12	.37	97.96			
26	.11	.34	98.31			
27	.10	.30	98.61			
28	.09	.27	98.89			
29	.08	.25	99.14			
30	.07	.23	99.37			
31	.06	.19	99.57			
32	.05	.17	99.74			
33	.04	.13	99.87			
34	.04	.12	100.00			

The rotated component matrix also suggests a six-factor solution. Hence, all the items in the analysis were retained and will be used in further analysis (Table 3.8).

Table 3.8

Rotated Component Matrix N = 100 (TPSA)

	Component					
	1	2	3	4	5	6
email1					.758	
email2					.711	
email3					.724	
email4					.761	
email5					.838	
www1				.750		
www2				.765		
www3				.752		
www4				.756		
www5				.860		
Intg1			.780			
Intg2			.744			
Intg3			.884			
Intg4			.847			
Intg5			.748			
EmtechS1		.753				
EmtechS2		.760				
EmtechS3		.730				
EmtechS4		.780				
EmtechS5		.769				
EmtechS6		.724				
TWT1						.759
TWT2						.713
TWT3						.807
TWT4						.814
TWT5						.762
TWET1	.788					
TWET2	.727					
TWET3	.763					
TWET4	.736					
TWET5	.831					
TWET6	.733					
TWET7	.774					
TWET8	.739					

3- For the scale of “tool,” different questions were asked related to satisfaction with the quality of internet at home, satisfaction with the quality of net at university, training, and availability of net at home and at university, hardware and software availability at home, and at university, access to relevant content, support from the institution and technical support from the department.

EFA results show an assessment of the correlation matrix. The adequacy of the correlation matrix for "tool" is assessed through Bartlett's Test of sphericity. Bartlett's test of sphericity hypothesizes that the correlation is an identity matrix (null hypothesis). A significance value of Bartlett's test of sphericity greater than 0.05 means the null hypothesis is acceptable.

On the contrary, a significance value less than 0.05 ($p < 0.05$) will make us accept the alternative hypothesis, i.e., the correlation matrix is not an identity matrix and there is a significant correlation between the items. The values in Table 3.9 below indicate that there is a significant correlation between the items of the scale, i.e., $p < 0.001$. Moreover, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy also indicates that an adequate sample was selected for the data collection.

Table 3.9

KMO and Bartlett's test (Tool)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.668
Bartlett's Test of Sphericity	Approx. Chi-Square	335.445
	df	45
	Sig.	.000

The factor loadings obtained from the EFA were analyzed for the dimensions of the "tool" and to eliminate the factor loadings that did not load properly on the respective dimensions. There are multiple thresholds given in the literature, ranging from 0.65 to 0.88. The principal component extraction technique with varimax rotation was utilized on the 10 items to extract the number of common factors based on Eigen values greater than one. The total variance explained (Table 3.10) indicates that the principal component extraction method extracted three factors similar to the original scale, having an Eigen value greater than one and explaining 62% of the variation in the scale.

Table 3.10

Total Variance Explained (Tool)

	Initial Eigen value			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.513	25.129	25.129	2.513	25.129	25.129
2	2.320	23.203	48.332	2.320	23.203	48.332
3	1.383	13.832	62.164	1.383	13.832	62.164
4	.845	8.453	70.618			
5	.708	7.080	77.697			
6	.690	6.897	84.595			
7	.550	5.504	90.098			
8	.406	4.057	94.155			
9	.303	3.027	97.182			
10	.282	2.818	100.000			

The results in the rotated component matrix suggest that most items have met the minimum threshold of 0.70 and are perfectly loading on the respective dimensions as well (Table 3.11).

Table 3.11

Rotated Component Matrix (Tool)

	Component		
	1	2	3
Training			.687
Satisfaction with quality of internet - H			.785
Satisfaction with quality of internet - U			.714
Hard/software access-H		.662	
Hard/software access-U	.657		
Internet at home		.883	
Internet at University	.832		
Support at University	.815		
Tech support at Department	.824		
Access to relevant content		.847	

The rotated component matrix also suggests a three-factor solution: one is related to the availability of technology at home, the second is related to the availability of technology at the university along with departmental and institutional support, and the third is related to satisfaction with the quality of net and training. Hence, all the items in the analysis were retained and will be used in further analysis (Table 3.11).

4- For Technology Integration three single-item questions were taken as one scale, including Level of Use (LoU), Stages of Adoption of Technology (SoAT), and the Apple Classroom of Tomorrow (ACOT) teacher survey.

An EFA was applied, which showed the adequacy of the correlation matrix through Bartlett's Test of sphericity. Bartlett's test of sphericity hypothesizes that the correlation is an identity matrix (null hypothesis).

The values in Table (3.12) below indicate that there is a significant correlation between the items of the scale, i.e., $p < 0.001$. Moreover, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy indicates that an adequate sample was selected for the data collection.

Table 3.12

KMO and Bartlett's Test (Integration)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.700
Bartlett's Test of Sphericity	Approx. Chi-Square	103.889
	df	3
	Sig.	.000

The principal component extraction technique with varimax rotation was utilized on the three items to extract the number of common factors based on Eigen values greater than one.

Table 3.13

Total Variance Explained (Integration)

	Initial Eigen values			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.092	69.749	69.749	2.092	69.749	69.749
2	.495	16.509	86.258			
3	.412	13.742	100.000			

The total variance explained (Table 3.13) indicates that the principal component extraction method extracted one factor similar to the original scale, having an Eigen value greater than one and explaining 69.749% variation in the scale.

Table 3.14

Rotated Component Matrix (Integration)

	Component
	1
Level	.817
Stages	.835
ACOT	.853

The results in the rotated component matrix suggest that all the items have met the minimum threshold of 0.70 and are perfectly loading on the respective dimensions as well. The rotated component matrix also suggests a single-factor solution (Table 3.14). Hence, all the items in the analysis were retained and will be used in further analysis.

The results of the pilot test and exploratory factor analysis helped determine the variables to retain for further analysis. This process is shown in detail in Table (3.15).

Table 3.15

Reliabilities of the scales employed in the study N = 100

Scale	Reliability	Comments
1- TAC (first round with 51 items)	.87	The reliability of each subscale was analyzed individually. The factor analysis showed nine factors similar to the original scale. Only one item in subscale "concern 1" was deleted.
TAC1: Satisfaction (5 items)	.87	Reliable according to Taber (2018)
TAC2: Comfort (5 items)	.90	Reliable
TAC3: Accommodation (5 items)	.87	Reliable
TAC4: Concern (8 items)	.88	Reliable, after factor analysis "concern 1" was deleted on account of low factor loading.
TAC5: Benefit (5 items)	.94	Excellent according to Taber (2018)
TAC6: Utility (8 items)	.91	Strong
TAC7: Perception (5 items)	.90	Reliable
TAC8: Absorption (5 items)	.87	Reliable
TAC9: Significance (5 items)	.90	Reliable
2- TPSA (21 items)	.94	Excellent according to Taber (2018). After factor analysis scale showed six subscales as according to the original. All items showed good factor loadings on their respective scales. Hence retained for further analysis.
TP email (5 items)	.91	Strong according to Taber (2018)
TP www (5 items)	.92	Strong
TP intg (5 items)	.94	Excellent according to Taber (2018)
TP Emtech (6 items)	.95	High (Taber, 2018)
TWT (5 items)	.93	Excellent according to Taber (2018).
TWET (8 items)	.93	Excellent according to Taber (2018).
3-Integration LEVELS Stages ACOT	.75	Since each of these three scales has only one item, Cronbach's alpha cannot be calculated for each scale separately. However, considering that they were all build measurements they were combined together as a single scale with three components called "Integration". Reliability was "good" according to Taber (2018). Factor analysis showed single factor
4-Tool (10 items) SWQNET-h SWQNET-U Hardware/software _h Hardware/software _U Internet-h Internet-U Support -institution Tech support-department Access to relevant content Training	.62	Moderate according to Taber (2018) criteria. Factor analysis showed three factors as "home tools", "university tools" and "support". All items show good factor loadings and retained for further analysis.

3.9 Validity of the Instrument

Simply put, a valid measure is one that captures the intended data (Murphy & Davidshofer, 1988). Reproducibility alone may be used by researchers to support validity claims (Buchner, Vamvakias, & Rom, 2010). A valid test guarantees that the outcomes are a true representation of the dimension being evaluated (Cizek, 2012).

The use of both theoretical and empirical data helps gauge validity. The process of translating a construct's concept into an operational measure by comparing it is known as theoretical evaluation or content validity. This was carried out by a panel of judges or university lecturers who graded each item's eligibility and assessed its compatibility with the construct's description, additionally; these people could confirm the queries known as "face validity" (Zohrabi, 2003). The content validity was checked by university professors (Appendix F).

The validity of the instruments was examined using a confirmatory factor analysis with the help of AMOS 26 software. According to Roos and Bauldry (2021), CFA is a statistical framework for connecting several observable variables to latent variables that are not immediately quantifiable.

Table 3.16

Fit Indices of Different Constructs N = 340

Constructs	χ^2	χ^2/df	df	NFI	TLI	CFI	GFI	RMSEA
Tools	52.14	1.63	32	.94	.96	.97	.97	.04
TPSA-21	1235.48	2.45	503	.90	.92	.93	.82	.06
TAC	1988.54	1.75	1132	.90	.92	.93	.82	.05

The one factor model of integration, the three-factor model of tools, the six-factor model of TPSA-21, and the nine-factor model of TAC that appeared in exploratory factor analysis were additionally analyzed via confirmatory factor analysis with the maximum likelihood estimation method.

Model fit indices that are most commonly utilized, CMIN/df, CFI, TLI, NFI, and RMSEA (Hair et al., 2010), with factor loadings of.50 (Byrne, 2006) and above, were kept in mind for the determination of model fit. Moreover, an acceptable model fit CFI value of.90 or greater was kept in mind (Hair et al., 2006). A Normative fit index (NFI) value of.90 or greater was considered (Hair et al., 2006). The Tucker-Lewis Index (Tucker & Lewis, 1973) shows model fit across all sample sizes.

The RMSEA values of 0 show perfect model fit, values less than.05 show good fit, values above.05 and below.08 show fair model fit, values exceeding.08 while lesser .10 reveal average model fit, and values that exceed.10 show poor fit (Browne & Cudeck, 1992). Table 3.16 depicts the model fit indices through the CFA of the scales. Factor loadings with constructs and subconstructs are given in tables 3.17, 3.18, and 3.19 below. Diagrammatic illustrations are in Figs 3.2, 3.3, and 3.4 (Appendix A).

Table 3.17

Factor Loadings and Reliability of Tools N =340

Construct	Sub construct		Factor loading	Reliability
Tools	1-university tool			.82
		Tsp_D	.652	
		sup_U	.804	
		net_U	.721	
		hs_U	.746	
	2- Home tools			.70
		AtRC	.555	
		net_H	.914	
		hs_H	.567	
	3- Satisfaction with quality			.62
		traing	.539	
		SwQonet_U	.685	
		SwQonet_H	.569	

Note. Tsp_D stands for technical support from the department. Sup_U is Support from university, net_u stands for net at university, hs_U means hardware software at university. AtRC means access to relevant content. net_H means net at home, hs_H represents hard software at home, SwQonet_U, SwQonet_H stand for satisfaction with the quality of the net at university and home.

Table 3.18 shows the factor loadings and reliabilities of the scale and subscale of TPSA.

Table 3.18

Factor loading and reliability of TPSA-21 N = 340

Construct	Sub construct	Factor loading	Reliability
TPSA-21	1-Email		.91
	eml1	.831	
	eml2	.859	
	eml3	.781	
	eml4	.881	
	eml5	.831	
	2- WWW		.93
	www1	.815	
	www2	.844	
	www3	.827	
	www4	.866	
	www5	.831	
	3-Integrated Application Skills		.92
	Int1	.843	
	Int2	.763	
	Int3	.924	
	Int4	.865	
	Int5	.825	
	4- Emerging Technology Skills		.94
	Emt1	.829	
	Emt2	.865	
	Emt3	.872	
	Emt4	.850	
	Emt5	.911	
	Emt6	.819	
	5- Teaching with Technology		.91
	TWT1	.869	
	TWT2	.865	
	TWT3	.894	
	TWT4	.789	
	TWT5	.700	
	6- Teaching with Emerging Technology		.93
	TWET1	.819	
	TWET2	.718	
	TWET3	.702	
	TWET4	.792	
	TWET5	.856	
	TWET6	.750	
	TWET7	.843	
	TWET8	.722	

Note. Eml stands for email, www for world wide network, int stands for integrated application skills, Emt for emerging tech skills, TWT for teaching with tech, TWET for teaching with emerg tech.

Table 3.19

Factor Loadings and Reliability of TAC N = 340

Construct	Sub construct	Factor loading	Reliability	Construct	Sub construct	Factor loading	Reliability
TAC	TAC 1: Satisfaction		.87	TAC	TAC6: Utility		.93
	st1	.875			util1	.780	
	st2	.812			util2	.831	
	st3	.866			util3	.844	
	st4	.545			util4	.842	
	st5	.590			util5	.718	
	TAC2: Benefit		.91		util6	.736	
	bnf1	.740			util7	.821	
	bnf2	.742			util8	.790	
	bnf3	.858			TAC7: Significance		.88
	bnf4	.901			sig1	.717	
	bnf5	.833			sig2	.827	
	TAC3: Perception		.91		sig3	.829	
	per1	.760			sig4	.694	
	per2	.807			sig5	.669	
	per3	.869			TAC8: Comfort		.92
	per4	.870			cmf1	.767	
	per5	.851			cmf2	.899	
	TAC 4: Absorption		.88		cmf3	.919	
	abs1	.823			cmf4	.840	
	abs2	.793			cmf5	.800	
	abs3	.714			TAC9: Accommodation		.89
	abs4	.823			acm1	.770	
	abs5	.701			acm2	.832	
	TAC5; Concern		.92		acm3	.838	
	con2	.773			acm4	.791	
	con3	.774			acm5	.738	
	con4	.770					
	con5	.792					
	con6	.835					
	con7	.812					
	con8	.836					

Note: st means satisfaction, ben = benefit, per = perception, con = concern, util = utility, sig = significance, cmf = comfort, acm = accommodation.

3.10 Data Collection

3.10.1Quantitative data collection

Data was collected online and personally, where feasible. Researcher used personal contact within the universities for the collection of the data. A total of 400 questionnaires were distributed among the university teaching faculty. The returned responses were 353, of which 340 were usable as the incomplete questionnaires were not incorporated in the final examination. All data screening processes were followed before conducting the final analysis. It was collected in two phases: quantitative first and qualitative afterwards. The estimated data collection time was five months. The data was assessed for normality and reliability.

3.10.2 Qualitative data collection

Semi-structured interviews were used in the qualitative technique to record participants' experiences related to the integration of technology. Understanding participants' points of view is a frequent goal of qualitative research techniques, which may help the research in ways that would not be feasible if just quantitative technique was used (Williams et al., 2011).

For qualitative data collection, personal cell numbers were obtained, while for quantitative data collection, their voluntary participation was obtained. Later, these 10 members were asked to take part in the interview. Three of them could not spare time on account of their workload, and only seven participants participated at a suitable time. Participants were contacted, and their interviews were obtained on the Zoom app. Each interview lasted for 30 to 35 minutes. The interview protocol was shared with them via WhatsApp.

3.11 Data Analysis

3.11.1 Quantitative data analysis

Data was analysed through SPSS-21, AMOS, and PLS3 software, calculating both descriptive and inferential statistics.

3.11.1.1Descriptive part

It was calculated by using means, standard deviation, and percentages for the calculation of knowledge, usage, preferences of Web 2.0 tools, and challenges confronted by the educators. The SD depicts the changeability of the numbers about the mean, and it is the most commonly used changeability measure. The mean calculates the middle inclination and displays the standard value of the distribution. While the divergence from the norm is measured by kurtosis and skewness, kurtosis quantifies the degree to which a distribution is flat and peaks, whereas skewness illustrates the degree to which values stray from symmetry. Kurtosis and skewness values of 1.0 or less are great for psychometric purposes, while values of 2.0 or less are also acceptable (Field, 2013).

3.11.1.2 Inferential part

It was computed by structural equation modelling (SEM) to see which factor contributes how much to the practice of web 2.0 tools. The introduction of SEM with latent constructs has transformed research in several fields. SEM is becoming one of the most important approaches for experiential inquiry since Jöreskog's (1967) early research on maximum likelihood factor analysis, in addition to its following applications to the estimation of structural equation systems (Jöreskog, 1972). Generally, two main methods for structural equation modelling (SEM) exist: covariance-based (CB-SEM), like executed in, for instance, LISREL, AMOS, and EQS; and variance-based structural equation modelling, known as partial least squares (PLS SEM). The goal of CB-SEM is to estimate a set of model parameters that will result in an empirical covariance matrix that is as close as feasible to the theoretical covariance matrix predicted by the system of structural equations.

This estimator must meet a number of conditions in order to be fitted using maximum likelihood (ML), including that the observed indicators have a multivariate average distribution and that the sample size is large enough. PLS-SEM (Hair et al., 2005) would be a good choice for investigators if these presumptions are broken. In view of Wold (1975), PLS-SEM analyses, in contrast to CB-SEM, do not need the completion of the least distributional postulations and are suitable for providing reliable fit using small samples (Tenenhaus et al., 2005). Overall, PLS-SEM can be a suitable substitute for CB-SEM if the issue satisfies the criteria listed below (Chin & Dibbern, 2007):

1- Since the phenomena under investigation are relatively new, new measurement models must be created.
2- The structural equation model has many hidden variables and indicator variables, making it complicated.
3- Different modelling approaches (such as formative and reflective measurement models) must be used to account for the associations between the indicators and latent variables.
4- The conditions for sample size, independence, or normal distribution do not exist.
5- It is more crucial to make predictions than to estimate parameters.

Despite how flexible PLS-SEM may be, CB-SEM is more often acknowledged for formal model evaluation since it is a further customary methodology with acknowledged goodness of fit (GoF) criteria and greater limit accuracy (Henseler & Fassott, 2010). Both strategies have unique benefits and drawbacks that make them suitable for different contexts. All statistical tests use .05 as the level of significance.

3.11.2 Qualitative data analysis

For the qualitative part, which included the open-ended questions and the interviews, thematic analysis was used. In the past ten years, one such strategy that has grown in popularity as a research methodology is thematic analysis (Braun & Clarke, 2006). Thematic analysis is used in this study's qualitative phase to further our understanding of technology integration in the teaching and learning process. QDA Miner Lite software was utilised for theme development.

Table 3.20

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Will	.046	340	.082	.993	340	.132
Skill	.072	340	.000	.950	340	.000
Tool	.243	340	.000	.845	340	.000
Pedagogy	.117	340	.000	.934	340	.000
INT	.179	340	.000	.929	340	.000

To find the normality of the data, the Shpiro-Wilk test was run. As most of the factors violate the normality test, it was decided to use PLS 3 software to test the model.

3.12 Ethical Considerations

Any research project must carefully evaluate ethical issues, but those that seek to understand participant social behaviour in particular must do so (Leavy, 2010). Basic research ethics include confidentiality and anonymity. Additionally, research ethics were kept in mind during data collection and the whole study course. The research's topic and goal were also described in the cover letter of the questionnaire, and their participation was made voluntary. No requests for respondents' names were made. The respondents' readiness was also taken into account. The researchers' works were properly referenced and cited.

Summary

The primary target in the chapter was to describe and support the rational viewpoint utilized in this work with reference to methodology, processes, and statistical techniques to accomplish the primary investigative goals, provide answers to the investigative questions, and conduct the pilot study. The present work followed a pragmatic approach and a mixed-method sequential explanatory design. In this chapter, details of population, sample, and sampling technique were discussed. Teaching faculty from six public sector universities was included in the population of the study. The questionnaires of teacher attitude towards computers (TAC v. 6.1) and teacher proficiency assessment (TPSA-C21) and the Levels, Stages, and ACOT survey were used to find the impact of *will*, *skill*, *tool*, and *pedagogy* on technology integration. Overall, the reliability of the scales was .62 to .95, which was good. The main statistical technique in this study was SEM using PLS 3 software. In the next chapter, the results are explained.

CHAPTER 4

ANALYSIS OF DATA

The result section includes detailed analysis and outcomes from the data. The study was based on analyzing integration of Web 2.0 into instructional practices at higher education level in a post-pandemic situation. A mixed-methods approach with parallel convergent design was used. Cross sectional survey was conducted using a questionnaire for quantitative part while a semi-structured interview was conducted for gathering qualitative data. The quantitative analysis reveals the descriptive statistics first, while in the next part, inferential statistics are elaborated. In qualitative analysis open-ended questions were analyzed first while thematic analysis was done later.

Descriptive analysis includes demographics, the mean and standard deviation (SD). In inferential section the PLS-SEM analysis incorporates the investigation of the measurement and structural models. The measuring model identifies the constructs' validity and reliability. The relevance of the predicted associations is established by the structural model. It consisted of three sections.

Section I- Quantitative Analysis

In many domains, quantitative analysis is an invaluable method for achieving measurable, objective findings. By measuring and interpreting numerical data, it enables analysts to get a better comprehension of facts along with the capacity to make defensible conclusions. It includes demographics, descriptive analysis and inferential statistics. Quantitative section is further divided in three parts.

4.1- Demographics

4.2- Descriptive statistics

4.3- Inferential statistics

Section II- Qualitative Analysis

For the qualitative part, which included the open-ended questions and the interviews, thematic analysis was used. Qualitative analysis consisted of two parts.

4.4- Open-ended questions analysis

4.5- Thematic analysis

Section III- Comparison and Integration of Quantitative and Qualitative analysis

In this part the quantitative and qualitative results are compared, related and integrated for better comprehension.

Section I - Quantitative Analysis

4.1 Demographics

The demographic data obtained by means of instruments is analyzed and explained in this section. The demographic analysis provided the relevant information about those who participated in the study. This information is displayed in the form of tables and graphs for better understanding.

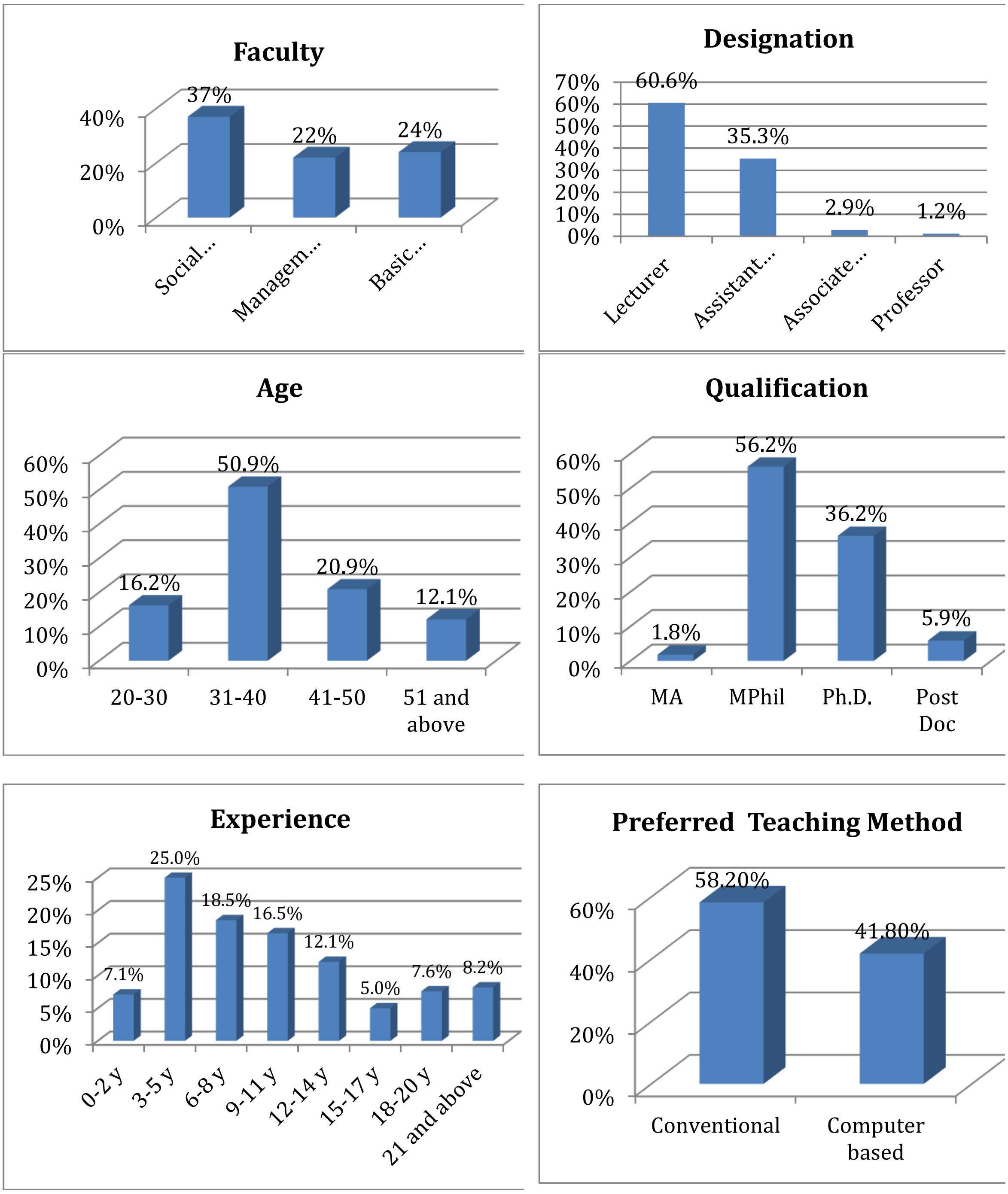
Table 4.1

Demographic information

Variable	Category	Frequency	Percentage%
	Social Sciences	150	37
Faculty	Management Sciences	90	22
	Basic Sciences	100	24
Designation	Lecturer	206	60.6
	Assistant Professor	120	35.3
	Associate Professor	10	2.9
	Professor	4	1.2
Age	20-30	55	16.2
	31-40	173	50.9
	41-50	71	20.9
	51 and above	41	12.1
Experience	0-2 y	24	7.1
	3-5 y	85	25.0
	6-8 y	63	18.5
	9-11 y	56	16.5
	12-14 y	41	12.1
	15-17 y	17	5.0
	18-20 y	26	7.6
	21 and above	28	8.2
Preferred Teaching method	Conventional	198	58.2
	Computer based	142	41.8
Qualification	MA	6	1.8
	MPhil	191	56.2
	Ph.D.	123	36.2
	Post Doc	20	5.9

Fig 4.1

Graphic Representation of Demographics Table 4.1



It is obvious from table 4.1 above that 37% of faculty from social sciences, approximately 22% from management sciences and 24% from basic sciences participated in the study. The designation shows that 60% were lecturers, 35% were assistant professors, and an approximate 3% were associate professors, while 1% was professors. According to age, 16% were members of the age group of 20-30 years, while, 51% were members of the age group of 31-40 years. Around 21% were between the ages of 41and 50, whereas only 12% were in the 51 and older age group. In qualification, approximately 2% had a master's degree, 56% had an M. Phil. degree, and 36% were PhD degree holders, while approximately 6% were postdoctoral holders. The maximum experience group 25% was from 3 to 5 years, 18% were from 6 to 8 years' experience group, 16% were from 9 to 11 years, 12% were of the 12 to 14 years' experience group.

Table 4.2

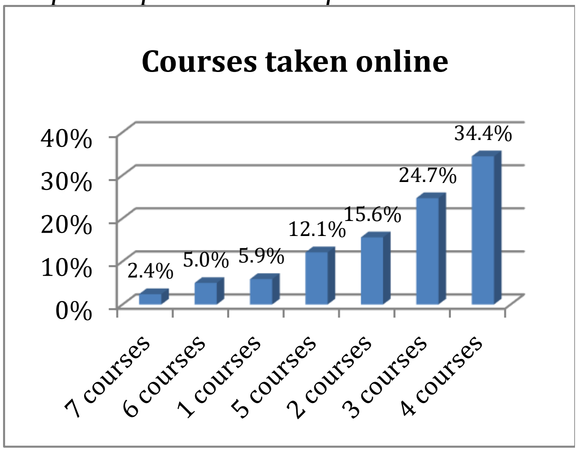
Courses Taken Online and number of Hours Spent on Web for Instructional Purpose

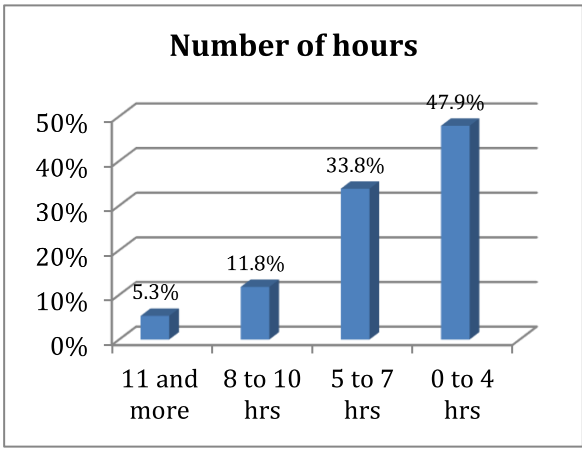
Variables	Number	Frequency	Percent
Number of online courses	7 courses	8	2.4
	6 courses	17	5.0
	1 course	20	5.9
	5 courses	41	12.1
	2 courses	53	15.6
	3 courses	84	24.7
	4 courses	117	34.4
Number of hours	11 and more	18	5.3
	8 to 10 hrs	40	11.8
	5 to 7 hrs	115	33.8
	0 to 4 hrs	163	47.9
	Total	340	100.0

It is clear from Table 4.2 that the majority (34%) took 4 courses online during the pandemic, whereas nearly 25% took 3 courses and only 2% took 7 courses. From Table 4.2, it can be seen that approximately 48% spend 0 to 4 hours on the internet for educational purposes.

Fig 4.2

Graphic representation of Table 4.2





Whereas 34% spend 5 to 7 hours, approximately 12% spend 8 to 10 hours, and 6% spend 11 hours or more than 11 hours on the web.

Table 4.3

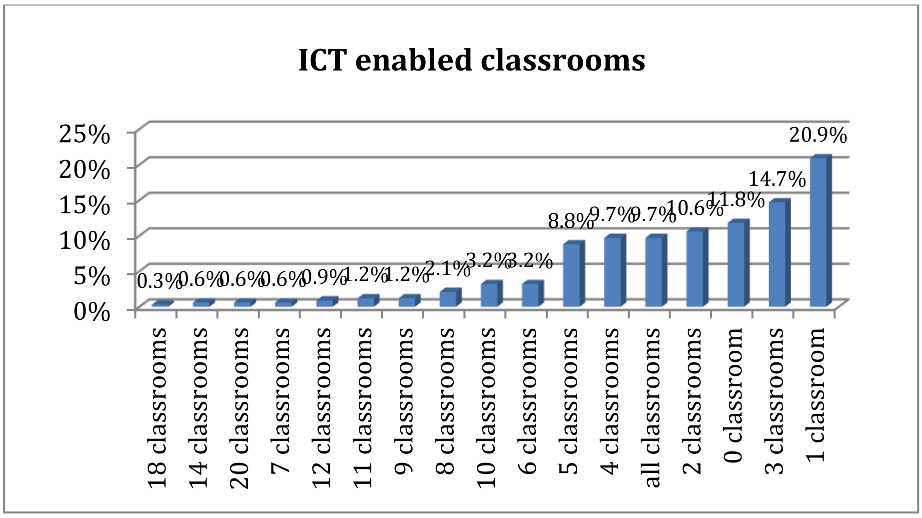
ICT Enabled Classrooms

Number of ICT enabled classrooms	Frequency	Percent
18 classrooms	1	0.3
14 classrooms	2	0.6
20 classrooms	2	0.6
7 classrooms	2	0.6
12 classrooms	3	0.9
11 classrooms	4	1.2
9 classrooms	4	1.2
8 classrooms	7	2.1
10 classrooms	11	3.2
6 classrooms	11	3.2
5 classrooms	30	8.8
4 classrooms	33	9.7
all classrooms	33	9.7
2 classrooms	36	10.6
0 classroom	40	11.8
3 classrooms	50	14.7
1 classroom	71	20.9
Total	340	100.0

From Table 4.3, approximately 12% reported there were no ICT-enabled classrooms in the department, whereas the majority, approximately 21%, reported only one classroom with an ICT facility.

Fig 4.3

Graphic Representation of Table 4.3



About 15% reported three classrooms, whereas 10% reported that there was an ICT facility available in all classrooms.

Table 4.4

Video Conferencing Rooms

Number of video conferencing rooms	Frequency	Percent
9 rooms	2	0.6
4 rooms	5	1.5
5 rooms	6	1.8
3 rooms	18	5.3
2 rooms	33	9.7
1 room	112	32.9
0 room	164	48.2
Total	340	100.0

From Table 4.5, it is evident that 48% reported that they don't have a video-conferencing room in their department, while less than 1% reported nine video conferencing rooms in their respective department. A graphic representation of Table 4.5 is given below.

Fig 4.4

Graphic Representation of Table 4.4

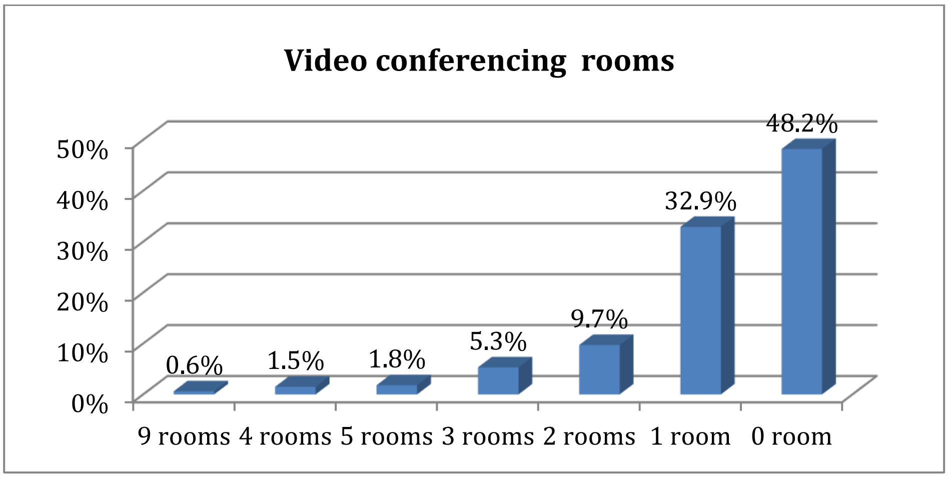


Table 4.5

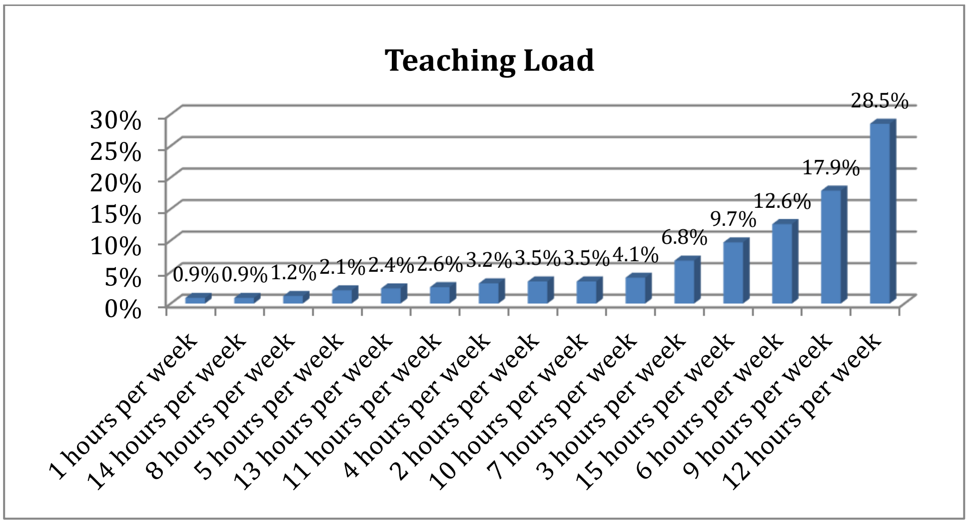
Teaching Load during Pandemic

Number of hours per week	Frequency	Percentage %
1 hours per week	3	0.9
14 hours per week	3	0.9
8 hours per week	4	1.2
5 hours per week	7	2.1
13 hours per week	8	2.4
11 hours per week	9	2.6
4 hours per week	11	3.2
2 hours per week	12	3.5
10 hours per week	12	3.5
7 hours per week	14	4.1
3 hours per week	23	6.8
15 hours per week	33	9.7
6 hours per week	43	12.6
9 hours per week	61	17.9
12 hours per week	97	28.5
Total	340	100.0

When asked about the teaching load, 28% of faculty members reported that they had taught 12 hours per week during the period of the pandemic. Approximately one percent reported teaching 1 hour per week, and less than one percent took 14 hours per week online during the pandemic (Table 4.5).

Fig 4.5

Graphic Representation of Table 4.5



4.2 Descriptive Statistics

A key component of statistical evaluation is a statistical description, which entails meaningfully summarizing and characterizing data. It gives scholars insightful information and enables them to make inferences from the data.

Objective 1: To analyse the integration of Web 2.0 technology (Levels, Stages, and ACOT) into instructional practices at the higher education level.

1.1 To analyse the integration of Web 2.0 technology on the Concern Based Adoption Model Level of Use (CBAM-LoU) scale.

1.2 To analyze the Web 2.0 technology integration by Stages of Adoption (SoA) scale.

1.3 To analyze the Web 2.0 technology integration by the Apple Classroom of Tomorrow (ACOT) teacher stages scale.

Table 4.6

Technology Integration

Scale/Subscale	Mean	SD	Skewness	Kurtosis	Alpha
Integration	2.38	0.19	-1.37	2.88	.71
Levels	5.17	1.51	-0.48	0.50	
Stages	4.39	1.04	-0.57	0.49	
ACOT	3.41	0.97	-.37	0.28	

The mean value of the levels scale is (M = 5.17, SD = 1.5), which is greater than the midpoint of 4.5, showing the above intermediate technology integration value of the respondents. The mean of levels was above intermediate, showing the faculty integrating technology at “routine level” (i.e., feeling comfortable and putting forth little effort to improve technology in education). Similarly, the mean value of the stages scale was (M = 4.39, SD = 1.04) greater than the midpoint of 3.5, showing slight rise above the intermediate level of integration. With a mean of stages above intermediate reflecting that the faculty may not yet consistently apply technology creatively. Likewise, the calculated mean value of the ACOT scale is (M = 3.41, SD = 0.97), which is again greater than the midpoint of 3, indicating moderately above the medium level of integration of technology by the teachers, and slightly above intermediate ACOT showing that they are likely adapting beyond the initial stages but not fully integrating it. Overall results show that the technology integration was moderately high (Table 4.6).

Skewness and kurtosis values of the scale integration were (skewness = - 1.37, kurtosis = 2.88) with its subscales of levels (skewness = -0.48, kurtosis = 0.50), stages (skewness = -0.57, kurtosis = 0.49), and ACOT (skewness = -0.37, kurtosis = 0.28). All the values of skewness and kurtosis show within the range of +2, -2, paving the way for possible analysis. The alpha value of integration was.71 (Table 4.6).

Objective 2: To explore the availability of Web 2.0 technologies at the higher education level.

When asked about their satisfaction with the quality of the internet at home, 75% said that they were satisfied, whereas 25% were unsatisfied with the quality. 74% were satisfied with the quality of net at the university whereas 26% were unsatisfied with the quality.

Table 4.7

Availability of Tools (N= 340)

Variables	Yes (%)	No (%)	Mean (SD)
Satisfaction with Internet Quality at Home	256(75%)	84(25%)	1.75(.43)
Satisfaction with Internet Quality at University	251(74%)	89(26%)	1.74(.44)
Training	255(75%)	85(25%)	1.74(.43)
Access to Relevant Content	310(91%)	30(9%)	1.90(.30)
Hardware/Software at Home	306(90%)	34(10%)	1.90(.30)
Hardware/Software at University	286(84%)	54(16%)	1.84(.36)
Internet at Home	313(92%)	27(8%)	1.92(.27)
Internet at University	298(88%)	42(12%)	1.88(.33)
Support at University	294(87%)	46(13%)	1.86(.34)
Technical Support at Department	295(87%)	45(13%)	1.87(.34)

When asked about the training received during the pandemic, 75% answered ‘yes,’ while 25% answered negatively. When asked whether they got access to the relevant content during the pandemic, 91% said yes while 9% said they did not have any access to the related material (Table 4.7).

In answering the question of hardware and software access at home, 90% said that yes, they had it at home, whereas 10% said they didn’t have it at home. 84% of respondents said that they had hardware and software at the university, while approximately 16% said they didn’t. 91% of respondents had the internet at home whereas 9% did not have it. Nearly 88% had the internet at the university, whereas 12%

didn't. 87% said that they received support from the university during the pandemic, while 13% denied it.

Approximately 87% got technical support at the university department level, whereas 13% didn't receive technical support from the department (Table 4.7). Most respondents were satisfied with the quality of net at home (M = 1.75, SD =.43) as compared to the quality of net at university (M = 1.74, SD =.44). Most of the respondents (M = 1.74, SD =.43) got training during the pandemic for online tool usage. Most of the faculty members had access to relevant content during the pandemic (M = 1.90, SD =.30).

Hardware and software availability at home (M = 1.90, SD =.30) was greater than at the university (M = 1.84, SD =.36). Satisfaction with the quality of internet at home was (M = 1.92, SD =.27) higher than satisfaction with internet at the university (M = 1.88, SD =.33). Support at university was quite satisfactory (M = 1.86, SD =.34), whereas technical support at the department (M = 1.87, SD =.34) was also high (Table 4.7).

Objective 3: To explore the use of Web 2.0 technologies at the higher education level.

When the faculty was asked about the tools used during the pandemic, 46% said that they had never used the blogs, while nearly 3% had used them during the pandemic (Table 4.8). Wikis were never used by 35% of the respondents, whereas 4% always used them during the pandemic. About WhatsApp, the percentage of people who had never used it was 4%, while 41% had often used it for teaching purposes. Facebook was never used for teaching, according to 35% of the faculty, while 8% reported to use it always. 48% had never used Twitter, whereas 4% reported using it always for the teaching and learning process. YouTube was often used by 34% of the faculty, while 11% said that they had rarely used it for instruction (Table 4.8). Nearly 7% had rarely used LMS, while 31% had always used it, as shown below in Table 4.8.

Table 4.8

Frequency and Percentage of Web 2.0 Tools Usage (N = 340)

Sr#	Tools	Never	Rarely	Sometimes	Often	Always	Mean (SD)
1	Blogs	157(46.2%)	90(26.5%)	54(15.9%)	29(8.5%)	10(2.9%)	1.96(1.10)
2	Wikis	120(35.3%)	68(20%)	74(21.8%)	65(19.1%)	13(3.8%)	2.36(1.24)
3	WhatsApp	14(4.1%)	19(5.6%)	48(14.1%)	140(41.2%)	119(35.5%)	3.97(1.04)
4	FB	111(32.6%)	70(20.6%)	46(13.5%)	85(25%)	28(8.2%)	2.56(1.37)
5	YouTube	45(13.2%)	36(10.6%)	64(18.8%)	116(34.1%)	79(23.2%)	3.44(1.31)
6	LMS	54(15.9%)	23(6.8%)	56(16.5%)	102(30%)	105(30.9%)	3.53(1.40)
7	CMS	88(25.9%)	67(19.7%)	56(16.5%)	57(16.8%)	72(21.2%)	2.88(1.49)
8	Google Meet	25(7.4%)	22(6.5%)	34(10%)	91(26.8%)	168(49.4%)	4.04(1.23)
9	Zoom	51(15.0)	50(14.7)	57(16.8)	99(29.1)	83(24.4)	3.33(1.38)
10	PowerPoi nt	13(3.8%)	22(6.5%)	38(11.2%)	92(27.1%)	175(51.5%)	4.16(1.09)
11	Google docs	20(5.9%)	24(7.1%)	68(20%)	113(33.2%)	115(33.8%)	3.82(1.15)
12	Any others						
Camtesia Video Recordings				2(0.6%)			
Mobile Video Recordings				2(0.6%)			
Teams App				20(6%)			

According to 26% of the respondents, the course management system (CMS) was never used whereas 21% always used it. 7% had never used Google Meet, whereas 49% used it always. Zoom apps were never used by 15%, while 29% often used them for the learning process. PowerPoint was never used by 4%, whereas 51% always used it. Google Docs were never used by 6%, while 34% had always used them for instruction. They were given the option to write about any other tool that was used by them during the lockdown period in order to instruct the students. In this option, 0.6% said that they had used the Camtesia Video Recording tool; 0.6% had made use of mobile video recordings; and 6% had used Microsoft Teams for teaching during the pandemic (Table 4.8).

From Table 4.8, the mean values related to Web 2.0 tools used during the pandemic show that the highest mean value (M = 4.16, SD = 1.09) of the tools used is for Power Point; the second highest mean value (M = 4.04, SD = 1.23) is for Google Meet;

and then WhatsApp has a mean value (M = 3.97, SD = 1.04). The lowest mean (M = 1.96, SD = 1.10) is for blogs as a teaching and learning tool in Pakistan.

Table (4.9) explains the descriptive statistics of the scales Will, Skill, Pedagogy, and Tool with their subscales. The values of mean, standard deviation, skewness, kurtosis, and alpha are given in Table 4.9.

The interpretation of results would be that the mean score from.01 to 1.00 strongly disagree, 2.00 for disagree, from 2.01 to 3.00 neutral, and from 3.01 - 4.00 means agree, whereas the mean score from 4.01 to 5.00 represents strongly agree (Farooq, 2016). It is different for the scale of the tool, as it is a dichotomous scale.

Will represents the teachers' attitude towards technology, which was measured on a five-point Likert scale with a mean value of M = 4.10, SD = 3.38, showing a positive attitude towards technology with the results of the mean statistics of its subscales of satisfaction (M = 3.8, SD =.69), comfort (M = 3.56, SD = .78), concern (M = 2.77, SD =.73), accommodation (M = 3.74, SD =.62), benefit (M = 3.31, SD =.71), utility (M = 3.67, SD =.58), perception (M = 3.43, SD = 1.06), absorption (M = 3.50, SD =.57), and significance (M = 3.71, SD =.46). Every subscale shows a positive attitude except concern, whose low mean value shows the neutral attitude of the respondents (Table 4.9).

According to Field (2009), the acceptable values of skewness and kurtosis are between +2 and -2. The skewness of the scale will (skewness = 3.38, kurtosis = -.16) with its subscales of satisfaction (skewness = -1.71, kurtosis = 5.36), comfort (skewness = -.90, kurtosis = 0.49), concern (skewness = 0.15, kurtosis = -1.08), accommodation (skewness = -0.53, kurtosis =0 .58), benefit (skewness = -0.67, kurtosis = -.85), utility (skewness = -0.95, kurtosis = 0.94), perception (skewness = 0.34, kurtosis = -0.82), absorption (skewness = -0.90, kurtosis = .18), significance (skewness = -0.89, kurtosis =

0.24). All these values of skewness and kurtosis show the acceptable range and the data to be fit for further analysis except "satisfaction" which has skew value more than +2, -2.

Table 4.9

Descriptive statistics of the scales

Scale/Subscale	Mean	SD	Skewness	Kurtosis	Alpha
TAC: Will/Attitude	4.10	3.38	-.16	-.69	.88
TAC1: Satisfaction	3.88	.69	-1.71	5.36	
TAC2: Comfort	3.56	.78	-0.90	0.49	
TAC3: Concern	2.77	.73	0.15	-1.08	
TAC4: Accommodation	3.74	.62	-0.53	0.58	
TAC5: Benefit	3.31	.71	-0.67	-0.85	
TAC6: Utility	3.67	.58	-0.95	0.94	
TAC7: Perception	3.43	1.06	0.34	-0.82	
TAC8: Absorption	3.50	.57	-0.90	0.18	
TAC9: Significance	3.71	.46	-0.89	0.24	
TPSA: Skill	3.73	0.44	-0.89	0.96	.91
Email skills	3.85	0.57	-1.00	1.90	
www skills	3.86	0.52	-0.58	1.53	
Integrated application skills	3.41	0.71	-0.67	-0.08	
Emerging technology skills	3.79	0.49	-0.68	0.56	
Pedagogy	3.71	0.49	-1.08	1.72	.91
TWT	3.71	0.55	-1.00	1.37	
TWET	3.71	0.57	-0.97	1.10	
Tool	1.84	0.16	-1.20	1.25	.59
Satisfaction with net	1.71	0.33	-0.86	-0.36	
Home tool	1.89	0.25	-2.36	4.88	
University tool	1.89	0.26	-2.54	5.52	

The mean value of the scale TPSA for skill (M = 3.73, SD = 0.44) exhibits the proficiency of the faculty in different areas, including email skills (M = 3.85, SD = 0.57), www skills (M = 3.86, SD = 0.52), integrated application skills (M = 3.41, SD = 0.71), and emerging technology skills (M = 3.79, SD = 0.49) (Table 4.9).

The skewness and kurtosis values of the scale skill were (skewness = -0.89, kurtosis = 0.96), with its subscales of email skills (skewness = -1.00, kurtosis = 1.90), www skills (skewness = -0.58, kurtosis = 1.53), integrated application skills (skewness = -0.67, kurtosis = -0.08), and emerging technology skills (skewness = -0.68, kurtosis =

0.56). All values of skewness and kurtosis are within the acceptable range, showing the suitability of further analysis.

The scale tool's mean value (M = 1.84, SD = 0.16) shows that the faculty had enough availability of the tool with its subscale satisfaction with net (M = 1.89, SD = 0.25), home tool (M = 1.89, SD = 0.26), and university tool (M = 1.71, SD = 0.33).
The skewness and kurtosis values for tools were (skewness = -1.20, kurtosis = 1.25), satisfaction with net (skewness = -0.86, kurtosis = -0.36), home tool (skewness = -2.36, kurtosis = 4.88), and university tool (skewness = -2.54, kurtosis = 5.52) that show the non-normal distribution of data (Table 4.9).

The value of reliability was already calculated in the third chapter for all the scales and is calculated again here. Cronbach's alpha reliability coefficient typically falls between 0 and 1. Nevertheless, the coefficient really has no lower bound. In view of Gliem and Gliem (2003), the items have good internal consistency, while Cronbach's alpha coefficient is close to 1.0. According to Griethuijsen et al. (2014), alpha scores are sometimes classified as adequate, sufficient, or satisfactory, with scores below the cutoff being labelled as inadequate. This threshold is typically defined as less than.70 or, more broadly, as between .6 and .7. According to Taber (2018), the satisfactory value of alpha is between 0.58 and 0.97. The calculated values of all the scales are within the satisfactory range, the scale of *will* has an alpha value of.89, the scale of *skill* has an alpha value of.94, the scale of *pedagogy* alpha value of.92, the alpha value for integration is.65, and the *tool* has an alpha value of.62 (Table 4.9).

4.3 Inferential Statistics

A subfield of statistics known as "inferential statistics" draws conclusions about a population using data from samples. It is employed in hypothesis testing, population parameter estimation, and future event prediction.

Research Objective 4: To analyze the influence of factors such as *will*, *skill*, *pedagogy*, and *tool* on the integration of Web 2.0 technologies into instructional practices at the higher education level.

There are four hypotheses to be tested, as follows:

H1: There is a direct positive effect of will on technology integration.

H2: There is a direct positive effect of skill on technology integration.

H3: There is a direct positive effect of tool on technology integration.

H4: There is a direct positive effect of pedagogy on technology integration.

4.3.1 Measurement Model

Smart PLS 3.0 (Ringle et al, 2015) was the tool to evaluate the measurement and structural models. This software assesses the psychometric properties of the measurement model and estimates the parameters of the structural model.

Validity and reliability of the measurement model are established by (1) indicator reliability and (2) internal consistency and reliability (3) convergent validity and discriminant validity. The following sections present the result of all analyses to assess the validity and reliability of the measurement model. The examination of construct validity and construct reliability comes after the factor loadings in the assessment of the quality standards.

4.3.1.1 Indicator reliability or Factor Loadings

The degree to which every indicator within the correlation matrix connects to a certain main element is referred to as "factor loading". In view of Pet et al.'s (2003) finding that component loadings can be negative or positive, higher associations between the item and the underlying factor are indicated by bigger absolute values.

Table 4.10

Factor loadings of indicators of TAC

	st	benfit	per	abs	con	util		sig	cmf	acm
st1	0.842						sig1	0.877		
st2	0.783						sig2	0.806		
st3	0.800						sig3	0.817		
st4	0.821						sig4	0.792		
st5	0.840						sig5	0.744		
bnf1		0.815					cmf1		0.649	
bnf2		0.863					cmf2		0.915	
bnf3		0.887					cmf3		0.844	
bnf4		0.887					cmf4		0.527	
bnf5		0.850					cmf5		0.772	
per1			0.768				acm1			0.750
per2			0.890				acm2			0.832
per3			0.907				acm3			0.896
per4			0.743				acm4			0.837
per5			0.765				acm5			0.805
abs1				0.772						
abs2				0.813						
abs3				0.833						
abs4				0.799						
abs5				0.820						
con2					0.860					
con4					0.660					
con5					0.747					
con6					0.828					
con7					0.818					
con8					0.744					
util1						0.757				
util2						0.878				
util3						0.872				
util4						0.855				
util5						0.687				
util6						0.827				
util7						0.820				
util8						0.760				

Note: st means satisfaction, ben = benefit, per = perception, con = concern, util = utility, sig = significance, cmf = comfort, acm = accomodation.

Hulland (1999) posits that if reflective indicators' loadings in the PLS model are below 0.4, they should be excluded from measurement models (Hulland 1999).

Table 4.11

Factor loading of TPSA

	email	www	Emt	intg	TWT	TWET	homtol	unitol	Integration
email1	0.831								
email2	0.866								
email3	0.850								
email4	0.882								
email5	0.878								
www1		0.861							
www2		0.862							
www3		0.732							
www4		0.877							
www5		0.899							
Emtech1			0.860						
Emtech2			0.895						
Emtech3			0.905						
Emtech4			0.871						
Emtech5			0.915						
Emtech6			0.850						
intg1				0.900					
intg2				0.841					
intg3				0.923					
intg4				0.869					
intg5				0.849					
TWT1					0.835				
TWT2					0.840				
TWT3					0.890				
TWT4					0.883				
TWT5					0.821				
TWET1						0.827			
TWET2						0.807			
TWET3						0.762			
TWET4						0.813			
TWET5						0.865			
TWET6						0.744			
TWET7						0.846			
TWET8						0.795			

Note: Eml stands for email, www for world wide network, int stands for integrated application skills, Emt for emerging tech skills, TWT for teaching with tech, TWET for teaching with emerging technology.

After the removal of concern3 and SWnet, which had factor loadings less than 0.4, neither of the study's components had factor loadings below 0.50, the suggested level by

Hair et al. (2016). Consequently, no other things were deleted. Below are the factor loadings of TAC (Table 4.10).

Table 4.11 shows the factor loadings of the scale TPSA. It is clear from the table that the factor loadings range from 0.92 to 0.73, allowing the retention of the indicators for further analysis.

Table 4.12 shows the factor loadings of *tool* and *integration*. The factor loadings for *tool* were from 0.75 to 0.84, while those for *integration* were from 0.76 to 0. 86, so all the items were included in the further analysis.

Table 4.12

Factor loading of Tool and Integration

Acc_content	0.761		
hardsoft-H	0.819		
Internet-H	0.780		
Techsup-Dpt		0.758	
hardsoft-U		0.778	
Internet-U		0.844	
support-U		0.832	
ACOT			0.862
LEVEL			0.762
STAGEs			0.799

Note: Acc_content shows access to relevant content, hardsoft-H = hardware software access at home, Internet-H = availability of net at home, Techsup- = technical support at department, hardsoft-U = hardware software at university

Indicator multicollinearity

Fornell and Bookstein (1982) explain that Variance Inflation Factor (VIF) statistics are used to appraise multicollinearity within the items. That's not a major problem if its assessment is less than the threshold of 5. Table (4.13) shows that the VIF of all indicators except Intg. 3 is less than 5. In view of Neter et al. (1996) in general, having linked predictor variables does not hinder our ability to find a good fit, nor do they usually have an impact on forecasts of future measurements or average responses.

Table 4.13

Multicollinearity Statistics (VIF) for Indicators

Indicator	VIF	Indicator	VIF	Indicator	VIF	Indicator	VIF
ACOT	1.492	TWT4	2.691	concrn2	2.150	signif1	1.915
LEVEL	1.416	TWT5	2.235	concrn4	1.991	signif2	2.200
STAGEs	1.504	Techsup-D	1.571	concrn5	1.984	signif3	2.303
Acc_content	1.354	absorp1	2.310	concrn6	2.776	signif4	2.326
Emtech1	2.890	absorp2	2.349	concrn7	1.817	signif5	2.004
Emtech2	3.491	absorp3	1.906	concrn8	2.139	st1	2.952
Emtech3	3.632	absorp4	1.997	email1	2.830	st2	2.410
Emtech4	3.327	absorp5	1.886	email2	2.880	st3	2.925
Emtech5	4.724	accomd1	1.831	email3	2.392	st4	3.266
Emtech6	2.837	accomd2	2.425	email4	3.108	st5	3.550
Internet-H	1.678	accomd3	2.797	email5	2.947	support-U	2.003
Internet-U	1.748	accomd4	2.332	hardsoft-H	1.372	utility1	2.862
TWET1	2.589	accomd5	1.935	hardsoft-U	1.822	utility2	2.902
TWET2	2.361	benfit1	2.383	intg1	3.004	utility3	3.071
TWET3	1.951	benfit2	2.423	intg2	2.373	utility4	3.872
TWET4	3.003	benfit3	3.061	intg3	5.462	utility5	1.950
TWET5	4.021	benfit4	3.536	intg4	3.905	utility6	2.152
TWET6	2.194	benfit5	2.721	intg5	2.562	utility7	2.822
TWET7	3.472	comf1	1.951	percp1	1.724	utility8	2.434
TWET8	2.642	comf2	4.612	percp2	2.553	www1	3.303
TWT1	2.458	comf3	4.548	percp3	3.519	www2	3.419
TWT2	2.686	comf4	2.855	percp4	3.494	www3	1.814
TWT3	3.382	comf5	2.107	percp5	2.828	www4	2.710
						www5	3.014

Note: Acc_content shows access to relevant content, hardsoft-H = hardware software access at home, Internet-H = availability of net at home, Techsup- = technical support at department, hardsoft-U = hardware software at university. Eml stands for email, www for world wide network, int stands for integrated application skills, Emt for emerging tech skills, TWT for teaching with tech, TWET for teaching with emerging technology. st means satisfaction, ben = benefit, per = perception, con = concern, util = utility, sig = significance, cmf = comfort, acm = accomodation.

4.3.1.2 Internal consistency reliability

According to Mark (1996), the degree of stability and consistency of a measuring device is known as “reliability”. Repetition is the cornerstone of reliability. Will an instrument produce the same findings if it is used repeatedly? Cronbach’s alpha as well as composite reliability (CR) are the two commonest techniques for determining reliability. In Table 4.14, the results for both are shown. The range of Cronbach’s alpha varies from

0.7 to 0.9, while the range of composite reliability is 0.83 to 0.95. As postulated by Hair et al. (2011), both indicators have consistency stats over the limit of 0.70. Construct dependability is developed as a result.

Table 4.14

Internal Consistency and Reliability

	Cronbach's Alpha	Composite Reliability (CR)
Integration	0.74	0.85
bnft	0.91	0.94
eml	0.91	0.94
homtol	0.71	0.83
sat	0.88	0.91
unitol	0.82	0.88
www	0.90	0.93
Emt	0.94	0.96
abs	0.87	0.90
acom	0.88	0.91
cmft	0.90	0.86
conc	0.89	0.90
int	0.93	0.94
per	0.91	0.91
sig	0.88	0.90
twe	0.93	0.94
twt	0.91	0.93
util	0.93	0.94

Note: bnft stands for benefit. Eml = email, homtol = home tool, sat = satisfaction, unitol = university tool, Emt = emerging technology skills, abs = absorption, acom = accommodation, cmft = comfort, conc = concern, int = integration, per = perception, sig = significance, twt = teaching with technology, twe = teaching with emerging technology, util = utility

4.3.1.3 Construct validity

Convergent and discriminant validity are required for construct validity to be verified analytically with PLS SEM.

4.3.1.3.1 Convergent validity

The level of agreement between different efforts to measure the same notion is known as "convergent validity". If two or more measurements of the same object are accurate gauges of the notion, then there should be a significant correlation between them

(Bagozzi et al., 1991). According to Fornell and Larcker (1981), to evaluate the underlying construct, items converge when the AVE value is above or equivalent to 0.50 and convergent validity is proven. Based on AVE statistics, the findings of the current study's convergent validity analysis reveal that all of the values were greater than 0.50. Convergent validity is thus not a problem. The measurement for all of the components is displayed (Table 4.15).

Table 4.15

Average Variance Extracted (AVE)

Indicator	Average Variance Extracted (AVE)
Integration	0.65
bnft	0.74
eml	0.74
homtol	0.62
sat	0.67
unitol	0.65
www	0.72
Emt	0.78
abs	0.65
acom	0.68
cmft	0.57
conc	0.61
int	0.77
per	0.67
sig	0.65
twe	0.65
twt	0.73
util	0.66

Note: bnft stands for benefit. Eml = email, homtol = home tool, sat = satisfaction, unitol = university tool, Emt = emerging technology skills, abs = absorption, acom = accommodation, cmft = comfort, conc = concern, int = integration, per = perception, sig = significance, twt = teaching with technology, twe = teaching with emerging technology, util = utility

4.3.1.3.2 Discriminant Validity

Bagozzi et al. (1991) posit that the points at which measurements of various ideas are distinctive are known as discriminant validity. The principle is that legitimate measures of each concept shouldn't strongly correlate with one another if they are unique

(Bagozzi et al., 1991). The Fornell and Larcker criterion, cross loadings, and heterotrait-monotrait ratio were used for the determination of discriminant validity.

Fornell and Larcker Criterion

When the square root of AVE for a concept is larger than its correlation with all other constructs, Fornell and Larcker (1981) claim that the criteria of discriminant validity for that construct has been established. This study revealed that a construct's square root of AVE (in bold and italic) was stronger than its connection with other constructs (Table 4.16). Hence, this offers substantial evidence in favour of the discriminant's validity.

Table 4.16

Discriminant validity_Fornell and Larcker

	INTEG	bnft	eml	homtol	sat	unitol	www	Emt	abs	acom	cmft	conc	int	per	sig	twe	twt	util
INTEG	***0.81***																	
bnft	-0.12	***0.86***																
emaill	0.24	0.05	***0.86***															
homtol	0.12	0.10	0.11	***0.79***														
sat	-0.06	0.09	0.05	0.02	***0.82***													
unitol	0.25	0.05	0.08	0.09	0.00	***0.80***												
www	0.26	0.09	0.51	0.13	0.03	0.13	***0.85***											
Emt	0.35	-0.09	0.61	0.13	0.00	0.20	0.57	***0.88***										
abs	0.18	0.24	0.35	0.11	0.13	0.08	0.36	0.16	***0.81***									
acom	0.28	-0.10	0.25	-0.01	-0.09	-0.04	0.22	0.23	0.03	***0.83***								
cmft	0.10	0.13	0.14	0.10	-0.07	0.04	0.18	0.12	0.04	0.39	***0.75***							
conc	0.07	-0.09	-0.13	-0.01	-0.16	0.11	-0.13	-0.11	-0.06	0.21	0.13	***0.78***						
int	0.36	0.01	0.47	0.07	0.01	0.21	0.46	0.64	0.19	0.19	0.09	-0.03	***0.88***					
per	0.06	0.04	0.05	-0.04	0.07	0.04	0.01	-0.02	-0.02	0.08	0.03	-0.04	-0.05	***0.82***				
sig	0.20	0.20	0.54	0.02	0.05	0.10	0.45	0.49	0.36	0.08	0.04	-0.20	0.38	0.06	***0.81***			
twe	0.28	0.14	0.44	0.17	0.01	0.12	0.46	0.50	0.29	0.31	0.23	-0.05	0.32	0.04	0.39	***0.81***		
twt	0.39	0.07	0.51	0.18	0.02	0.14	0.54	0.53	0.32	0.23	0.17	-0.07	0.46	0.01	0.43	0.55	***0.85***	
util	0.14	0.40	0.36	0.10	0.17	0.18	0.36	0.24	0.40	0.08	0.20	-0.12	0.22	0.07	0.47	0.32	0.31	***0.81***

Note: Bold and Italic represents the square root of AVE.

Cross loadings

Cross-loadings allow researchers to determine if an item greatly influences its own parent construct rather than other constructs under examination. The outcome (Table 4.17) shows that each item's factor loading is stronger on the study's underlying construct than on any other construct, rather than vice versa (Wasko & Faraj, 2005). Therefore, discriminant validity is achieved on the basis of the examination of cross-loadings.

Table 4.17

Discriminant validity_ Cross Loadings

	INTEG	bnft	eml	homtol	sat	unitol	www	Emt	abs	acm	cmft	conc	int	per	sig	twe	twt	util
Level	0.76	-0.05	0.19	0.22	-0.03	0.20	0.19	0.24	0.16	0.17	0.09	0.04	0.24	0.05	0.13	0.17	0.23	0.07
Stages	0.80	-0.09	0.25	0.02	0.00	0.17	0.26	0.31	0.17	0.21	0.02	0.05	0.26	0.03	0.18	0.25	0.30	0.15
ACOT	0.86	-0.13	0.16	0.07	-0.09	0.24	0.20	0.29	0.12	0.28	0.12	0.07	0.36	0.05	0.17	0.26	0.39	0.11
benfit1	-0.07	0.82	0.05	0.10	0.11	0.07	0.06	-0.09	0.30	-0.13	0.08	-0.05	0.03	0.06	0.25	0.16	0.06	0.35
benfit2	-0.13	0.86	0.04	0.02	0.08	0.03	0.06	0.00	0.12	-0.08	0.06	-0.11	0.18	0.05	0.22	0.12	0.07	0.32
benfit3	-0.11	0.89	0.02	0.05	0.01	0.07	0.05	-0.16	0.19	-0.09	0.17	-0.02	-0.05	0.04	0.13	0.00	0.01	0.34
benfit4	-0.09	0.89	0.09	0.14	0.12	-0.02	0.12	-0.07	0.23	-0.06	0.16	-0.15	-0.08	0.04	0.15	0.17	0.11	0.38
benfit5	-0.10	0.85	0.03	0.16	0.09	0.07	0.13	-0.09	0.26	-0.09	0.08	-0.04	-0.10	-0.03	0.15	0.15	0.06	0.36
email1	0.16	0.05	0.83	0.07	-0.01	-0.03	0.45	0.55	0.28	0.25	0.11	-0.11	0.38	0.04	0.47	0.40	0.45	0.29
email2	0.20	0.06	0.87	0.11	0.01	0.09	0.49	0.55	0.27	0.18	0.08	-0.10	0.36	0.04	0.51	0.34	0.47	0.30
email3	0.24	0.05	0.85	0.13	0.01	0.09	0.39	0.51	0.30	0.20	0.16	-0.11	0.44	0.03	0.44	0.33	0.38	0.34
email4	0.22	0.06	0.88	0.08	0.09	0.10	0.47	0.55	0.38	0.25	0.17	-0.13	0.47	0.09	0.50	0.47	0.50	0.36
email5	0.19	-0.01	0.88	0.06	0.09	0.09	0.41	0.48	0.28	0.20	0.07	-0.10	0.38	0.02	0.39	0.36	0.43	0.25
h/sH	0.11	0.02	0.09	0.82	0.07	0.11	0.17	0.15	0.12	0.00	0.01	-0.01	0.11	-0.08	-0.01	0.13	0.19	0.08
net-H	0.06	0.08	0.02	0.78	-0.03	0.04	0.03	0.06	0.05	-0.06	0.04	0.01	-0.04	0.01	0.04	0.10	0.09	0.02
ActC	0.10	0.15	0.11	0.76	-0.02	0.05	0.08	0.08	0.06	0.01	0.18	-0.01	0.05	0.00	0.03	0.16	0.12	0.10
st1	-0.04	0.11	0.04	0.03	0.84	-0.05	0.09	-0.01	0.15	-0.07	-0.12	-0.13	0.03	0.05	0.06	0.02	0.08	0.20
st2	-0.04	0.10	0.05	-0.03	0.78	0.02	0.07	0.03	0.19	-0.05	-0.07	-0.08	0.03	0.08	0.03	0.05	0.05	0.14
st3	-0.05	0.11	0.07	0.02	0.80	0.00	0.07	0.00	0.19	-0.05	-0.06	-0.11	0.06	0.07	0.10	0.04	0.01	0.16
st4	-0.06	0.04	0.00	0.04	0.82	0.01	-0.05	-0.04	0.02	-0.09	-0.02	-0.14	-0.03	0.04	0.00	-0.03	-0.01	0.12
st5	-0.05	0.03	0.04	0.02	0.84	0.02	-0.02	0.01	0.03	-0.09	-0.05	-0.17	-0.01	0.06	0.02	-0.01	-0.02	0.11
net-U	0.26	0.01	0.05	0.04	0.04	0.84	0.09	0.18	0.07	-0.07	-0.01	0.05	0.18	0.07	0.08	0.05	0.09	0.09
h/s-U	0.14	0.19	0.04	0.06	0.00	0.78	0.08	0.10	0.00	-0.02	0.13	0.10	0.14	0.00	0.08	0.14	0.16	0.18
suport-U	0.18	0.02	0.07	0.14	0.01	0.83	0.14	0.20	0.05	-0.02	-0.03	0.11	0.16	0.06	0.10	0.10	0.12	0.20
Techsup	0.20	-0.01	0.10	0.06	-0.06	0.76	0.09	0.13	0.11	-0.02	0.07	0.10	0.19	-0.01	0.06	0.12	0.11	0.16
www1	0.21	0.07	0.52	0.11	0.07	0.03	0.86	0.50	0.37	0.20	0.15	-0.13	0.35	0.04	0.42	0.42	0.50	0.30
www2	0.19	0.05	0.55	0.15	0.07	0.03	0.86	0.55	0.33	0.21	0.15	-0.15	0.42	0.02	0.48	0.46	0.49	0.35
www3	0.17	0.15	0.27	0.09	-0.02	0.23	0.73	0.38	0.13	0.11	0.11	-0.11	0.28	-0.02	0.25	0.31	0.35	0.18
www4	0.24	0.03	0.45	0.07	0.00	0.09	0.88	0.51	0.34	0.22	0.18	-0.08	0.46	0.02	0.39	0.41	0.50	0.29
www5	0.28	0.11	0.40	0.14	0.01	0.16	0.90	0.49	0.31	0.19	0.17	-0.10	0.41	-0.01	0.37	0.37	0.46	0.35
Emtech1	0.26	-0.03	0.52	0.15	0.03	0.16	0.45	0.86	0.14	0.20	0.13	-0.06	0.53	-0.01	0.42	0.46	0.44	0.15
Emtech2	0.32	-0.13	0.55	0.13	0.02	0.21	0.52	0.90	0.16	0.15	0.07	-0.08	0.55	-0.04	0.43	0.49	0.53	0.20

Emtech3	0.38	-0.07	0.56	0.13	0.02	0.17	0.54	0.91	0.18	0.21	0.08	-0.12	0.56	-0.02	0.46	0.44	0.51	0.19
Emtech4	0.29	-0.11	0.52	0.08	-0.07	0.19	0.46	0.87	0.07	0.19	0.10	-0.05	0.59	-0.01	0.42	0.41	0.41	0.22
Emtech5	0.29	-0.06	0.59	0.12	-0.03	0.18	0.55	0.92	0.13	0.22	0.12	-0.14	0.60	-0.01	0.47	0.43	0.46	0.27
Emtech6	0.27	-0.06	0.48	0.07	0.00	0.15	0.51	0.85	0.14	0.25	0.18	-0.11	0.55	-0.01	0.38	0.39	0.45	0.25
absorp1	0.08	0.23	0.24	0.03	0.10	0.06	0.27	0.08	0.77	-0.01	0.05	0.01	0.13	-0.06	0.29	0.29	0.26	0.37
absorp2	0.14	0.15	0.29	0.03	0.17	0.04	0.30	0.15	0.81	0.07	0.01	-0.04	0.16	-0.02	0.27	0.20	0.23	0.35
absorp3	0.18	0.20	0.29	0.11	0.10	0.11	0.32	0.18	0.83	0.01	0.04	-0.08	0.18	0.03	0.31	0.26	0.31	0.31
absorp4	0.12	0.22	0.23	0.11	0.06	0.07	0.26	0.11	0.80	-0.03	0.08	-0.06	0.17	-0.02	0.29	0.22	0.19	0.34
absorp5	0.16	0.21	0.36	0.12	0.10	0.03	0.28	0.09	0.82	0.05	0.00	-0.06	0.11	-0.03	0.30	0.23	0.27	0.29
accomd1	0.19	-0.13	0.16	-0.05	-0.03	-0.12	0.09	0.06	-0.06	0.75	0.26	0.13	0.04	0.07	-0.01	0.12	0.13	0.01
accomd2	0.18	-0.07	0.22	-0.03	-0.06	-0.02	0.22	0.19	0.14	0.83	0.35	0.17	0.11	0.09	0.19	0.24	0.19	0.16
accomd3	0.29	-0.07	0.17	-0.02	-0.12	-0.06	0.21	0.14	-0.01	0.90	0.34	0.20	0.12	0.07	0.01	0.26	0.17	0.04
accomd4	0.25	-0.07	0.20	0.00	-0.08	0.02	0.20	0.26	0.06	0.84	0.30	0.22	0.25	0.07	0.09	0.31	0.20	0.11
accomd5	0.22	-0.09	0.29	0.05	-0.06	-0.01	0.19	0.28	0.00	0.81	0.36	0.11	0.24	0.04	0.07	0.33	0.25	0.04
comfrt1	0.01	-0.05	0.09	0.04	-0.14	-0.05	0.03	0.08	-0.05	0.37	0.65	0.01	-0.02	0.09	-0.04	0.23	0.10	0.00
comfrt2	0.05	0.10	0.11	0.08	-0.06	0.02	0.13	0.11	-0.03	0.44	0.92	0.14	0.05	0.04	-0.04	0.23	0.12	0.10
comfrt3	0.05	0.10	0.24	0.04	-0.09	-0.01	0.20	0.17	-0.02	0.48	0.84	0.12	0.08	0.02	0.11	0.29	0.21	0.15
comfrt4	-0.06	-0.01	0.17	0.00	-0.05	-0.06	0.07	0.05	-0.06	0.49	0.53	0.12	-0.07	0.04	0.04	0.20	0.08	0.00
comfrt5	0.04	0.06	0.11	0.08	0.01	0.02	0.12	-0.01	0.12	0.37	0.77	0.15	-0.03	0.03	0.10	0.10	0.07	0.18
TWET1	0.23	0.15	0.35	0.13	-0.02	0.13	0.41	0.45	0.27	0.19	0.12	-0.01	0.27	-0.02	0.40	0.83	0.46	0.35
TWET2	0.26	0.10	0.28	0.13	-0.03	0.09	0.29	0.38	0.20	0.17	0.15	-0.05	0.17	0.06	0.29	0.81	0.39	0.23
TWET3	0.29	0.13	0.22	0.08	0.06	0.07	0.26	0.27	0.20	0.20	0.19	-0.06	0.24	0.01	0.25	0.76	0.39	0.22
TWET4	0.19	0.09	0.44	0.16	-0.02	0.08	0.45	0.53	0.25	0.29	0.15	-0.11	0.34	0.03	0.33	0.81	0.45	0.25
TWET5	0.23	0.05	0.40	0.13	-0.02	0.14	0.46	0.51	0.22	0.30	0.20	-0.03	0.33	0.04	0.32	0.87	0.50	0.26
TWET6	0.13	0.19	0.33	0.22	-0.01	0.05	0.38	0.28	0.22	0.26	0.18	-0.07	0.19	0.07	0.31	0.74	0.41	0.24
TWET7	0.18	0.08	0.47	0.14	0.04	0.10	0.47	0.44	0.32	0.28	0.17	-0.07	0.29	0.00	0.39	0.85	0.52	0.29
TWET8	0.24	0.13	0.42	0.19	0.08	0.11	0.35	0.36	0.22	0.35	0.29	0.03	0.24	0.09	0.28	0.80	0.46	0.24
TWT1	0.33	0.02	0.45	0.22	-0.04	0.21	0.40	0.52	0.23	0.17	0.16	-0.03	0.44	0.05	0.33	0.47	0.84	0.25
TWT2	0.28	0.14	0.44	0.11	-0.02	0.13	0.49	0.46	0.25	0.17	0.15	-0.05	0.38	0.07	0.39	0.52	0.84	0.26
TWT3	0.27	0.07	0.51	0.17	0.05	0.08	0.51	0.49	0.28	0.23	0.15	-0.10	0.35	0.01	0.39	0.50	0.89	0.26
TWT4	0.42	0.01	0.44	0.18	0.03	0.09	0.49	0.46	0.27	0.21	0.14	-0.09	0.42	-0.01	0.37	0.42	0.88	0.26
TWT5	0.32	0.09	0.36	0.08	0.06	0.09	0.45	0.34	0.33	0.18	0.11	-0.04	0.37	-0.07	0.36	0.47	0.82	0.29
concrn2	0.07	-0.09	-0.06	-0.03	-0.15	0.06	-0.10	-0.06	-0.03	0.20	0.17	0.86	0.01	-0.02	-0.15	-0.10	-0.07	-0.10
concrn4	-0.01	-0.11	-0.07	0.00	-0.13	-0.03	-0.12	-0.08	-0.17	0.13	0.13	0.66	-0.06	-0.05	-0.05	-0.13	-0.10	-0.13
concrn5	0.04	-0.11	-0.25	0.00	-0.17	0.09	-0.18	-0.14	-0.13	0.07	-0.04	0.75	-0.05	-0.12	-0.18	-0.08	-0.09	-0.15
concrn6	0.04	-0.04	-0.19	0.02	-0.17	0.08	-0.16	-0.13	-0.09	0.17	0.07	0.83	-0.03	-0.07	-0.16	-0.08	-0.12	-0.11
concrn7	0.06	-0.06	0.00	-0.01	-0.06	0.10	-0.04	-0.06	-0.01	0.20	0.16	0.82	-0.02	0.02	-0.13	0.05	0.02	-0.06
concrn8	0.01	-0.08	-0.14	0.03	-0.10	0.09	-0.14	-0.14	-0.10	0.18	0.10	0.74	-0.09	-0.05	-0.25	0.00	-0.11	-0.11
intg1	0.39	-0.03	0.46	0.07	-0.04	0.15	0.48	0.61	0.18	0.18	0.11	0.00	0.90	-0.05	0.39	0.30	0.46	0.18
intg2	0.31	0.01	0.33	0.08	0.01	0.22	0.31	0.44	0.16	0.15	0.06	0.01	0.84	-0.03	0.22	0.24	0.39	0.14
intg3	0.30	0.02	0.47	0.04	0.02	0.16	0.39	0.57	0.17	0.23	0.08	-0.04	0.92	-0.03	0.35	0.27	0.37	0.22
intg4	0.26	0.02	0.43	0.02	0.03	0.17	0.37	0.59	0.15	0.14	0.09	-0.05	0.87	-0.05	0.39	0.27	0.34	0.26
intg5	0.28	0.01	0.38	0.08	0.07	0.24	0.44	0.59	0.15	0.14	0.05	-0.04	0.85	-0.05	0.32	0.31	0.45	0.20
percp1	0.03	0.01	0.02	-0.06	0.08	-0.08	-0.03	-0.05	-0.04	0.08	-0.02	-0.10	-0.05	0.77	0.03	0.00	-0.02	0.04
percp2	0.04	-0.01	0.05	-0.03	0.05	0.03	-0.01	-0.02	-0.03	0.07	0.04	0.00	-0.03	0.89	0.01	0.02	-0.02	0.03
percp3	0.05	0.08	0.04	-0.03	0.06	0.12	0.03	0.00	0.01	0.05	0.03	-0.03	-0.06	0.91	0.10	0.05	0.03	0.11
percp4	-0.02	0.06	-0.02	-0.04	0.05	0.09	-0.04	-0.05	-0.01	0.01	0.00	-0.05	-0.09	0.74	0.08	-0.04	-0.03	0.08
percp5	0.00	0.06	-0.02	-0.03	0.05	0.07	-0.01	-0.04	-0.06	0.05	0.02	-0.03	-0.06	0.77	0.06	-0.01	-0.01	0.04
signif1	0.25	0.18	0.46	0.07	0.06	0.10	0.37	0.38	0.32	0.03	0.09	-0.15	0.27	0.05	0.88	0.43	0.44	0.42
signif2	0.12	0.11	0.39	0.02	0.09	0.08	0.36	0.40	0.29	0.09	0.03	-0.19	0.35	0.11	0.81	0.32	0.36	0.37
signif3	0.13	0.17	0.47	0.03	-0.01	0.05	0.41	0.45	0.37	0.10	-0.02	-0.18	0.38	0.01	0.82	0.29	0.33	0.37
signif4	0.08	0.14	0.39	-0.05	-0.03	0.08	0.31	0.40	0.15	0.05	-0.04	-0.14	0.33	0.04	0.79	0.22	0.24	0.35
signif5	0.11	0.22	0.43	-0.09	0.04	0.09	0.38	0.40	0.27	0.09	0.03	-0.15	0.29	0.05	0.74	0.19	0.24	0.36
utility1	0.03	0.40	0.18	0.14	0.15	0.14	0.28	0.10	0.41	-0.01	0.22	-0.11	0.08	0.07	0.33	0.17	0.14	0.76
utility2	0.14	0.37	0.33	0.08	0.08	0.20	0.35	0.21	0.41	0.07	0.15	-0.10	0.18	0.08	0.40	0.26	0.23	0.88
utility3	0.14	0.30	0.39	0.07	0.17	0.18	0.36	0.29	0.35	0.13	0.18	-0.15	0.28	0.06	0.41	0.33	0.33	0.87
utility4	0.06	0.38	0.28	0.11	0.17	0.15	0.24	0.15	0.31	0.02	0.23	-0.12	0.13	0.04	0.36	0.24	0.26	0.86
utility5	0.00	0.41	0.14	-0.02	0.06	0.11	0.22	0.06	0.26	-0.02	0.14	-0.14	0.13	0.06	0.29	0.27	0.19	0.69
utility6	0.15	0.26	0.31	0.09	0.14	0.12	0.26	0.21	0.28	0.07	0.14	-0.08	0.17	0.06	0.41	0.26	0.28	0.83
utility7	0.06	0.42	0.24	0.07	0.20	0.10	0.26	0.16	0.32	0.03	0.14	-0.13	0.16	0.02	0.38	0.29	0.23	0.82
utility8	0.05	0.40	0.19	0.05	0.18	0.12	0.26	0.12	0.29	0.07	0.17	0.01	0.18	0.08	0.37	0.21	0.20	0.76

Heterotrait-Monotrait ratio (HTMT)

The heterotrait-monotrait ratio is founded on an estimate of the relationship between the components. The HTMT ratio is used to verify discriminant validity. However, the threshold for HTMT has been debated in the existing literature. Different cut-off values are given by different authors, for example, 0.85 or below by Kline (2011) whereas 0.90 by Teo et al. (2008), which is quite liberal. The results of Table 4.18 show that the HTMT ratio for this study is below the necessary level of 0.90.

Table 4.18

Discriminant Validity_ HTMT Ratio

	INTEG	bnft	eml	homtol	sat	unitol	www	Emt	abs	acom	cmft	conc	int	per	sig	twe	twt	util
INTEG																		
bnft	0.13																	
eml	0.29	0.07																
homtol	0.21	0.16	0.12															
sat	0.08	0.12	0.07	0.07														
unitol	0.31	0.11	0.11	0.12	0.06													
www	0.32	0.11	0.57	0.15	0.09	0.16												
Emt	0.41	0.11	0.66	0.14	0.05	0.22	0.62											
abs	0.22	0.29	0.38	0.13	0.16	0.10	0.39	0.17										
acom	0.33	0.12	0.28	0.08	0.10	0.08	0.24	0.25	0.09									
cmft	0.09	0.10	0.19	0.10	0.10	0.07	0.15	0.11	0.08	0.57								
conc	0.06	0.11	0.17	0.07	0.18	0.12	0.18	0.14	0.13	0.22	0.17							
int	0.41	0.11	0.51	0.10	0.06	0.24	0.49	0.68	0.20	0.20	0.06	0.07						
per	0.05	0.07	0.04	0.06	0.08	0.11	0.04	0.04	0.06	0.08	0.06	0.09	0.07					
sig	0.21	0.22	0.59	0.08	0.08	0.12	0.50	0.54	0.39	0.12	0.10	0.22	0.44	0.09				
twe	0.32	0.17	0.49	0.22	0.06	0.15	0.52	0.53	0.33	0.34	0.27	0.11	0.35	0.05	0.40			
twt	0.45	0.10	0.57	0.21	0.07	0.17	0.60	0.57	0.35	0.25	0.16	0.12	0.49	0.06	0.45	0.61		
util	0.12	0.49	0.33	0.11	0.20	0.21	0.36	0.21	0.46	0.09	0.13	0.16	0.22	0.08	0.49	0.33	0.31	

4.3.2 Validating Higher Order Construct (Reflective- Reflective)

These higher-order constructs have also been confirmed as part of the evaluation of the measurement model. The convergent validity and reliability of all these constructs were evaluated. In addition, following the advice of Sarstedt et al. (2019), the higher- order items in the research were examined for discriminant validity with additional lower-order constructs. The results for the higher-order constructs' reliability and validity demonstrated that both were established. The reliability value is greater than 0.70 and the AVE is greater than 0.50, respectively, establishing the reliability and convergent validity for additional constructs, except for the constructs of *tool* and *will* for which Cronbach's alpha and CR values are lower than 0.7 and the value of average variance extracted (AVE) is also less than 0.50 (Table 4.19). Furthermore, discriminant validity between the higher-order construct and the lower-order construct is established, in addition to reliability and validity assessments. The square root of the construct's AVE is greater than its correlation with all other constructs, according to the results of Farnell and Larcker's (1981) criterion, while HTMT is also less than 0.90.

Larcker's (1981) criteria show that the square root of AVE of the construct is higher than its correlation with all other constructs (Table 4.20), whereas HTMT is also lower than 0.90 (Table 4.21). The discriminant validity Farnell and Larcker criteria for the construct "will" is not established partially (Table 4.20), whereas it is established through HTMT ratio criteria (Table 4.21).

Table 4.19

Higher Oder Construct Reliability and Convergent Validity

Construct	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
pedagogy	0.70	0.87	0.77
skill	0.82	0.88	0.65
integration	0.73	0.85	0.65
tool	0.16	0.68	0.53
will	0.47	0.55	0.18

Table 4.20

Fornell and Larcker (1981) Criterion_ Higher Order Discriminant Validity

	pedagogy	skill	integration	tool	will
pedagogy	***0.87***				
skill	0.65	***0.81***			
integration	0.38	0.37	**0.81**		
tool	0.21	0.23	0.27	**0.73**	
will	0.53	0.53	0.36	0.10	***0.42***

Table 4.21

HTMT_ Higher Order Discriminant Validity

	pedagogy	skill	integration	tool	will
pedagogy					
skill	0.86				
integration	0.51	0.47			
tool	0.69	0.60	0.73		
will	0.67	0.63	0.39	0.56	

Hypotheses Testing

H1: There is a direct positive effect of will on technology integration.

H1 evaluates whether *will* has a significant impact on integration. The results reveal that *will* has a significant impact on technology integration ($\beta = 0.22$, $t = 3.00$, $p < .05$). Hence, H1 is supported (Table 4.22).

H2: There is a direct positive effect of skill on technology integration.

H2 evaluates that *skill* as having a significant impact on technology integration. The results reveal that *skill* has a significant impact on technology integration ($\beta = 0.12$, $t = 2.08$, $p < .05$). Therefore, H2 is supported (Table 4.22).

H3: There is a direct positive effect of tool on technology integration.

H3 evaluates that *tool* has a significant impact on technology integration. The results reveal that the *tool* has a significant impact on technology integration ($\beta = 0.18$, $t = 3.89$, $p < .05$) and consequently H3 is sustained (Table 4.22).

H4: There is a direct positive effect of pedagogy on technology integration.

H4 concludes that *pedagogy* has a significant impact on technology integration. The results reveal that *pedagogy* has a significant impact on technology integration ($\beta = 0.15$, $t = 2.05$, $p < .05$). Hence, H4 is supported (Table 4.22).

Table 4.22

Direct Relationship Results

	Sample mean (M)	Standard deviation (STDEV)	T statistics	P values	2.5%	97.5%
pedagogy -> integration	0.153	0.07	2.05	.04	-0.001	0.305
skill -> integration	0.122	.06	2.08	.03	0.006	0.241
tool -> integration	0.188	.04	3.89	.00	0.094	0.283
will -> integration	0.225	.06	3.01	.00	0.098	0.349

The study's 5000 resample also generated 95.5% confidence intervals, as shown in Table 4.22. A confidence interval different from zero shows a significant relationship.

R Square Value

R squared explains the variance in the endogenous variable explained by the exogenous variables. The R square value shows that *will, skill, tool,* and *pedagogy* can produce a 23 % change in technology integration, which is nearly substantial (Table 4.24). Cohen (1988) offered the following R^2 values for the endogenous latent variable: 0.26 (substantial), 0.13 (moderate), and 0.02 (weak). The change in R square is calculated if a specific exogenous variable is left out of the model in order to more accurately measure the explanatory power of each exogenous variable in the model. This measurement's effect size is calculated as F squared (f^2). The effects of every exogenous variable on the endogenous variable are measured by the effect size. When an independent variable in a PLS path model is eliminated, it is determined if the deleted independent variable had a significant impact on the value of the dependent variable by measuring the variance in squared correlation values. Cohen (1988) suggests that if f-square is 0.35, the influence of the independent variable at the structural level is large; if f-square is 0.15, it is medium; and if f-square is 0.02, it is negligible. The model's effect size demonstrates the contribution of each external latent variable to the endogenous latent variable's R squared. In other words, effect size assesses how strongly the latent variables are related. Table (4.23) reveals the f-sq effect size as negligible from 0 to .04. Finally, the Q-square value for the endogenous construct was over 0, and predictive relevance was established. Q square values of 0.02 are considered weak, 0.15 as moderate, and 0.35 as strong predictive relevance (Hair et al., 2013). A moderate predictive relevance was established for the model (Table 4.23).

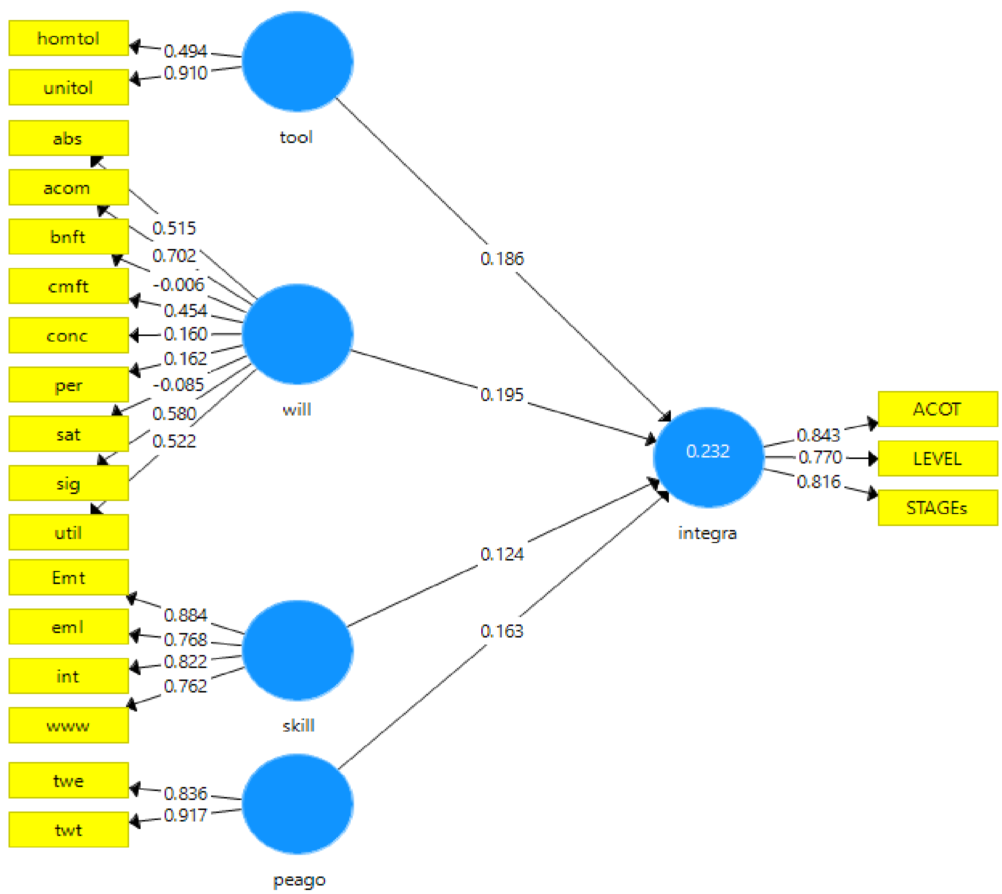
Table 4.23

The Explanatory Power

Predictors	Outcome	R square	F square	Q square
	Integration	0.23	0.00	0.19
Pedagogy		0.16	0.02	
Skill		0.12	0.01	
Tool		0.18	0.04	
Will		0.19	0.03	

Figure 4.6

Structural Equation Modeling



Objective 5: To explore the barriers and challenges faced by the faculty for the adoption of Web 2.0 technologies at the higher education level.

Q5: What challenges hindered the integration of Web 2.0 technologies at the higher education level?

Table 4.24

Frequency Percentage and Mean Values of the Barriers (N = 340)

Barrier	Not at all	Rarely	Sometimes	Often	Always	Mean (SD)
Required level of knowledge	8(2.4%)	44(13%)	64(19%)	197(58%)	27(8%)	3.56(.89)
Poor quality of internet	6(1.8%)	52(15.3%)	78(23%)	156(46%)	48(14.1%)	3.55(.97)
Unspecified evaluation strategies	4(1.2%)	47(14%)	84(25%)	182(53.5%)	23(6.8%)	3.51(.85)
Electricity issues	8(2.4%)	25(7.4%)	58(17.1%)	177(52.1%)	72(21.2%)	3.82(.92)
Lack of capacity or willingness	20(6%)	70(20.6%)	76(22.4%)	146(43%)	28(8.2%)	3.27(1.06)
Focus on technology than content	9(3%)	30(9%)	71(21%)	204(60%)	26(8%)	3.61(.85)

The respondents were asked about the barriers they faced during this online instructional period of the pandemic. 58% agreed that the required level of knowledge was often a barrier, while 2.4% strongly disagreed with the statement. Poor quality of internet was a problem for 46% of the respondents, whereas nearly 2% denied it. Unspecified evaluation strategies were a barrier, according to 53.5% of respondents, whereas 1.2% strongly disagreed with the statement. 52% of faculty members agreed that electricity issues posed a barrier during online instruction. 2.4% strongly disagreed with it. 43% of respondents agreed that a lack of capacity or willingness to change often poses a problem, while 6% strongly disagreed with the statement. 60% of faculty agreed with the statement that the focus was on technical aspects of the technology than content often posed a problem, whereas 3% strongly denied it (Table 4.24).

In the column of mean and standard deviation (Table 4.24), it can be seen that the highest mean was for the barrier of electricity issues (M = 3.82, SD =.92), whereas the lack of capacity or willingness to change got the lowest mean (M = 3.27, SD = 1.06).

Section II- Qualitative Analysis

A useful research method for extracting knowledge and comprehension from written or visually appealing information is qualitative analysis. It entails the methodical analysis and interpretation of data using a range of techniques, including document analysis, focus group interviews, content analysis, and thematic analysis. With the aid of these techniques, researchers can better comprehend their research topic by recognizing trends, themes, and interpretations in qualitative data.

4.4 Analysis of Open-Ended Questions

Research Question 5: What barriers and challenges hindered the faculty's integration of Web 2.0 technologies at the higher education level?

Q: 1 Major Problem and Challenges Faced by Faculty

The question was about the opinion of faculty related to the major problems and challenges being faced by them regarding Web 2.0 integration into instruction. Only 120 out of 340 respondents submitted their answers. Hence, the total response rate for the second open- ended question was 35%. The answers were analyzed and themes were generated as shown in Table 4.25. The themes were as follows:

Scarcity of Resources/infrastructure

17% of the respondents said that resources or proper infrastructure was the major problem and a big challenge, as one respondent said, "ICT literacy, and the availability of resources were the major challenges." In the view of another respondent, "new infrastructure must be installed." According to one respondent, "a limited number of online classroom licenses are available." "Infrastructure, opportunities, resources, and a lower developmental rate in all areas" were reported by respondents.

Internet Issues

Around 28% of the respondents reported internet connectivity as a major problem. One of the respondents said, "The slow speed of computers on the internet and the poor working conditions of computers are the major problems."

Electricity Issues

4% of them reported electricity issues as the major problem. "Students' connectivity, and load shedding minimized their participation of students," reported a respondent. One respondent said, "Electricity failure, deficiency of tech training, and laptop accessibility were key issues." For the teachers at the university the major problem is to interact with each student individually and solve the connectivity issues," said a faculty member.

Lack of Training

According to 13% of the respondents, lack of training was a major issue, as one respondent said, "Deficiency of interest and training, not having technical maintenance at work, the interest of individuals is a powerful factor in this regard, and teachers are not ready to take responsibility for doing it on their own." "Most teachers never used computers in their lives before the pandemic." "It was really hard for them to start at zero without any training or help," reported another respondent.

Unwillingness to Change

7% of the respondents reported that some people were unwilling to change; in the words of one of the respondents, teachers were "not willing to develop with the time and requirements." "The teacher's find it hard to adapt to the use of Web 2.0." "The students are not serious while studying through ICT or Web 2.0," said a respondent. The unwillingness was also on the part of the students, as a respondent reported that "the unwillingness of students to take classes seriously was a great issue."

Student behavior that is not serious

Some 12% considered the student behavior that is not serious during online classes a challenge. "Students' internet connectivity and lack of concentration by students" were the major issues, in the words of another faculty member. A faculty member said, "Some of the major challenges are maintaining students' attention in the class and subject owing to the many available distractions in online classes, along with maintaining transparency in education."

Unreliable evaluation

3% of the respondents considered the unreliable evaluation system a major issue. "There is also no fair mechanism of student evaluation apart from visas," said a respondent. "Exam quality issue," "fair assessment" and "assessment system not validated" was some of the responses in this regard.

Lack of Funds

5% of them said that the lack of funds at the Institutions of higher learning was among the major issues. In the words of one respondent, "the universities were reluctant to spend on the adoption of a new mode of learning." One respondent proposed that "more IT resources be provided plus Zoom Pro IDs for classes to be conducted for more than 40 minutes." It was also reported in the manner of "not enough rooms, not enough support from university organizations."

Table 4.25

Major Problems and Challenges Faced by Faculty

Themes	Percentage	Example
Scarcity of resources/infrastructure	17%	Lack of ICT knowledge, electricity and Internet connectivity problems are main challenges.
Internet connectivity	28%	Slow speed of computer, signal problem of internet, poor working condition of computer
Electricity	4%	Electricity, internet connectivity, less training sessions for teachers.
lack of training	13%	Training sessions should be arranged, and the quality of web tools should be improved.
lack of willingness to change	7%	People feel uncomfortable with technology as compared to the old means and are not willing to adopt.
non serious behavior of students	12%	students lose concentration towards online lectures
unreliable evaluation system	3%	Exams and evaluation were the major issues.
lack of funds	5%	the universities were reluctant to spend on adoption of new mode of teaching
remote area problems	3%	Some students from rural areas and small cities face connectivity and electricity issues.
lab work	3%	Lab conductance should be done physically.
distorted student teacher relation	2%	Distorted relationship between teacher and students.
Miscellaneous	4%	difficult to satisfy students in PowerPoint
Total	100%	

Students living in Rural Areas

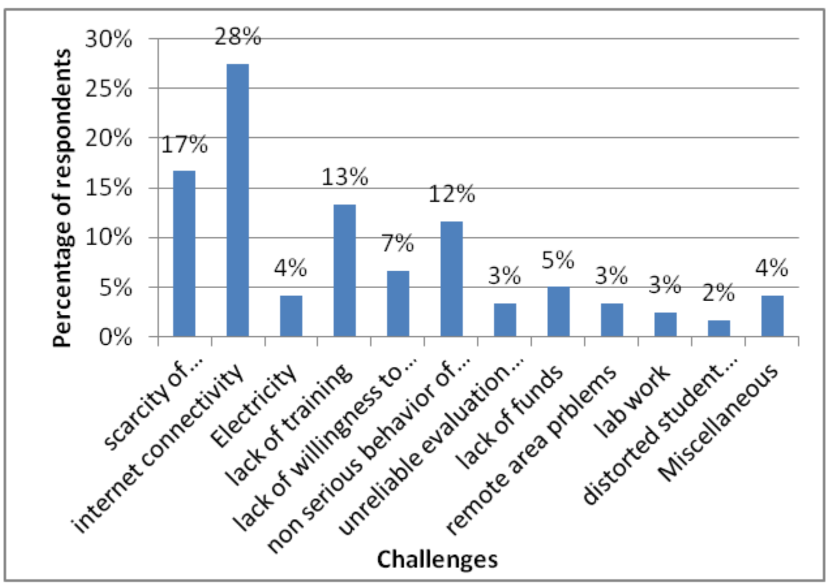
According to 3% of the issues, the students living in rural areas or small cities faced issues related to net connectivity and electricity, and this made them deprived of taking online classes. In the words of one respondent, “internet connectivity, and far-flung electricity problems affected teacher-student interaction and capacity building.”

Practical Work

3% of respondents reported that it was impossible to conduct lab work during the pandemic, and it remained an issue.

Figure 4.7

Challenges faced by the faculty during pandemic



Distorted Student Teacher Relations

2% of the respondents considered that the type of association for communication between student and teacher was a major issue during the pandemic.

Multiple

4% of the teachers gave multiple answers related to the challenges during online pandemic instruction. According to one respondent, “it was difficult to satisfy the students with PowerPoint presentations.” One respondent reported that “lack of control mechanisms” was an issue. According to another respondent, “the indecisive behavior of the HEC and administrator” posed a problem. Table (4.25) shows the main themes, and Figure (4.7) shows the graphical representation of the major issues faced by the faculty during instruction.

Q3- Measures to improve the integration of Web 2.0 into instruction at higher education level.

A question was asked to suggest some measures to improve the incorporation of Web 2.0 in education at institutions of higher learning; only 98 out of 340 respondents showed their response to this question. Therefore, the response rate to this question was only 29%. The responses of the respondents were analyzed and themes were made as shown in Table 4.26. The themes were discussed as follows:

Training workshops

It was suggested by 39% of the teaching faculty that the professional development and training of the faculty to use the technology should be arranged. A respondent said, “Arranging teaching and learning workshops related to educational technology.” Another respondent reported that “proper training programs for students and teachers” should be arranged. “Training and webinars should be conducted to have a better understanding for teachers,” suggested a faculty member.

Accountability of teacher

The second theme was about the establishment of a regular accountability mechanism according to 5% of the faculty members; as a respondent suggested, "Regular evaluation of teachers' classroom students' performance can make both ends think seriously about virtual systems." According to another respondent, "regular evaluation, and feedback" as well as a "well-defined follow-up system for the whole process" were necessary. A faculty member, while making suggestions for improving technology integration in higher education, asserted, "A proper check and balance mechanism should be there."

Proper assessment of students

7% faculty members suggested, "Online evaluations must be improved," along with "the presence of students must be assured, and assessment needs more transparency." In the view of another faculty member, "assessment criteria need to be clear because oral assessment is not appropriate."

Introduction of advanced LMS

The introduction of advanced learning management system (LMS) was another theme created by the answers of 4% of the respondents. A respondent suggested, "Link Avicenna to LMS because faculty feel difficulty entering marks in two systems."

Improved internet quality

"High-quality internet and trained instructors" were another theme created by the answers of 17% of the respondents. One respondent suggested "providing good internet packages for students and university faculty." In their view, a "strong network" was the necessity of the time. The respondents felt the need for high speed and improved quality of internet for students living in far-flung areas, as they said, "The internet speed should be improved with proper provision of hardware and software especially for remote area students."

Technical support

11% of the respondents were of the view that technical support ought to be made available to both scholars and teachers while working with technology.

Table 4.26

Any Other Aspect

Themes	Percentage	Example
Training workshops	39%	Workshops and hands-on training may help in supporting the system.
Accountability of teachers	5%	Proper check and balance mechanism should be there.
Proper assessment of students	7%	Assessment criteria need to be clear because oral assessment is not appropriate.
Introduction of advanced LMS	4%	Proper established system of LMS, regular training workshops to teachers and students
Improved internet quality	17%	Provide good internet packages for students and university faculty
Technical support	11%	Latest technical support is necessary.
Motivation of students	4%	Students should be motivated about studies that are important even during the lockdown phase
Gadgets availability	9%	Regular training, provision of tools i.e., laptop, internet, software.
Peaceful home environment	2%	Proper internet, electricity, peaceful environment at home, web 2.0 can be improved.
Miscellaneous	2%	Strict plagiarism and attendance policies should be adopted.
Total	100%	

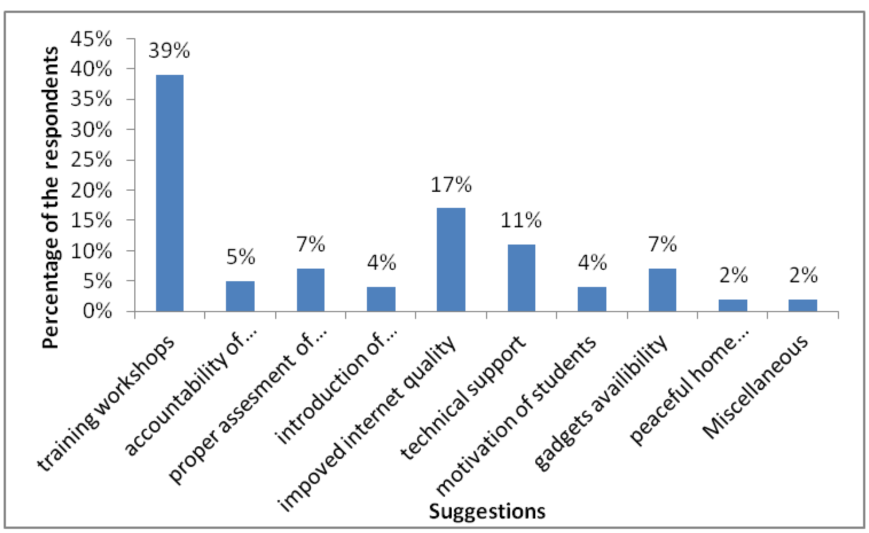
While using the technology for the first time, in some cases the respondents said, “The latest technical support is necessary.” The need for technical support was felt not only by the teachers but also by the students at the same time. One respondent suggested, “The IT section can give training to students as well as teachers.”

Motivation of students

While the pandemic situation has its effects on all parts of life, it seems that it has also affected the motivation of students in the field of education. 4% of respondents reported facing difficulty in the teaching process because of the low motivation of the students when said, “There is a lack of interest in both teachers and students to adopt those services and we need some training motivation to accept this reality of digital transformation.” Some felt that the instructors' level of motivation as well required some boost through seminars and workshops at the institution level. A respondent said, “Teachers should be motivated through seminars to see that Web 2.0 is a resource rather than a crutch.”

Figure 4.8

Suggestions for improvement



Peaceful home environment

During the pandemic, most people worked from home, and this caused many problems like not having a proper background or noise problems. The need for a peaceful home environment was felt by 2% of the respondents. One respondent said, "With proper internet, electricity, and a peaceful environment at home, Web 2.0 integration can be improved."

Miscellaneous

2% of the faculty members gave multiple answers, like one that suggested, "Strict plagiarism and attendance policies should be adopted." Another respondent suggested, "Security threats should be minimized, and teachers as well as students should be given training in this regard." One respondent suggested reducing the screen time because, in his words, "staring at the screen all the time is not good for the eyes." One suggested that arrangements be made in such a way that "students may not open other browsers during class time." A respondent said, "We need to train our students to use ICT for learning better, honestly, and efficiently," and "we should try to engage students through interesting activities."

4.5 Thematic Analysis

There were seven respondents to the semi-structured interviews. The respondents belonged to different public-sector universities. Out of seven respondents, one belonged to the faculty of sciences, two were from management sciences, and four were from the faculty of social sciences.

Table 4.27

Qualitative Analysis (N = 7)

Themes	Categories	Codes	Occurrence
Technology integration	Level	initial stage	1
		above medium	3
		medium	3
	Priority	will	3
		tools	1
		skills	2
		pedagogy	2
Will	Feelings	Positive	3
		Negative	1
		Mixed feelings	3
	Support	Yes	4
		No	3
	Confidence	High level	6
		Low level	1
	Institutional role	No role	1
		Minimal role	4
		Training provided	2
Skill	technology skills	still room for learning	1
		Yes, I have skills	7
	institutional part in skill	not as such	4
		learned ourselves	3
		faculty WhatsApp groups	1
		training provided by QEC	1
		daily use compels us	1
	Need for skill enhancement	21st century skills need of the time	4
		global competition	1
		learning is lifelong process	2
Pedagogy	teaching method in the institution	blend of student and teacher centered	1
		mix of both, more conventional	3
		mostly student centered	2
		depends upon teacher	1
	instruction from institution	no	7
	right instructional method	blend of both, more student, less teacher-centered	5
		Learning-centered	1
Tools	technology availability	not enough	3
		enough	4
		better at home	3
		better at university	2
		equally good at home and university	2
	Technology used	Google Meet	5
		WhatsApp	3
		LMS	2
		Microsoft teams	2
		Zoom	2
		Microsoft Office, Word and Excell	2
		Ups studio, Cam 8 video lecture	1
		Movie maker, Editing software, YouTube	1

Here in the analysis, first the technology integration is discussed, and then the internal and external factors like *will, skill, pedagogy* and *tool* were discussed afterwards (Table 4.27). The challenges faced by the faculty in technology integration and the measures to improve have also been discussed (Table 4.28).

Question: 1

Level of technology integration

Technology integration refers to the process of incorporating computers, computer software, computer-led messages, and cyberspace into the design of educational programs and courses (Leonard, 2002). When asked about their perceptions related to the level of technology integration, three of them said that they were at medium level, three were above medium level, and one respondent considered it at the initial stage.

The higher grades were given to those who claimed to be "well prepared," “not frightened," and "ready to try." A lower grade was given by the one who considered herself “needing to learn more,” and “unable to understand technicalities behind.” The number of respondents who considered themselves at a medium level of technology integration and those who considered themselves above medium was equal, which shows there is still a need for training opportunities in order to produce more confident faculty.

Priority given to factors

When asked about choosing the most important aspect among *will, skill, tool,* and *pedagogy,* three of the respondents chose *will* as the most important aspect in technology integration because, in their view, “*Will is most important. In my personal experience, we didn't have support from institutions, but we have learned due to will power, interest, and* *passion." "It is different for different people; those who do not adopt technology very quickly lack willpower."* Whereas *skill* was selected by two respondents as, in their view, "*resources are available even for free to use; you must be skilled and know how to make them better."*

Pedagogy was chosen by two respondents as the most important for integrating technology, while *tool* was chosen by one respondent. This finding showed that the availability of *tool* was not a big problem for the faculty, and almost everybody had the basic hardware available. This result of *will* is also consistent with the quantitative result, where the construct *will* get the most prominent value; however, the *tool* was at the second highest level, whereas in the qualitative result it got the lowest priority.

Question: 2

Technology availability

Respondents were asked about the availability of Web 2.0 technology tools, and four respondents were of the view that their institutions had enough availability of technology, while three of them showed their dissatisfaction in this regard. When asked to compare the technology tools at home and at the university, three were of the opinion that they had better technology tools at home, as according to one respondent, "*Taking classes from home was not an issue while it became impossible for all teachers to take online classes from the university as the bandwidth of the internet at the university was not good*." "*Management told me that it would be enhanced soon, but unfortunately, it could not be fixed till the end.*"

Two respondents were of the view that university tools were better, whereas two of them rated both as equally good and expressed, "*Problems can occur on both sides."* While relating this finding to the quantitative part, it is obvious that "tools at home" got a higher score, and “satisfaction with technology at home” showed a higher mean value than “satisfaction with tech at the institution.” This finding reveals that our institutions are still in need of more fiscal help for the enhancement of the infrastructure if technology is to be integrated at a higher level.

Question: 3

Technology used

Different types of technologies were used by the respondents to stay in contact with their students, including Google Meet, WhatsApp, Microsoft Teams, Zoom, LMS, Microsoft office, including Word and Excel, UPS Studio, Cam8, and YouTube. Most of the respondents (five) used Google Meet to stay in contact with their students. WhatsApp usage was at the second-highest level. Relating this finding with the quantitative findings, it is obvious that Google Meet was at the highest level of use and WhatsApp was at the second-highest level. This finding reveals that the faculty at public sector institutions is very aware of the technology, and its usage is quite high, as well as its availability issues, which are almost negligible. They got support from the institution as well as from the senior faculty, as in the words of respondent A, “*I can learn via seminars, but at that time our faculty had made WhatsApp groups, and we used to share things related to different software because different software has their own difficulty levels.*”

Question: 4

Will

Will is defined here as the attitude of a person. In view of Fiske (2010), in general, attitude means an individual's appraisal of something that could be favourable or unfavourable. One's sentiments, preferences, and feelings about technology are all examples of one’s attitude towards technology, according to Tuncer (2012).

When the participants were asked to express their feelings at the time of the pandemic, three of them felt positive in the sense that the online system had its positive dimensions. For example, respondent A said,

“*It was a positive experience as I felt comfortable working from home because, as a mother of two kids, it was quite easy for me to take classes as well as look after my kids and fulfil my duties as a mother too. It saved me time while travelling.” “The negative things associated with the workload increased in the manner that lecture recording, editing, and uploading were time-consuming processes, plus gauging the interest of students became difficult as compared to face-to-face teaching*.”

Respondent B said, “*Pandemic brought an online teaching and learning system, which was a new experience I enjoyed, and the reason was that it is such a medium that enhances the student-teacher relationship and students can clear their misconceptions by easily asking the questions during the classroom.” “They can also take help from different websites for this purpose.”*

Respondents who felt positive said that the reason for this feeling was that they were good at using technology prior to the pandemic situation, along with their interest in using it. Respondent E told the researcher that it helped me learn new things with which I was not familiar before.

Three respondents showed mixed positive and negative feelings, as, according to respondent C, “*it was a positive experience as I personally like it, even as a complementary* *mode of teaching along with the conventional way of teaching." "Due to certain types of issues related to lockdown like electricity, internet issues, and the unavailability of a peaceful environment, it created negative feelings as well."*

While one respondent said that it brought negative feelings just because of the uncertain situation of lockdown, every institution was closed, and so many casualties were happening around us that it ultimately had a negative impact on our teaching and learning processes. The negative aspects revealed by the respondents with mixed feelings included the inability to assess the student's response as well as the introduction of novice technology with which they were not familiar. While relating this finding with the quantitative part, it is found that the "satisfaction" construct got the highest mean value and "lack of concern" got the lowest, confirming the respondents' inclination towards more positive and less negative feelings.

The role of the institution in order to deal with such feelings was marginal, according to three respondents, whereas four of them said that the institution provided training and senior faculty also helped in this regard. Relating this finding with the quantitative results of the "training" score, it is confirmed that most respondents said that they got training from the institution, while a few said that they had not.

When they were asked to express their confidence level in technology and the reason behind that, the majority (six) said that they felt quite confident in that because they had prior interest in using the technology along with its integration into education. In explaining the reasons behind this confidence, respondent B said that it was due to the help provided by the senior faculty of different campuses who provided guidance in this regard. Respondent A said, "*If the higher management motivates the staff members to make use of technology in their instruction, it ultimately brings confidence in a teacher.*" Respondent G added, "*I have been associated with technology for the last 15 to 20 years.*" "*All correspondence in our offices is done through social media platforms, which made me confident.*"

Only one respondent, C, felt less confident and said, *"I don't feel confident in using technology because I don't have such necessary skills." "I have learned a few skills to use it during the pandemic through training provided by the institution." "The training was not provided as it should be, and the session was very short, so I tried to learn it on my own via different YouTube channels."*

Related to the role of the institution in changing the confidence level of the faculty, most of the respondents (4) were of the view that the institution had a very small role in boosting self-assurance, although they had provided training workshops and seminars. They said that these sessions were few in number and of little use. Respondent A said, *"Institution has a small role in boosting my confidence; all my confidence is due to my prior experiences of school, college, and university life*."

Respondents D and E were of the view that due to the lockdown position; it was nearly impossible for the universities to take part in such activities that could provide assistance in this regard. They were of the view that all the confidence they had was due to their personal efforts and interests. In contrast, two members expressed the opinion that the role of the institution was paramount in this regard, as respondent F added, "*It was only because of the institution that we made the online learning process possible; only the institution was responsible for issuing the personal IDs to the students and letting them take* *part in the educational activities; it made it possible to take online attendance and use the interactive white board*." Respondent B said, *"Our institution shared useful links with us; the faculty of other campuses also provided help, which was not present before the pandemic."* One respondent was of the view that the institution had played no part in boosting confidence. This finding reveals that more training sessions are needed, as well as awareness seminars that should be arranged by the institution and the Higher Education Commission.

Skill

In view of Ananiadou and Claro (2009), "electronic proficiency" means the practical use of digital awareness, expertise, and attitude. In the answer of having skills, all asserted that they possessed the required skillfulness to assimilate the tech in instruction during the pandemic. Only one respondent was of the view that, despite having the necessary skills, there was still room for learning. This finding shows awareness of one's own shortcomings as well as confidence. Respondent F said, "I *cannot say that I am perfect, but I have skills above average."*

Respondent D said, "*I have learned the skills during the pandemic which I practice even now in the class." "I have even participated in multiple training sessions as a trainer about editing and video making.*"

In the answer to the question about the role of the institution in developing the required skills, most of the respondents expressed the general impression that they had learned it by themselves and that the role of the institution was minimal. Respondent F said, "*The quality assurance and enhancement cell in our institution had arranged training seminars that were very beneficial for those faculty members who were unaware of the* *modern technological tools, but we tried them ourselves as well.*" Respondent E added, "*Yes, they have arranged some training sessions, but they were not effective, as mostly teachers learned through their own efforts*." One respondent said that the routine office use compelled the faculty to learn the required skills. Another respondent added that the faculty had made WhatsApp groups, and it helped them a lot in learning the required competencies.

When asked as to why there is a need for skill improvement, most (4) respondents said that it is a need of the time. Respondent C added, "*We are living in the 21st century, and being a developing country, it is imperative to learn new skills*." Two respondents said that one should learn it, as learning is a lifelong process. Respondent D added, "*One has to learn from cradle to grave, and it is a continuous process.*" One respondent said that having technological skills is necessary in the world of global competition. This finding reveals that our faculty is motivated enough and well aware of the need for capacity building. This again shows the positive attitude of the faculty, because feeling motivated to learn is only possible because of one's optimistic attitude towards it. Relating these findings with the quantitative findings, it is obvious that both converge because in the quantitative findings, *skill* showed an above-average score, which showed that faculty were quite confident in using the technology tools.

Pedagogy

Respondents were asked about the method of teaching used by their institution during the pandemic, to which they gave almost the same answer: both students centered and teacher- centered were used in their respective institutions. Respondent D said, "*Although student- centered methods were used according to my subject, like role play and presentations, I would say the conventional touch was more prevalent.*"

Respondent A said, "*In our settings, one can't go for a 100% student-centered method as some students need a push, so both methods were used: 80% student-centered and 20% teacher- centered*." Respondents F and B said that it was more student-centered. Respondents E said that conventional methods were mostly used. Respondent G said that it was up to the teacher to decide what method should be applied. When asked whether they had received some instruction from the institution to use certain methods, all of them answered in the negative. It was derived from their responses that choosing a method depended upon the subject as well as on the teacher's determination. This finding shows that teachers of higher institutions have full authority to practice and they teach according to their own decisions without any external influence.

They were asked to articulate their view in relation to the right way of instruction, teaching method, or approach to teaching in a technology-integrated class, mostly expressing their opinion that it should be a mix of both, more student-centered and less teacher-centered. Respondent C said, "*It depends upon which subject or topic a teacher is going to teach as well as the intelligence level of the student, which lets a teacher decide what method of teaching to apply." "I wouldn't go for only student-centered rather it should be a blend of both, like 60% student-centered and 40% teacher-centered."*

Respondent E added, *"Student-centered is the right way, but the situation in our institution was different, and we focused on teacher-centered because the workload and time constraint related to the policy of the institution demanding coverage of the course within a certain time limit posed limitations upon us."* In view of respondent G, a learner-centered method is better at the stage of higher learning. This finding shows that although teachers appreciate student-centered instruction, due to some contextual factors, they try to practice teacher-centered approaches. These contextual factors include the workload, timely course coverage, different mental capabilities, and individual differences among the students. Student-centered techniques require more time for the planning phase which our faculty is short of.

Question: 5

Barriers and Challenges

Respondents were asked to describe a few difficulties they faced in the continuation of the learning process regarding Web 2.0 integration during the pandemic.

Table 4.28

Qualitative Analysis N = 7

Themes	Categories	Codes	Occurrence
Challenges and measures	Challenges	internet connectivity	4
		distortion due to social life	3
		motivation and interest of students	3
		check and balance on teaching and assessment	2
		No feedback from students on the spot.	2
		increased workload	2
		Power failure	2
		not practical enough	1
		full investment by institution	1
		course coverage	1
		dealing with technology laggards	1
		Technical issues can’t be solved at home.	1
	Improvement measures	Faculty capacity building	4
		organizational policies for tools usage	1
		availability of tools in the institution	1
		launch apps by the institution	1
		introduction of hybrid system	1
		enhanced monitoring system	1
		training of students	1
		resourceful teachers	1
		awareness seminars	1

Most of them said that electricity issues, internet connectivity, students' motivation and interest, course coverage, and gauging students' responses were major challenges. Other issues included online evaluation, less check and balance in teaching and assessment, increased workload, and less practicality in the system. Respondents A and D added, "*Peaceful home environment while working from home was an issue because one cannot avoid the social life in the background like noise in the street, etc*."

Respondent A also added, "*While working on campus, if a technical issue is faced, one feels relaxed that it will be fixed shortly, but this is not the case when working from home*." Respondent E said, "*Less engagement with students and limited time were the challenges*." Another respondent added that coordination with technology laggards was a major issue. These findings are consistent with those of the open-ended answers.

Measures for Improvement

Respondents were asked to suggest some measures for improving the situation, to which mostly (4) answers were training workshops. Respondents C and B were of the same view and added, "*There should be a policy from the institution regarding the resources to be used, and the institution should make sure the availability of the technology."* Respondents D and G were of the same view when they added, "*Accountability is more important regarding assessment and evaluation of the student; teaching and monitoring should go side by side in online systems*." Respondent E said, "*Try to make the system hybrid as we face issues in the online system." "It's better if 50% of students take online classes while 50% physically attend the classes on campus*." Relating these findings with those of open-ended questions, it seems relevant, and the same responses are given by the respondents.

Section III- Comparison and Integration of Quantitative and Qualitative Analysis

Table 4.29 shows the mixed method results according to the objectives of the study.

Table 4.29

Mixed Method Results

Quantitative	Qualitative
Moderately high technology integration. (R sq = 23%)	Equal response on medium, above medium, and one below medium. "I *cannot say that I am perfect, but I have skills above average."*
Availability, Satisfied with quality at home (M = 1.75, SD = 0.43), Hardware/ software at home (M = 1.90, SD = 0.31), Internet at home (M = 1.92 SD = .27)	Mostly said enough; better at home.
Usage Power point (M = 4.16, SD = 1.09), Google meet (M = 4.04, SD = 1.23)	Google meet by most of the respondents.
Will shows the highest value in technology integration (R sq = 19%)	"*Will is most important, my personal experience, we didn't have support from institutions, but we have learned due to will power, interest, and passion."* (One respondent)
Pedagogy predicted 16% variance in technology integration.	Pedagogy was at the second-highest level.
Skill can produce 12% variance in technology integration.	Skill was also at the second level: "*I have learnt the skills during the pandemic which I practice even now in the class." "I have even participated in multiple training sessions as a trainer about editing and video making*."
Tool was the second highest predictor (R sq = 18%)	Tool was given the least priority
Electricity issues (M = 3.82, SD =.92), Focus on technology than content (M = 3.61, SD = .85)	Internet connectivity, *"The slow speed of computers on the internet and the poor working conditions of computers are the major problems."* Distortion due to social life. "A *peaceful home environment while working from home was an issue because one cannot avoid the social life in the background, like noise in the street, etc*."

4.6 Triangulation of Results

Triangulation is a technique for improving the validity and trustworthiness of research findings (Cohen, Manion, & Morrison, 2002)**.** Triangulation led to a deeper meaning of technology integration at the higher education level in the post-pandemic era. Technology integration level, availability and usage of Web 2.0, and the *will* were convergent in both quantitative and qualitative thematic analysis results. Qualitative thematic analysis also added insights into the technology availability and the *will, skill, and pedagogy* of the participants. The synthesis of both quantitative and qualitative analysis revealed that the faculty of higher education institutions showed moderately high integration of technology as well as a positive attitude towards it. Moreover, it was obvious from the quantitative analysis that most of the teachers of higher institutions were satisfied with the availability of tools in the university as well as with the quality of the internet at home. Most of them got training and access to relevant content during the pandemic. The faculty got technical support from the university during the pandemic period. It was found that they had better access to hard ware and software at home as compared to the university. Qualitative thematic analysis also exposed the same level of satisfaction among the faculty. Google Meet and Power Point were among the most widely used tools.

The quantitative analysis showed that the *will* of the respondents was the highest predictor of technology integration, whereas the qualitative thematic analysis also revealed that they had a positive attitude towards technology, received support from colleagues and the institution, had confidence in their abilities, and above all, the role of the institution was minimal, and it was only their will power that let them sustain such a crucial situation.

There were areas of divergence. The synthesis of both quantitative and qualitative analysis exhibits that their proficiency in technological *skills*, including email, www, integrated application skills, and emerging technology skills is also established, along with their confidence in teaching with technology. The faculty exhibited confidence in the usage of technology, and most of them considered themselves at a medium level of technology proficiency. The number of respondents considering themselves at a high or low level was lower. Qualitative analysis showed that the role of the institutions in boosting this confidence or skill was very small. The faculty showed enthusiasm to try new technology and were quite skilled at it. However, the quantitative and qualitative results showed divergence in the prediction of skill for technology integration. Skill was at the lowest level of prediction in quantitative results, while in qualitative analysis it was the second-most important variable in technology incorporation.

Quantitative and qualitative results also showed divergences in *pedagogy*. Quantitative results revealed that pedagogy was the third most important predictor of technology integration, whereas qualitatively it got the second highest value. Qualitative thematic analysis revealed that the teaching method followed by the faculty during online classes was a mix of both student- centered and teacher-centered. There were no formal instructions from the university to apply a certain method of instruction, and they agreed that the role of a teacher should be that of a facilitator and supervisor in a technology integrated classroom. However, they admitted that the teacher-centered method was most prevalent in our institutions.

Results also showed divergence in *tools* when the quantitative results showed tools as the second highest predictor and the qualitative results gave them the least priority in technology integration.

In quantitative analysis, while measuring the challenges faced by the faculty in technology integration, most of them considered the electricity issues as the biggest and focused on technical aspects rather than content as the second biggest challenge, while the scarcity of the required level of knowledge was next to it. Some other barriers during quantitative analysis were the lack of required knowledge about technology integration, unspecified evaluation strategies, and a lack of capacity or willingness to change. The qualitative thematic analysis revealed that poor quality of the internet was the highest issue, while distortion due to social life and students' motivation were the second highest issues.

Some other challenges during qualitative thematic analysis were check and balance on teaching and assessment, no feedback from students at the spot, increased workload, power failure, not being practical enough, full investment by the institution, course coverage, dealing with technology laggards, and technical issues that can't be solved at home. Open-ended questions about barriers and challenges revealed a lack of proper infrastructure, a lack of training, non-serious behavior of the students, an unreliable evaluation system, a lack of funds, issues of the students living in rural areas, the conduct of lab work, the type of affiliation for communication among student and teacher, satisfying the students' needs, a lack of control mechanism, and the indecisive behavior of HEC and administrators were also barriers faced by the faculty.

CHAPTER 5

SUMMARY, FINDINGS, DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Summary

The present project was a post-pandemic situational analysis to look at the integration of web 2.0 tech into instructional practices at the higher education level. The primary goals were to investigate and analyze the influence of factors such as will, skill, tool, and pedagogy on the use of Web 2.0 tech, and to explore and analyze the power of aspects such as access to computers and software, training of software, access to relevant content, and technical and administrative support on the exercise of Web 2.0 tech. Moreover, the exploration of the availability and use of Web 2.0 technologies in institutions of higher education, as well as the barriers and difficulties faced, were also incorporated into the objectives of the current research.

The dependent variable was the integration of Web 2.0 technology, whereas the independent variables were *will, skill, tool,* and *pedagogy*. A person's inclination to react positively or adversely to an item, human being, association, event, or any distinguishable feature of their environment is referred to as their attitude (Ajzen, 1989). According to Coughlin and Nemky (1999), "skill" is the capability to utilize and to practice technology, plus the self- efficacy and willingness to make use of it. Tool is defined as teachers' access, availability and environment to use technology. Pedagogy includes the concepts, beliefs, perceptions, and difficulties that guide and influence the practice of educators (Moyles, Adams, & Musgrove, 2002). Pedagogy comprises teaching styles, instructional approaches (constructivist, behaviourist, etc.), as well as general didactic practices.

Will consist of satisfaction, accommodation, comfort, benefit, concern, utility, perception, and absorption and significance dimensions included in TAC (teachers' attitude towards computer scale) version 6.1 (Christensen and Knezek, 2009). The scale consisted of 51 items, with 5 items on each dimension except "concern" and "utility" both having 8 items each on a Likert scale. Pilot testing shows that overall scale reliability was 0.87.

Skill consisted of email, www, integrated application skills, and emerging technology skills. The Technology Proficiency Self-Assessment (TPSA-21) was used to assess the variable skill. This is a 34-item Likert-type scale divided into six subscales. It was constructed by Ropp (1999) and revised later by Christensen and Knezek in 2014. Pilot results illustrate the general reliability of 0.94 for the scale of skill.

Pedagogy consisted of teaching with technology and teaching with emerging technology dimensions included in the Technology Proficiency Self-Assessment Scale (TPSA-21). The pilot result shows the overall reliability of the pedagogy scale at 0.93. To check the variable *tool*, many items were used, including the satisfaction of internet quality at home, the satisfaction of internet quality at university, the availability of training, hardware and software access at home, hardware and software access at university, the availability of internet at home, the availability of internet at university, support from university administration and technical support from the IT department, training, and access to relevant content. The scale was dichotomous and included “yes” and “no” options. A pilot study shows a reliability value of 0.65.

The integration scale was measured by three single-item sub-constructs, including the Stages of Adoption of Technology scale by Christensen (1997) of the University of North Texas, the CBAM level of use (CBAM-LoU) scale by Griffin and Christensen (1999), and the Apple Classroom of Tomorrow (ACOT) teacher stages scale by Dwyer, Ringstaff, and Sandholtz (1994). The pilot test shows a reliability of 0.75 for the integration scale.

The study employed a parallel convergent mixed method design with two unique phases (Tashakkori & Teddlie, 1998). In this layout, quantitative and numerical data were obtained and examined initially. Second in order, qualitative text and data are collected and assessed. This process aids in the explanation or expansion of quantitative data acquired in the initial stage. The total population was 1017, and a sample of 340 university faculty participated in the study. Out of 340 participants, 150 were from social sciences, 90 were from management sciences and 100 were from basic and applied sciences. Statistical procedures included mean, SD, factor analysis, and SEM and the statistical software used was SPSS 21, AMOS, PLS 3, and QDA Minor Lite. The software proved helpful in calculating the results. Further open-ended questions and interviews were analyzed and themes were generated. The results of the quantitative data and the findings of the qualitative analysis were realigned with each other and contrasted with the results of the literature study. Recommendations are given in the next pages.

5.2 Findings

The study's conclusions were reached using the outcomes of statistical analyses of the data. These findings and recommendations were made with the help of these results. The study's conclusions were supported by its objectives and assumptions. A total of 354 public university teaching faculty took part in the study, out of which only 340 usable responses were added to the statistical calculations. The respondents included social sciences, management sciences, and basic sciences faculty. Both male and female teaching faculty belonged to different age groups and job types participated in the study.

Demographics

1- 34% of faculty from social sciences, approximately 32% from management sciences and 33% from basic sciences participated in the study.

2- The designation shows that 60% were lecturers, 35% were assistant professors, and an approximate 3% were associate professors, while 1% were professors.

3- 16% were of the age between 20 and 30 years, while mostly 51 % were of the age 31 to 40 years. About 21% were aged 41 to 50, whereas only 12% were in the 51-year-old and above age group.

4- In qualification, approximately 2% had a master’s degree, 56% had an M. Phil. degree, and 36% were PhD degree holders, while approximately 6% were postdoctoral holders.

5- The maximum experience group 25% were from 3 to 5 years, 18% were from 6 to 8 years of experience, 16% were from 9 to 11 years, 12% were from 12 to 14 years of experience, 8% were from 21 years and above, 7.6% were from 18 to 20 years of experience, 7.1% were from zero to 2 years of experience, and 5% were from 15 to 17 years of experience.

6- The majority (34%) took 4 courses online during the pandemic, whereas nearly 25% took 3 courses and only 2% took 7 courses.

7- Approximately 48% spend 0 to 4 hours on the internet for educational purposes, whereas 34% spend 5 to 7 hours, approximately 12% spend 8 to 10 hours, and 6% spend 11 hours or more than 11 hours on the web.

8- Approximately 12% reported there were no ICT-enabled classrooms in the department, whereas the majority, approximately 21%, reported only one classroom with an ICT facility.

9- About 15% reported three classrooms, whereas 10% reported that there was an ICT facility available in all classrooms.

10- 48% reported that they don’t have a video conferencing room in their department, while less than 1% reported nine video conferencing rooms in their respective department.

11- About the teaching load 28% of faculty members reported that they had taught 12 hours per week during the period of the pandemic. Approximately 1% reported teaching 1 hour per week, and less than 1% took 14 hours per week during the pandemic.

Objective 1: To analyze the integration of Web 2.0 technology (ACOT, Stages, and Levels) into instructional practices at the higher education level.

12- Levels showed above medium integration (M = 5.17, SD = 1.5), stages (M = 4.39, SD = 1.04), and the ACOT survey (M = 3.41, SD = 0.97) showed slightly above the medium level of technology integration by the faculty. Overall, the technology integration value was moderately high (Table 4.6).

Objective 2: To explore the availability of Web 2.0 technologies at the higher education level.

13- Most respondents showed satisfaction regarding the quality of net at home (M = 1.75, SD = 0.43) as compared to the quality of net at the university (M = 1.74, SD = 0.44).

14- Most of the respondents (M = 1.74, SD = 0.43) got training during the pandemic for online tool usage.

15- Most of the faculty members had access to relevant content during the pandemic (M = 1.90, SD = 0.30).

16- Hardware and software availability at home (M = 1.90, SD = 0.30) was greater than that at the university (M = 1.84, SD = 0.36).

17- Satisfaction with the quality of internet at home was (M = 1.92, SD = 0.27) higher than satisfaction with internet at the university (M = 1.88, SD = 0.33).

18- Support at the university was quite satisfactory (M = 1.86, SD = 0.34), whereas technical support at the department (M = 1.87, SD = 0.34) was also high (Table 4.7).

Objective 3: To explore the usage of Web 2.0 technologies at the higher education level.

19- PowerPoint was the most used tool (M = 4.16, SD = 1.09), while Google Meet was the second most used tool (M = 4.04, SD = 1.23) (Table 4.8).

20- WhatsApp (M = 3.97, SD = 1.04) and Google Docs (M = 3.82, SD = 1.15) were also used by the majority.

21- LMS usage (M = 3.53, SD = 1.40), YouTube (M = 3.44, SD = 1.31), and Zoom app usage (M = 3.33, SD = 1.38) were also considerable.

22- Course management systems (CMS) (M = 2.88, SD = 1.49) and Facebook usage (M = 2.56, SD = 1.37) exhibit less use.

23- Blog usage by the respondents during the pandemic was lowest ($M = 1.96$, $SD = 1.10$), while usage of Wikis ($M = 2.36$, $SD = 1.24$) was second lowest (Table 4.8).

24- In any other app column, 6% had used Microsoft Teams for teaching during the pandemic. 0.6% said that they had used the Camtasia Video Recording tool, and 0.6% had made use of mobile video recordings (Table 4.8).

Objective 4: To analyze the influence of factors such as *will, skill, tool,* and *pedagogy* on the use of Web 2.0 technologies.

H1- There is a direct positive effect of *will* on technology integration.

25- The results reveal that *will* has a significant impact on technology integration ($\beta = 0.19$, $t = 3.00$, $p < .05$). Hence, H1 is supported.

H2: There is a direct positive effect of *skill* on technology integration.

26- The results reveal that *skill* has a significant impact on technology integration ($\beta = 0.12$, $t = 2.06$, $p < .05$). Therefore, H2 is supported.

H3: There is a direct positive effect of *tool* on technology integration.

27- The results reveal that *tool* has a significant impact on technology integration ($\beta = 0.18$, $t = 2.05$, $p < .05$). Hence, H3 is supported (Table 4.23).

H4: There is a direct positive effect of *pedagogy* on technology integration.

28- H4 evaluates that *pedagogy* has a significant impact on technology integration. The results reveal that pedagogy has a significant impact on technology integration ($\beta = 0.16$, $t = 2.05$, $p < .05$). Hence, H4 is supported (Table 4.23).

Objective 5: To explore the barriers and challenges faced by the faculty for the adoption of web 2.0 technologies (the quantitative part).

29- Faculty members agreed that electricity issues posed a major barrier during online instruction (M = 3.82, SD =.92).

30- The second-most felt barrier emerged and focused on technical aspects of the technology rather than content (M = 3.61, SD = .85).

31- Many agreed that the required level of knowledge was a barrier (M = 3.56, SD =.89).

32- Poor quality of the internet was a problem (M = 3.55, SD =.97) in the view of respondents.

33- Unspecified evaluation strategies were a barrier (M = 3.51, SD =.85).

34- Lack of capacity or willingness to change (M = 3.27, SD = 1.06) was the least felt barrier by the faculty (Table 4.24).

Question5 (Open ended questions)

35- Internet connectivity was reported as a major problem by 28% of the respondents.

36- Lack of resources or proper infrastructure was the second major problem for 17% of the respondents.

37- Lack of training was the third major issue, according to 13% of the respondents.

38- The non-serious behavior of the students during online classes was a challenge for 12%.

39- 7% of the respondents reported that some people were unwilling to change, which posed a problem.

40- 5% of them said that the lack of funds at the institutions of higher learning was among the major issues.

41- 4% of them reported electricity issues as the major problem.

42- 3% of the respondents considered the unreliable evaluation system a major issue.

43- The issues facing the students living in rural areas or small cities related to internet connectivity and electricity prevented them from taking online classes.

44- 3% of respondents reported that it was impossible to conduct lab work during a pandemic, and it remained an issue.

45- 2% of the respondents considered that the type of interpersonal interaction between student and teacher was a major issue during the pandemic.

46- 4% of the teachers give multiple answers related to the challenges during online pandemic instruction, including “it was difficult to satisfy the students in PowerPoint presentations,” “lack of control mechanisms,” and “indecisive behavior of the HEC and administrator.”

Interview Findings

Question1: To analyze the integration of web 2.0 technology (ACOT, Stages, and Levels) into instructional practices at the higher education level.

1- When asked about the level of technology integration they consider themselves to be at, three of them said that they were at medium level, three were above medium level, and one respondent considered herself at the initial stage.

2- When asked about choosing the most important aspect among will, skill, tool, and pedagogy, three of the respondents chose *will* as the most important aspect of technology integration whereas *skill* was selected by two respondents. *Pedagogy* was chosen by two respondents as the most important, while *tool* was chosen by one respondent.

Question 2: To explore the availability of Web 2.0 technologies at the higher education level.

3- Respondents were asked about the availability of Web 2.0 technology tools, and four respondents were of the view that their institutions have enough availability of technology, while three of them showed their dissatisfaction with it.

4- When asked to compare the technology tools at home and at the university, three were of the opinion that they had better technology tools at home. Two respondents were of the view that university tools were better, whereas two of them rated both as equally good.

Question 3: To explore the use of Web 2.0 technologies at the higher education level.

5- The different technologies used by the respondents to stay in contact with their students included Google Meet, WhatsApp, Microsoft Teams, Zoom, LMS, Microsoft Office, including Word and Excel, UPS Studio, Cam8, and YouTube. Most of the respondents (five) used Google Meet to stay in contact with their students. WhatsApp usage was at the second highest level.

Question 4: Does the integration of Web 2.0 technology at the higher education level directly affected by factors such as *will, skill, and pedagogy*?

6- When the participants were asked to express their feelings at the time of the pandemic, three of them felt positive, three respondents showed a mix of positive and negative feelings, and one respondent said that it brought negative feelings.

7- The role of the institution dealing with such feelings was marginal, according to most of the respondents.

8- When they were asked to express their confidence level in technology and the reason behind that, the majority (6 respondents) said that they felt quite confident in that. Only one respondent felt less confident.

9- The role of the institution in changing the confidence level of the faculty: most (four respondents) were of the view that the institution had a very small role in boosting self-assurance, although they had provided training workshops and seminars.

10- In the answer of having skills, it was mostly said that they possessed the required expertise to amalgamate the tech in instruction during the pandemic.

11- When asked as to why there was a need for skill improvement, most (four) respondents said that it was a need at the time.

12- Respondents were asked to talk about the method of teaching used by their institution during the pandemic, to which they gave almost the same answer: both student-centered and teacher-centered were used by them.

13- When asked whether they had received some instruction from the institution to use certain methods, all of them answered in the negative.

14- They were to state their view regarding the right way of instruction, teaching method, or approach to teaching while teaching in a technology-integrated class, mostly saying it should be a mix of both, mostly student-centered and less teacher-centered.

Question 5: To explore the barriers and challenges faced by the faculty while making use of Web 2.0.

15- Most of them said that electricity issues, internet connectivity, students' motivation and interest, course coverage, and gauging students were the main problems.

16- Two respondents said that a peaceful home environment while working from home was a major issue.

17- One respondent said that technical problems remained unresolved, which was a major problem.

18- A respondent said that less engagement with students while working online was an issue.

19- Working with people who were not technically sound posed an issue.

5.2.1 Generalization of the study

University teaching faculty from the public sector made up the study's sample. In Pakistan's public institutions, conditions like the atmosphere, educational standards for classes, and methods for hiring staff are essentially the same. Additionally, the research's positive components are universally applicable and may be applied to any profession, including education. Because all instructors in the public sector have almost the same social and ethnic characteristics, the results of the current work may apply to all educators, not just those who teach at Islamabad's public institutions.

5.3 Discussion

The aim was to analyze the integration of Web 2.0 technology into instructional practices at the higher education level along with key factors like *will, skill, tool,* and *pedagogy* in integration of technology. A mixed-methods paradigm was implemented to conduct the study. Within the mixed-methods study, a parallel convergent design was applied. The population of the study consisted of public-sector universities. A total of 340 responses were analyzed from seven interviewees. The statistical test included the mean score, structural equation modelling (SEM), and qualitative theme analysis.

Results of the first objective show an overall moderately high integration of technology by the faculty. The technology integration scale consisted of three subscales: levels, stages, and ACOT. By analyzing the mean score, the “levels” subscale shows a mean value of 5.17 (SD = 1.51), indicating above medium level of technology integration. This means that teachers feel comfortable while using the technology, and they put their efforts into excelling in the use of technology so as to take full advantage of its effects in their teaching. The mean value of the “stages” subscale was 4.39 (SD = 1.04) which indicates an above intermediate level of technology integration. This means that the teachers are gaining confidence in using the technology tools for specific tasks and have also started to feel comfortable with them yet not applying it creatively. The ACOT subscale has a mean value of 3.41 (SD = 0.97), indicating an above intermediate level of technology integration, which means that they are discovering the potential of technology for increasing efficiency but not full integrating it, and this finding is in line with Rahmadi (2021). Respondents’ score on one dimension (levels), and two dimensions (stages and ACOT) were above intermediate level. This means their overall technology integration was moderately high, which is a good sign in a post-pandemic situation, revealing the comfort level of the faculty with technology and nearly an absence of fear.

Thematic analysis shows that there was an equal response on the medium and above medium proficiency level of technology, whereas only one respondent was of the view that it was at the initial stage. These findings support the quantitative findings as well. Literature shows different reasons, like lack of self-confidence (Siren & Knudsen, 2017), time consumption, and failure to do tasks on time (Harrell & Bynum, 2018), that prevent technology integration. Mac Callum and Jeffrey (2014) declared that the fear factor generally arises when educators don't feel at ease with the technology or when the utility factors of the technology are not perceived. The comfort factor with technology enhances the integration, and this finding is in line with Al- Maroof et al. (2020).

As far as the availability of tools is concerned, the faculty had enough tools to use during the pandemic, and this might be due to the fact that mostly everyone has a personal computer, a mobile device, and internet access nowadays. This is in line with the findings of Soomro et al. (2015, 2020) that faculty members used social Web 2.0 tools quite often than functional ones and had better access at home than on their respective campuses. The path analysis shows the significant impact of tools on technology integration. Although their satisfaction level with the quality of the internet was higher at home as compared to the internet at university, this might be because of the poor band width at university level. During the interview, a respondent said that they had faced the bandwidth issue at the university while at home the speed and connectivity issues were very small, and this result is consistent with Woltron (2022). Training and satisfaction with the quality of the internet got a low mean value, which shows dissatisfaction with it. During the thematic analysis, most respondents declared they had enough availability of tools, while more satisfaction with the quality of tools was found at home. Thus, the qualitative results support the quantitative findings. In summary, results show sufficient availability of tools. More satisfaction was found with the availability and quality of the internet at home. Support from the university and technical support from the department were provided to most of the respondents.

The third objective was about the practice of Web 2.0, and results revealed that blogs were among the least used tools by the faculty during the pandemic whereas Facebook and Wikis were also less used tools for learning in higher education. The most used tool was

PowerPoint; the second most used tool was Google Meet which was also supported by qualitative analysis. Another frequently used tool was WhatsApp, which was used frequently during the pandemic for instruction, and it is at odds with the result of Martin et al. (2020), where the usage of a learning management system received the highest ratings from the faculty in terms of significance and competency. YouTube, Zoom, LMS, CMS, and Google Docs were also frequently used during the pandemic for instructional purposes, which is consistent with the results of Chawinga and Zinn (2015). During the interview, some other tools were known to be used, like Zoom, Camtasia video recording, UBS Studio, Window Movie Maker, and MS Teams. Therefore, it can be said that the faculty had enough availability and usage of the technology tools, and this result is contrary to those of Kolawole and Mutula (2016) in Nigeria and Moodley (2019) in South Africa, who found the usage of Web 2.0 in the universities to be low. But the reason for its greater use in our country might be that it was the only option left in the teaching field during the pandemic period, and teachers already had a positive attitude and were familiar with it.

The fourth objective was about the exploration of the effects of factors including *will* (attitude), *skill* (competence), *pedagogy*, and the effects of *tools* on technology integration. The descriptive results reveal the positive attitude of the faculty towards the integration of technology. For analyzing the internal factor of *will*, the path analysis shows that the *will* (attitude) of the university teaching faculty has a significant effect on technology integration. This positive attitude (Sadaf et al., 2011) always serves to mix tools in instruction.

The verdict is in accordance with that of Cakir et al. (2015) and Durgo's (2020) study findings, which indicated that instructors felt very favorably about the use of educational technology. According to Ajjan and Hartshorne's (2008) and Tyagi's (2012) findings, faculty members' attitudes and perceptions of their level of behavioral control were reliable predictors of their desire to utilize Web 2.0. While having interviews with the participants, they also showed a positive attitude, and the reasons behind this were their personal interest in technology over and above their attitude to make an effort for novel things. This result is consistent with that of Woltron (2022), in which teachers' attitudes during COVID-19 were studied.

During an interview with seven participants, the researcher came across positive as well as negative feelings. The reasons behind those negative feelings were perhaps the uncertain conditions prevailing at that time as well as the overall depression about the uncertainty of human life, as according to Kidman and Chang (2020), people in this pandemic crisis may have distress, combat disorder, anxiety owing to a lack of knowledge about how to get essential services, interactive fallback, poor focus, or loss of confidence. And it had impacted the teaching and learning process as well. The negative feeling might be because of the fact that it was a situation for which few teachers were not technically and mentally prepared and they were compelled to adopt technology, in which they found themselves in an uncomfortable condition. Hartshorne et al. (2020) declare that teachers require assistance while using teaching in emergency scenarios. Many instructors feel unprepared to utilize emergency teaching because they have not received teacher training in integrating technology into the classroom (Hodges et al., 2020). According to ITTE (2020), particularly widespread in nations with poor and low-middle incomes is a lack of technical skills and expertise among teachers. These findings are consistent with Woltron's (2022), in which teachers had a negative attitude.

When the mean results are compared for different subscales, “concern” shows the lowest mean values as compared to the other dimensions, which is another indication of their neutral attitude. Therefore, this scale shows that there is no lack of concern. One of the interviewees said that the positive perception was due to the fact that Web 2.0 technology was already in use during teaching for the completion of different tasks at the university premises. So, the neutral concerns might be because, although some were not prepared for the uncertain situation, they were well aware of the emerging technology and felt its importance related to other tasks of their jobs, as according to Arslan (2019), regular practicing teachers have a more favorable attitude than trainee teachers, and the practice of technology is found to be subjected to its utility and simplicity of usage. The relevance of technology to the prevailing situation at that time might have motivated them to make use of it, as according to Echeng and Usoro (2016), factors of practice of Web 2.0 in universities were positively connected with the prior knowledge and motivation of the teachers.

Another factor was *skill* or self-confidence in using the technology. The results of the mean value of *skill* tell us about the second highest mean value, representing the skillfulness of the faculty in technology usage. The path coefficient of *skill* shows a significant impact on technology integration. This is in line with Soomro et al. (2015), who found that teachers were more proficient with social tools than they were with instrumental ones. When asked about their skills during the interview, most respondents said that they have an average or above-average level of skills to use technology and rated themselves as medium to high proficient. Only one respondent was of the view that she was not very highly proficient but only acquired the necessary skills. In the answer to the question of the role of institutions in enhancing the required skills, most of the respondents claimed a minimal role, and it was said that they had acquired these skills on their own; this result is in harmony with that of Khlaif et al. (2021). Interestingly, all of them showed their agreement that they would like to improve their proficiency in the future to cope with the changing scenario of the educational field, which is commensurate with the conclusion of Tamah (2020) and Aurangzeb et al. (2020). It was also the impression that the pandemic had exposed the weaknesses of the faculty to themselves, plus it had caused increased technological dexterity.

Pedagogy also shows a high mean value with both of its subscales, namely teaching with technology and teaching with emerging technology. The path coefficient also shows a significant impact of pedagogy on the integration of technology. It is worth recognizing that the shift online creates new pedagogical opportunities (Salmon 2019). During interviews, most respondents revealed that they had followed a blend of teacher-centered and student-centered methods during pandemic while taking online classes. Two respondents were of the view that although the student-centered way of teaching should be applied while taking online classes, they had followed a mostly teacher-centered way of teaching. A respondent gave the reason in a teacher- centered way, mostly because it depended on the nature of the subject and level of students, which showed the direction to go. "*It depends upon which subject or topic a teacher is going to teach as well as the intelligence level of the student, which lets a teacher decide what method of teaching to apply." "I wouldn't go for only student-centered rather; it should be a blend of both, like 60% student-centered and 40% teacher-centered."*

In view of another respondent, the student in our setting needs a push and this push factor engages us in teacher-centered strategy. The reason for adopting more teacher-centered pedagogy might be that the workload burden increases while taking online classes. As a respondent said, *"Student-centered is the right way, but the situation in our institution was different, and we focused on teacher-centered because the workload and time constraint related to the policy of the institution demanding coverage of the course within a certain time limit posed limitations upon us."* Another respondent said that recording, editing, and uploading the lectures took most of the time, and as compared to conventional teaching, the burden increased in online teaching. This result is consistent with Woltron (2022) and Collis and Moonen (2007), who found that workload and managing difficulty, pose barriers to the implementation of technology. Interestingly, when they were asked about their preferred methods of teaching, most of them selected the conventional method rather than the computer-based.

For the adoption of a particular strategy during the pandemic, all of them told the researcher that there were no proper instructions from the institution side as to which form of pedagogy to follow, and it was dependent on their own decision accordingly. Issues related to this are solved at the time of syllabus construction at the start of the semester, if any. A respondent suggested that clear instructions from the university should be given as to what technology to use and at what time to use it. While talking about the types of activities to make lessons interactive, they mostly answered that they used question-answer techniques, assignments, and presentation activities for this purpose. This is a type of formative assessment, which is in line with Minocha (2009), who found that most Web 2.0 educational activities encompass formative evaluation.

About the role of the teacher during online classes, they said that it should be that of a supervisor and a facilitator. It might be because they are aware of modern teaching methodologies and, during their student lives, have experienced such roles as teachers. A respondent added that while teaching online, the responsibilities of a teacher increased, and he or she should be more compassionate and caring in order to make the lesson effective and get the attention of the students. According to Ananga and Biney (2017), the instructor has a lesser amount of influence on the learning of pupils during online instruction and acts more as a "guide on the side." At the time of such health emergencies, when teachers and students may not engage in physical settings, the instructors must plan lessons such that even at such a distance from the classroom, the learning opportunities may still be interesting and engaging (Looi et al., 2021).

Related to the fifth objective of barriers and challenges faced during the integration of Web 2.0 technologies, the respondents were given a checklist with five options and an open-ended question. According to the results of the questions asked, the majority complained about internet connectivity as a major challenge in an open-ended response consistent with Chawinga and Zinn (2015), Gaffar, Singh, and Thomas (2011), and Hakim (2020), who concluded that internet connectivity proved a barrier to the adoption of Web 2.0. Whereas in the given checklist, “focus on technology rather than content” was mostly agreed upon, the required level of knowledge was the second highest agreed upon barrier, in line with the findings of Alenezi (2021). Poor quality of the internet, unspecified evaluation strategies, and electricity issues were also among the great barriers, in line with the findings of Kolawole and Mutula (2016).

The lowest percentage was the lack of capacity or willingness to change, which is in line with the results of Alenezi (2021). In a developing country like Pakistan, there are many infrastructural problems, including internet connectivity and speed, which is in accordance with Alijani (2020). Pakistan is a country of 220 million people in which 17% use social media, which makes up 35% of the total population. Only 76% of the population has access to the internet, which poses the biggest hurdle in the e-learning system (Iqbal & Campbell, 2021). The second highest percentage of the respondents was found in the infrastructural problems, in line with Shukla (2019). Electricity issues, lack of training, non-serious behavior of students are in line with Hakim (2020), an unreliable evaluation system, problems of students living in remote areas, a lack of funds, lab work difficulties, and student-teacher relationships, as well as the difficulty of satisfying students online, were some other major issues. The lack of interest of the students might be because they were not used to such a system before, and in this regard, their parents might get involved to get their children engaged in the learning process (Baroudi & Shaya, 2022).

Regarding the attitude of students, an interviewee told that students' behavior was not refined in order to make proper use of the technology, as they did not have social manners to ask the questions while using WhatsApp. During interviews, students' motivation and interest were reported as a major issue, which is in line with Baroudi and Shaya (2022). While examining the exercise of Web 2.0 in tertiary settings, institutes found that Arab instructors were still unsure of how to increase their students' participation in the class and the impact this would have on their online teaching. The disengagement of students produces negative perceptions among teachers, which in turn affect their confidence in using the technology (Baroudi & Shaya, 2022). Other issues included course coverage, gauging students, and a peaceful home environment. The inability to resolve technical issues as well as treat the less technologically proficient faculty was also challenging.

5.4 Conclusion

The faculty of higher education institutions showed moderately high integration of technology as well as a positive attitude towards it. Findings of levels showed an above-intermediate technology integration value, whereas stages and ACOT also showed slightly above moderate values. Most of the teachers of higher institutions were satisfied with the availability of tools in the university as well as with the quality of the internet at home. Most of them got training and access to the relevant content during and after the pandemic. The faculty got technical support from the university. It was found that they had better availability of hardware and software at home as compared to the university.

Blogs were among the least used tools by the faculty, whereas Facebook and Wikis were also less used tools for learning in higher education. The most highly used tool was PowerPoint; the second most used tool was Google Meet; and then came WhatsApp, which was frequently used for instruction. YouTube, LMS, CMS, Zoom, Google Docs, Microsoft Teams, Window Movie Maker, Cam 8 UBS Studio and Microsoft Office including Word and Excel, were also frequently used by the faculty for instructional purposes.

The *will* of the respondents was the highest predictor of technology integration. They had a positive attitude towards technology, received support from colleagues and the institution, had confidence in their abilities, and above all, the role of the institution was minimal, and it was only their willpower that let them sustain such a crucial situation.

Their proficiency in technological skills, including email, web, integrated application skills, and emerging technology skills, is also established, along with their confidence in teaching with technology. The faculty exhibited confidence in the usage of technology, and most of them considered themselves to have a medium level of technology proficiency. The number of respondents considering themselves at a high or low level was less. The role of the institutions in boosting this confidence or skill was very small. The faculty showed enthusiasm to try new technology and were quite skilled at it.

Pedagogy was the third important predictor of technology integration. The teaching method followed by the faculty during online classes was a mix of both student-centered and teacher-centered. There were no formal instructions from the university to apply a certain method of instruction, and they agreed that the role of a teacher should be that of a facilitator and supervisor in a technology-integrated classroom. Overall observation of the analysis shows that the *will* or attitude component was most significant in the integration of technology, whereas *tool* and *pedagogy* were next to it. Will, skill, tool, and pedagogy showed a significant positive direct impact on technology integration and can produce nearly substantial change (23%) in it.

The challenges and barriers were a lack of required knowledge about technology integration, poor quality of the internet, unspecified evaluation strategies, electricity issues, a lack of capacity or willingness to change, and a focus on technical aspects of the technology rather than content. Most of them considered the focus on technical aspects rather than content as the biggest challenge, while the scarcity of the required level of knowledge was next to it. Proper infrastructure, internet connectivity, lack of training, non-serious behavior of the students, unreliable evaluation system, lack of funds, issues of the students living in rural areas, conduct of lab work, type of affiliation for the communication among student and teacher, satisfying the students' needs, lack of control mechanism, indecisive behavior of HEC, and administrator were also the barriers faced by the faculty. Challenges pointed out were internet connectivity, students' motivation and interest, course coverage and gauging students, working with people who were not technologically sound, less engagement with students, technical problems that remained unresolved, and a peaceful home environment.

5.5 Recommendations

The recommendations are given as below:

1- Regular teacher professional development programs integrating innovative pedagogy and technology may enhance technical capability and education quality. This includes workshops, seminars, and training sessions led by technical specialists and guest speakers (Appendix H).

2- Implementing a hybrid learning system with 50% in-person and 50% online classes may boost student interest and motivation in emergency situations, incorporating innovative technologies like virtual reality and interactive simulations. Prioritizing bandwidth allocation for academic and research-related activities to prevent network congestion during peak usage times may ensure faster and more reliable internet connectivity across campus.

3- Universities may promote the use of diverse communication and collaboration tools, including Microsoft Teams and Zoom, and provide training on these platforms. Clear guidelines and policies should be established for efficient use, ensuring users have a wide range of options.

4- Funds may be allocated for ongoing professional growth programs such as learning management systems and online assessment tools. Technology training may be combined with pedagogical training to ensure that teachers not only know how to use technology but also understand how to use it effectively to enhance student learning.

5- Instead of relying totally on the electricity provided by the state, institutions as well as individuals may opt for an alternate power supply system (like solar or generators) for a shortfall of electricity.

6- HEC may launch authorized user-friendly, low-cost applications in order to minimize the discomfort of the users and enhance their skills.

7- Investment in modern network infrastructure, including high-speed fiber-optic connections for reduced distortion of audio and video systems would be helpful to overcome the barriers.

8- By hiring support staff, the workload of teachers might be re-managed for maximum output.

9- A proper accountability system for teachers and students may help reduce negligence in the teaching and learning process. A proper assessment system may enhance the reliability of the online education process.

10- A proper movie making camera, microphone, and lighting may be provided, along with a well-managed room, while taking online classes from home.

5.6 Recommendations for Future Work

1- In the present study, the incorporation of Web 2.0 technology was explored at public-sector universities. Future research may include private sector universities as well as universities of a particular province.

2- A comparison of the institutions at different levels, like colleges and universities, might be added.

3- This study is limited to teachers only; in the future, the students' perspective might be explored in this regard.

5.7 Limitations

The empirical findings presented here should be viewed in the context of some limitations. First, the data was taken from the university teaching faculty, and the students' point of view was not taken into account. Second, only public-sector universities were chosen for collecting the data, while the comparison of public and private universities might shed light on the instructional use of technology and its potential benefits and challenges. Also, it was a cross- sectional study carried out in a post-pandemic situation that utilized the questionnaire and interviews as data collection techniques. The problem studied had the limitation that the researcher could not include observation. Moreover, data was taken from urban areas, and the areas where internet availability was a problem as such were not included. A comparison of the institutions situated in deprived areas might enhance the strength of the research.

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Appendix A

Fig 3.2

Tool

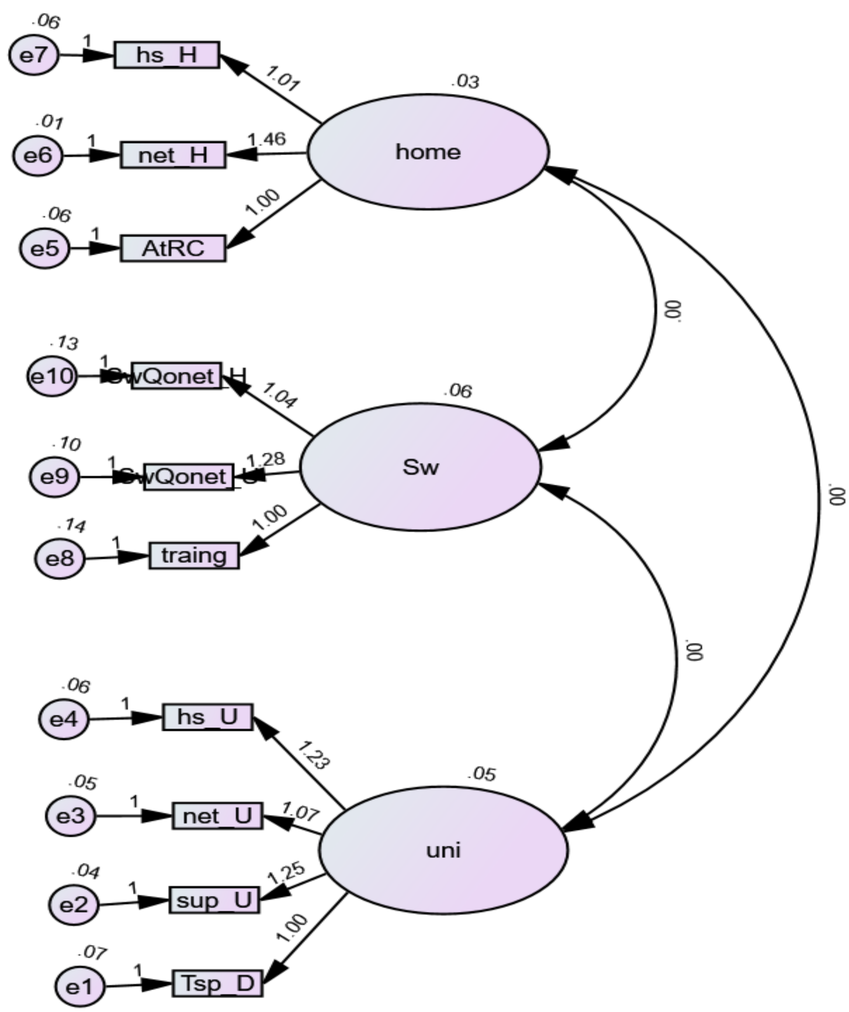


Figure 3.3

TPSA-21

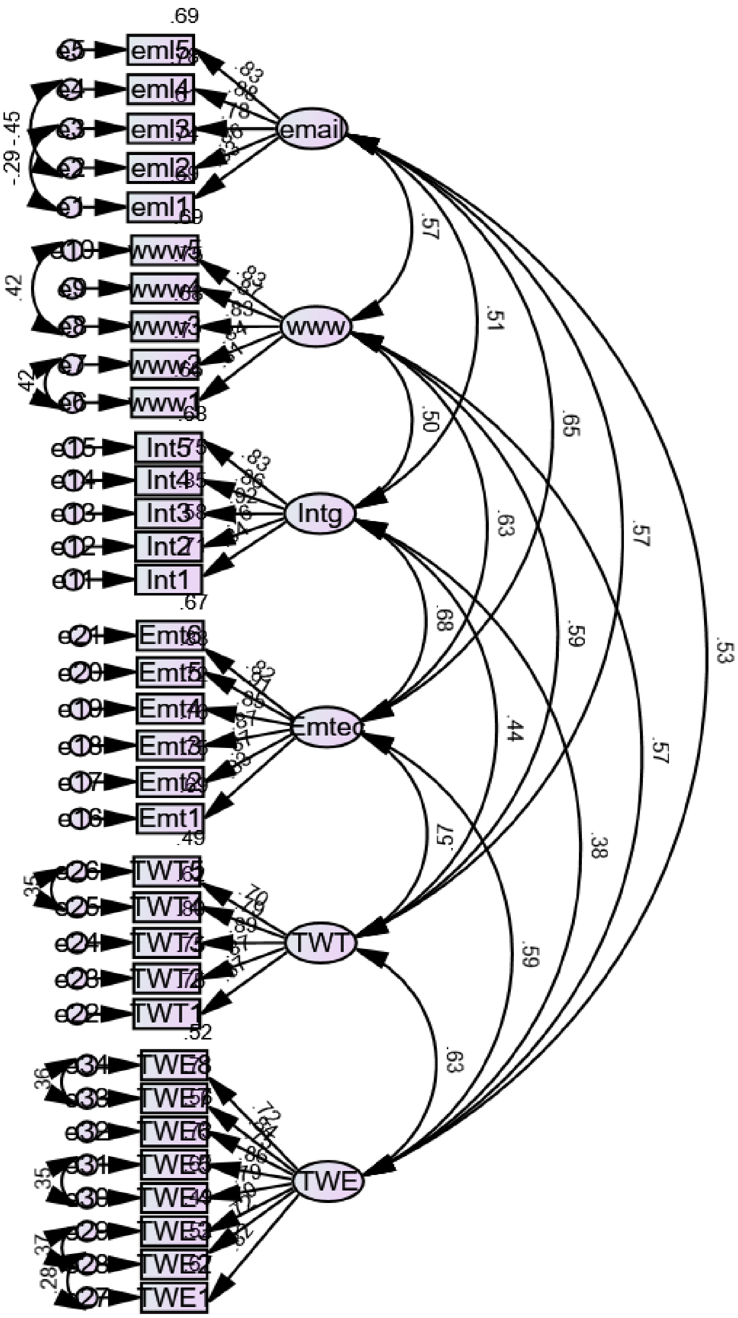
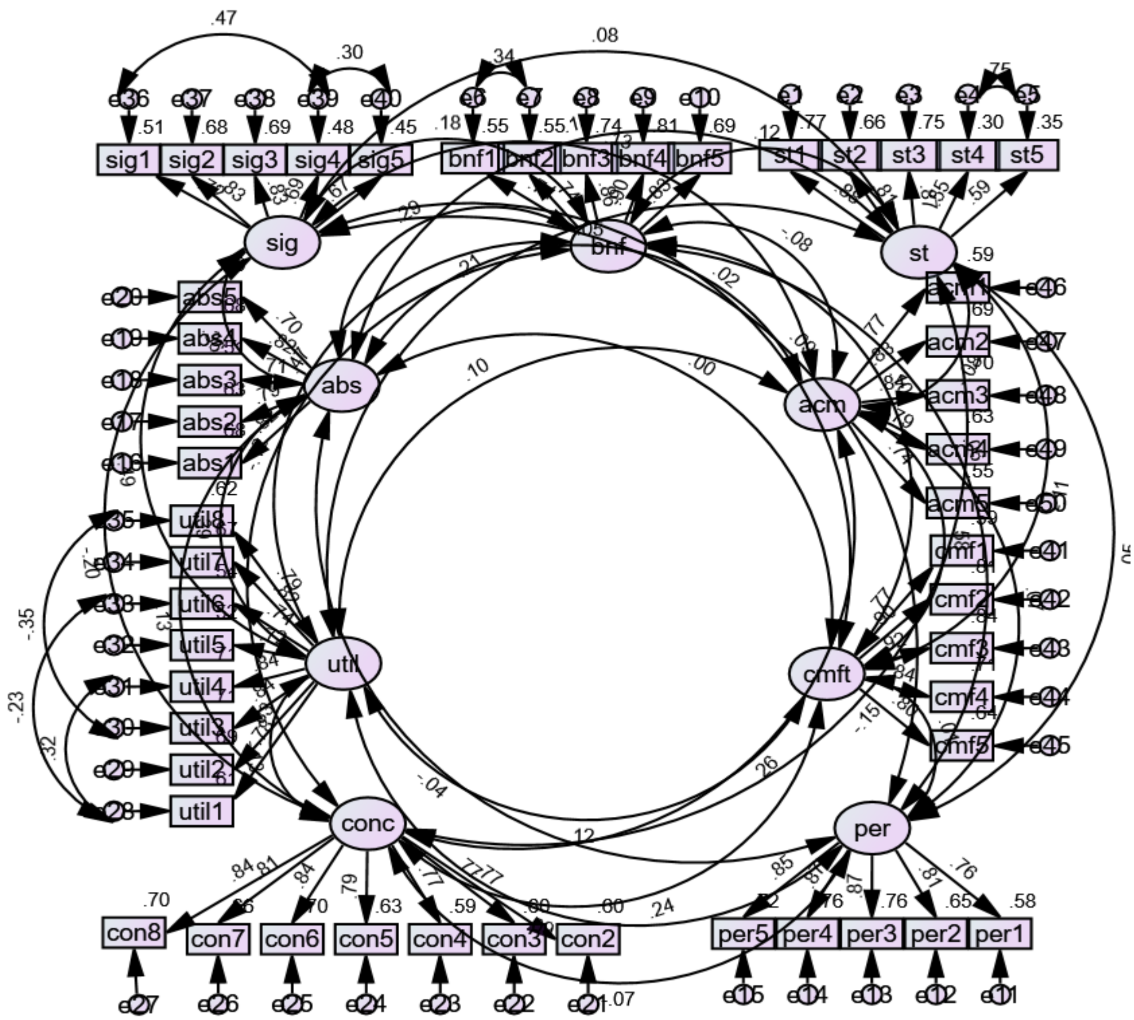


Fig 3.4

TAC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cmf3
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con5
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per2
per1

Appendix B

Survey Questionnaire

COVER LETTER OF QUESTIONNAIRE

Integration of Web 2.0 technology into Instructional Practices at Higher Education: Post Pandemic Situational Analysis.

Dear Respondent,

I am a Ph.D. Scholar at the Department of Education, National University of Modern Languages, Islamabad. I am working on a research thesis topic, “Integration of Web 2.0 technology into Instructional Practices in Higher Education: Post Pandemic Situational Analysis. The questionnaire in hand is to collect data for my Ph.D research work. You are requested to fill in the questionnaire attached. It is assured that your responses will be kept confidential and will not be disclosed to any person or authority. Moreover, the information shall only be used for research purposes.

Farah Rashid
Ph.D. (Education) Scholar
Department of Education,
NUML Islamabad

Section I

Sector: Public … / Private... **Department**: ……………………………. ……

Designation: ……………………………….

Gender: Male … / Female …

Age Group: 20-30 … 31-40 …, 41-50 …, 51➔

Qualifications: ---------------------- No. of ICT enabled classes in the department----------

Experience (in years): ------------- No. of video conferencing rooms in department--------

No. of courses taught online during pandemic: -------------------------

Teaching load (Numbers of hrs per week) --------------------

Preferred Method of Teaching: Conventional … / Computer-based …

Number of hours using the Web daily for student learning: … 0-2hr…. 3-5hrs…, 6-8hrs…, 9-11hrs…, more than 12h…

Section II

Q 1- Usage of ICT/ Web 2.0 tools and applications in COVID 19 Pandemic Era: To what extent following tools and applications of ICT/Web 2.0 (digital programs) have you used during Pandemic period for teaching? Please indicate your response by encircling the most appropriate.

Never=1, Rarely=2, Sometime=3, Often=4, Always=5

S.#	**Web 2.0 tools & Applications**	**Never**	**Rarely**	**Some-times**	**Often**	**Always**
1	Blogs (WordPress)	1	2	3	4	5
2	Wikis	1	2	3	4	5
3	Whatsapp	1	2	3	4	5
4	Facebook	1	2	3	4	5
5	You Tube	1	2	3	4	5
6	Learning Management System (LMS)	1	2	3	4	5
7	Course Management System(CMS)	1	2	3	4	5
8	Google classroom/meet	1	2	3	4	5
9	Zoom	1	2	3	4	5
10	Presentation software (power point etc.)	1	2	3	4	5
11	Google docs	1	2	3	4	5

12	Any other please specify	

Q-3: Reflect your views/opinion regarding Enjoyment and Satisfaction in using technology by using following scale: Strongly Disagree: SD. Disagree: D, Neutral: N, agree: A. Strongly Agree: SA

S.#	Statements	SD	D	N	A	SA
1	I think that working with Web 2.0/ ICT is enjoyable and stimulating.	1	2	3	4	5
2	I want to learn a lot about Web 2.0/ ICT.	1	2	3	4	5
3	The challenge of learning about Web 2.0/ICT is exciting.	1	2	3	4	5
4	I like learning on Web 2.0/ICT.	1	2	3	4	5
5	I can learn many things when I use a Web 2.0/ICT tools.	1	2	3	4	5

Q-4: Express you level of comfort while using the web tools and application.

S.#	Statements	SD	D	N	A	SA
1	I get a sinking feeling when I think of using Web 2.0 tools.	1	2	3	4	5
2	Working with Web 2.0/ICT makes me feel tense and uncomfortable.	1	2	3	4	5
3	Working with Web 2.0/ICT makes me nervous.	1	2	3	4	5
4	Web 2.0/ICT intimidate (threaten) me.	1	2	3	4	5
5	Using Web 2.0 tools is very frustrating.	1	2	3	4	5

Q-5: Express you level of Adoption/ Accommodation of ICT/ Web 2.0

S. #	Statements	SD	D	N	A	SA
1	If I would have a computer I would try to get rid of it	1	2	3	4	5
2	Studying about Web 2.0/ICT tools is a waste of time.	1	2	3	4	5
3	I can't think of any way that I will use Web 2.0 tools in my career.	1	2	3	4	5
4	I will probably never learn to use Web 2.0/ICT tools.	1	2	3	4	5
5	I see Web2.0/ICT as something I will rarely use in my daily life.	1	2	3	4	5

Q-6: Express you level of agreement with the benefits of web 2.0.

S. #	Statements	SD	D	N	A	SA
1	Web 2.0 makes the students feel more involved.	1	2	3	4	5
2	Web 2.0 helps provide a better learning experience	1	2	3	4	5
3	Web 2.0 makes a class more interesting.	1	2	3	4	5
4	Web 2.0 helps the student learn more.	1	2	3	4	5
5	Web 2.0 increases motivation for teaching and learning.	1	2	3	4	5

Q-7: Reflect extent of your Concerns

S#	Statements	SD	D	N	A	SA
1	Web 2.0/ICT are changing the world rapidly	1	2	3	4	5
2	I am afraid that if I begin to use Web 2.0 technologies, I will become dependent upon them.	1	2	3	4	5
3	Web 2.0 technologies dehumanize society by treating everyone as a number.	1	2	3	4	5
4	Our country relies too much on Web 2.0 technologies.	1	2	3	4	5
5	Web 2.0 technologies isolate people by inhibiting normal social	1	2	3	4	5

	interactions among users.					
6	Use of Web 2.0/ICT in education almost always reduces the personal treatment of students.	1	2	3	4	5
7	Web 2.0/ICT has the potential to control our lives.	1	2	3	4	5
8	Working with Web 2.0/ICT makes me feel isolated from the people.	1	2	3	4	5

Q-8: Select level of agreement to indicate the utility of Web 2.0.

S#	Statements	SD	D	N	A	SA
1	Web 2.0/ICT has increased my productivity	1	2	3	4	5
2	Web 2.0/ICT can help me learn	1	2	3	4	5
3	Web 2.0/ICT tools are necessary in both educational and work settings.	1	2	3	4	5
4	Web 2.0/ICT is useful instructional aid in almost all subject areas.	1	2	3	4	5
5	Web 2.0/ICT has improved the overall quality of life.	1	2	3	4	5
6	If there was a multimedia in my classroom it would help me to be a better teacher.	1	2	3	4	5
7	Web 2.0/ICT enhances remedial instruction.	1	2	3	4	5
8	Web 2.0/ICT is improving the quality of education.	1	2	3	4	5

Q-9: Perception: Choose one location in the given continuum between each adjective pair to indicate how you perceive Web 2.0/ICT.

S#	Web 2.0/ICT is								
1	Unpleasant	**1**	**2**	**3**	**4**	**5**	**6**	**7**	Pleasant
2	Suffocating	**1**	**2**	**3**	**4**	**5**	**6**	**7**	fresh
3	Dull	**1**	**2**	**3**	**4**	**5**	**6**	**7**	Exciting
4	Unlikeable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	likeable
5	Uncomfortable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	comfortable

Q-10: Select one level of agreement to indicate the absorption of web 2.0.

S.#	Statements	SD	D	N	A	SA
1	I like to talk to others about Web 2.0/ICT.	1	2	3	4	5
2	It is fun to figure out how Web 2.0/ICT work.	1	2	3	4	5
3	If a problem is left unsolved in a computer class, I continue to think about it afterwards.	1	2	3	4	5
4	I like reading about Web 2.0/ICT.	1	2	3	4	5
5	The challenge of solving the problem with Web 2.0/ICT does not appeal to me.	1	2	3	4	5
6	When there is a problem with the Web 2.0/ICT tools that I can't immediately solve, I stick with it until I have the answer.	1	2	3	4	5

Q-11: What is your level of Significance of ICT/Web2.0.

S.#	Statements	SD	D	N	A	SA
1	It is important for students to learn about Web 2.0/ICT in order to be informed citizens.	1	2	3	4	5

2	All students should have opportunity to learn about Web 2.0/ICT at school.	1	2	3	4	5
3	Students should understand the role Web 2.0/ICT play in society.	1	2	3	4	5
4	Having Web 2.0/ICT skills helps one get better jobs.	1	2	3	4	5
5	Web 2.0/ICT tools could stimulate creativity in students.	1	2	3	4	5

Q-12: Skills: What is your level of agreement about the following Technology related skills

S.#	**Email Skills** I feel confident that I could. . .	**SD**	**D**	**N**	**A**	**SA**
1	Send e-mail to a friend.	1	2	3	4	5
2	subscribe to a discussion list	1	2	3	4	5
3	Create a distribution list" to send e-mail to several people at once.	1	2	3	4	5
4	send a document as an attachment to an e-mail message.	1	2	3	4	5
5	keep copies of outgoing messages that I send to others.	1	2	3	4	5

S#	**WWW Skills** I feel confident that I could. . .	**SD**	**D**	**N**	**A**	**SA**
1	Use an Internet search engine (e.g., Google) to find Web pages related to my subject matter interests.	1	2	3	4	5
2	Search for and find any Web site.	1	2	3	4	5
3	Create my own web page.	1	2	3	4	5
4	Keep track of Web sites I have visited so that I can return to them later. (An example is using bookmarks.)	1	2	3	4	5
5	Find primary sources of information on the Internet that I can use in my teaching.	1	2	3	4	5

S#	**Integrated Application Skills** I feel confident that I could. . .	**SD**	**D**	**N**	**A**	**SA**
1	use a spreadsheet to create a bar graph of the proportions of the different colors of M&Ms in a bag.	1	2	3	4	5
2	create a newsletter with graphics.	1	2	3	4	5
3	save documents in formats so that others can read them if they have different word processing programs (e.g., saving Word, pdf, RTF, or text).	1	2	3	4	5
4	use the computer to create a slideshow presentation	1	2	3	4	5
5	create a database of information about important authors in a subject-matter field.	1	2	3	4	5

S.#	**Emerging Technology Skills** I feel confident that I could. . .	**SD**	**D**	**N**	**A**	**SA**
1	download and listen to podcasts/audio books.	1	2	3	4	5
2	download and read e-books.	1	2	3	4	5
3	download and view streaming movies/video clips.	1	2	3	4	5
4	send and receive text messages.	1	2	3	4	5
5	transfer photos or other data via a smart phone.	1	2	3	4	5

6	save and retrieve files in a cloud-based environment.	1	2	3	4	5

S.#	**Teaching With Technology (TWT)** I feel confident that I could. . .	**SD**	**D**	**N**	**A**	**SA**
1	write an essay describing how I would use technology in my classroom.	1	2	3	4	5
2	create a lesson or unit that incorporates subject matter software as an integral part	1	2	3	4	5
3	use technology to collaborate with teachers or students, who are distant from my classroom.	1	2	3	4	5
4	describe 5 software programs or apps that I would use in my teaching.	1	2	3	4	5
5	write a plan with a budget to buy technology for my classroom	1	2	3	4	5

S. #	**Teaching With Emerging Technology (TWET)** I feel confident that I could. . .	**SD**	**D**	**N**	**A**	**SA**
1	integrate mobile technologies into my curriculum.	1	2	3	4	5
2	use social media tools for instruction in the classroom. (e.g., Facebook, Twitter, etc.)	1	2	3	4	5
3	create a wiki or blog to have my students collaborate.	1	2	3	4	5
4	use online tools to teach my students from a distance.	1	2	3	4	5
5	teach in a one-to-one environment in which the students have their own device.	1	2	3	4	5
6	find a way to use a smart phone in my classroom for student responses.	1	2	3	4	5
7	use mobile devices to connect to others for my professional development.	1	2	3	4	5
8	use mobile devices to have my students access learning activities	1	2	3	4	5

Q13- CBAM-LEVEL OF USE

Instruction: Please, read the descriptions of each of the six levels related to adoption and use of technology for instruction. Then tick (√) the stage you best fit into. Please, **select only one level**.

Levels	**I best fit in**
Level 0 Non-use I have little or no knowledge of information technology in education, no involvement with it, and I am doing nothing toward becoming involved.	
Level 1 Orientation I am seeking or acquiring information about information technology in education.	
Level 2 Preparation I am preparing for the first use of information technology in education.	
Level 3 Mechanical Use I focus most effort on the short-term, day-to-day use of information technology with little time for reflection. My effort is primarily directed toward mastering tasks required to use the information technology.	
Level 4 A Routine I feel comfortable using information technology in education. However, I am putting forth little effort and thought to improve information technology in education or its	

consequences.	
Level 4 B Refinement I vary the use of information technology in education to increase the expected benefits within the classroom. I am working on using information technology to maximize the effects with my students.	
Level 5 Integration I am combining my own efforts with related activities of other teachers and colleagues to achieve impact in the classroom.	
Level 6 Renewal I reevaluate the quality of use of information technology in education; seek major modifications of, or alternatives to, present innovation to achieve increased impact, examine new developments in the field, and explore new goals for myself and my school or district.	

Stages of Adoption of Technology

Instructions: Please read the descriptions of each of the six stages related to adoption of technology. **Tick only one stage** that best describes where you are in the adoption of technology.

Stages	**I best fit into**
Stage 1: Awareness I am aware that technology exists but have not used it–perhaps I'm even avoiding it.	
Stage 2: Learning the process I am currently trying to learn the basics. I am often frustrated using computers. I lack confidence when using computers.	
Stage 3: Understanding and application of the process I am beginning to understand the process of using technology and can think of specific tasks in which it might be useful	
Stage 4: Familiarity and confidence I am gaining a sense of confidence in using the computer for specific tasks. I am starting to feel comfortable using the computer.	
Stage 5: Adaptation to other contexts I think about the computer as a tool to help me and am no longer concerned about it as technology. I can use it in many applications and as an instructional aid.	
Stage 6: Creative application to new contexts I can apply what I know about technology in the classroom. I am able to use it as an instructional tool and integrate it into the curriculum.	

ACOT: What would you estimate to be your current level of understanding and use of technology? Select **only one level** from list below:

Levels	**I best fit into**

ACOT 1: Entry I am trying to learn the basics of using technology	
ACOT 2: Adoption I can successfully use technology on a basic level (e.g., use drill and practice software in classroom instruction).	
ACOT 3: Adaptation I am discovering technology's potential for increased productivity (e.g., use of word processors for student writing).	
ACOT 4: Appropriation I can use technology "effortlessly" as a tool to accomplish a variety of instructional and management goals.	
ACOT 5: Invention I am prepared to develop entirely new learning environments that utilize technology as a flexible tool.	

III-Checklist

Q14-To what extent following resources are available to you? Not at all = 1, rarely = 2, sometimes = 3, Often = 4, Always = 5

Sr. no	**Resources**	No	yes
1	Hardware/ software access at home	1	2
2	Hardware/ software access at university	1	2
3	Internet connectivity at home	1	2
4	Internet connectivity at university	1	2
5	Access to the relevant content	1	2
6	Adequate training to use the technology	1	2
7	Support from university administration	1	2
8	Technical support from IT department	1	2
9	Satisfaction with the quality of net at home		
10	Satisfaction with the quality of net at university		

Q15- Barriers: To what extent do you agree about the following barriers related to Web2.0 as per scale key?

Sr. no	**Barriers**	Not at all	Rarely	Some times	Often	Always
1	Required level of knowledge	1	2	3	4	5
2	Poor quality of internet	1	2	3	4	5
3	Unspecified evaluation/assessment strategies	1	2	3	4	5
4	Electricity issues	1	2	3	4	5
5	Lack of capacity or willingness of	1	2	3	4	5

	teachers to adapt					
6	Focus on technical aspect of technology than content	1	2	3	4	5

IV-Open ended Questions

Q1. In your opinion what are the major challenges and problems being faced by the university teachers regarding integration of Web 2.0 into instruction?

Q2. Please suggest some measures to improve integration of Web 2.0 into instruction in institution of higher learning?

Thanks for your cooperation.

Interview protocol

Will

Q1-How did you respond (feel) to the change in teaching learning process during pandemic, negative or positive? Did your institution help in order to deal with such feelings/ reinforce or to change them?

Q2- How confident you feel while working with technology in your teaching?

-What are the reasons behind?

-Did your institution contribute to your confidence?

Skill

Q1-Do you think you have the necessary skills to integration Web 2.0 technology in your educational practice? - How did your institution help in stimulating the improvement of the required skills?

Q2- Why there is need for enhancement of skills?

Tool

Q1-Does there enough availability of technology at your institution? Do you have better technology and internet facilities at home?

Pedagogy

Q1-What method of teaching (conventional, student centered) is being followed in your institution? Is there any instruction from the institution for following a particular instructional method?

Q2- What is the right way to use ICT/ Web 2.0 for pupils learning from your point of view? In your opinion what should be the teacher's role in an ICT integrated classroom?

Technology integration

Q1-Which technology did you use for being in contact with the students during the Pandemic?

Q2- At what level of technology proficiency do you consider yourself low, medium or high?

Q3- Explain some **challenges** faced by you while integrating the technology?

Q4- How integration of Web 2.0 can be improved into instruction at institution of higher learning?

Q5- Questions are asked about your attitude, skill, tool and pedagogy. In your opinion which of these is most important in technology integration at higher education level?

Appendix C

Permission Letter

Inbox

Farah Rashid **<farashid40@gmail.com>** Sat, Nov 27, 2021, 3:00 PM

to rhonda.christensen

Hi, hopefully, this email finds you in good health. My name is Farah Rashid a Ph.D. scholar at NUML (National University of Modern Languages) Islamabad Pakistan. I am working on my Dissertation "*INTEGRATION OF WEB 2.0 TECHNOLOGY INTO INSTRUCTIONAL PRACTICES AT HIGHER EDUCATION LEVEL:*
POST PANDEMIC SITUATIONAL ANALYSIS". I want to use your model of will skill tool pedagogy as a framework and I require your permission for your questionnaire to use in my study with a few changes in it. Please let me use your questionnaire referred to in the model testing.
looking for your kind response.
Regards

Gerald Knezek **<gknezek@gmail.com>** Nov 28, 2021, 9:23 AM

to Rhonda, me, Gerald

Greetings Farah,

Please let us know which questionnaire specifically you are referring to RE:

I want to use your model of will skill tool pedagogy as a framework and I require your permission for your questionnaire to use in my study with a few changes in it. Please let me use your questionnaire referred to in the model testing.

We have many instruments linked at iittl.unt.edu and I am not certain which one you are seeking permission to use (and modify).

We would normally grant permission for use, with the stipulation that you list the authors on the instrument (for credit) when it is administered. However, in this case I am not sure of the details of your request. Also, you would need to re-validate for your local environment if you modify the instrument, but that is not necessarily a problem from our side. Primarily the citation would change to something like:

Adapted from Christensen & Knezek, ?(Remainder of citation here)

Perhaps you can list the journal article (bibliographic citation) to which you are referring; and please send us a screen print of the instrument (first page) you wish to use.

Thanks,
Gerald Knezek

On Sat, Nov 27, 2021 at 9:59 AM Christensen, Rhonda <Rhonda.Christensen@unt.edu> wrote:
I am cc'ing Gerald Knezek as he is the first author.
Best,
Rhonda Christensen

****

Rhonda W. Christensen, Ph.D.
Research Professor

NSF Research on Emerging Technologies for Teaching and Learning (RETTL) PI
NASA Education Space Science Consortium (NSSEC) Co-PI
Co-Director, Institute for the Integration of Technology into Teaching and Learning (IITTL)
University of North Texas
Consultative Council Associate Chair, Society for Information Technology in Teacher Education (SITE)
Email: rhonda.christensen@gmail.com
Project Web: www.iittl.unt.edu

Farah Rashid **<farashid40@gmail.com>** Mon, Nov 29, 2021, 5:18 AM

to Gerald

Hi, thank you for your kind response. Actually, I want to use your Will Skill Tool Pedagogy model and the questionnaires mentioned in the article namely *'Extending the will, skill, tool model of technology integration: adding pedagogy as a new model construct" (2016).* The instruments are
1- TAC (6.1) (Christensen and Knezek 2009)
2-Proficiency Self-Assessment Questionnaire TPSA C21 (2014)
3- Stages of Adoption, and CBAM LoU
The changes I want to make are that in some places instead of the word computer I will use the word Web 2.0 tools or technology. The reason is that my study is related to Web 2.0 tools. The Construct related to email in TAC 6.1 will also be replaced by the word Web 2.0 tools or technology. The analysis will surely be done for my circumstances. Hopefully, you will allow me to do this. Sending you the first pages as an attachment.
Regards
Farah

Gerald Knezek **<gknezek@gmail.com>** Sun, Nov 28, 2021, 8:42 PM to Rhonda, me

Greetings Farah,

Thank you for the clarification of instruments and scales.

1. We grant you permission to use the Will Skill Tool Pedagogy Model in your study. Thank you for the courtesy of asking but please know that it is usually only necessary to cite published models in a thesis or dissertation work.

2. Regarding the instruments you plan to use in your research, it normally IS expected (by scholarly convention) that you request the authors' permission. I grant this permission for my part as well, but refer back to Dr. Christensen for the final joint approval since she is first author on most of the actual instruments you plan to use.

3. The substitutions you propose seem reasonable to me; probably you can simply reconfirm the Alphas for the modified scales after your data are gathered.

4. Remember that we only ask that:

a) You cite the authors (Adapted from TAC 6.1 by Christensen & Knezek ....) etc.; you can find these citations linked on copies of the instruments at iittl.unt.edu, click on Instruments; And
b) You send us an abstract/summary of the results of your research.

Good luck on your project!

Gerald Knezek

Rhonda Christensen **<rhonda.christensen@gmail.com>** Tue, Nov 30, 2021, 12:02 AM

to Gerald, RhondaUNT, me

Dear Farah,
Yes, I agree with Dr. Knezek's statements of use.
Rhonda Christensen

Appendix D

Approval letter

NATIONAL UNIVERSITY OF MODERN LANGUAGES
FACULTY OF SOCIAL SCIENCES
DEPARTMENT OF EDUCATION

ML.1-4/2020/Edu

Dated: 30-07-2020

To: **Farah Rashid,**
773-Ph.D/Edu/F18

Subject: **APPROVAL OF Ph.D THESIS TOPIC AND SUPERVISOR**

1. Reference to Letter No, ML.1/2/2020-Edu, dated 06-07-2020, the Higher Authority has approved the topic and supervisor on the recommendation of Faculty Board of Studies vide its meeting held on 14th May 2020.

a. Supervisor's Name & Designation
Dr. Sajid Ali Yousafzai (Contract)
Assistant Professor,
Department of Education, NUML, Islamabad.

b. Topic of Thesis
"Integration of web 2.0 technology into instructional practices at higher education level: post pandemic situational analysis."

2. You may carry out research on the given topic under the guidance of your Supervisor and submit the thesis for further evaluation within the stipulated time. It is inform you that your thesis should be submit within described period by **31 August 2023** positively for further necessary action please.

3. As per policy of NUML, all MPhil/PhD thesis are to be run on turnitin by QEC of NUML before being sent for evaluation. The university shall not take any responsibility for high similarity resulting due to thesis run from own sources.

4. Thesis are to be prepared strictly on NUML's format that can be had from (Coordinator, Department of Education)

Telephone No: 051-9265100-110 Ext: 2090
E-mail: ftabassum@numl.edu.pk

30/07/20
Dr. Marium Din
A/Head,
Department of Education

Distribution: Ms. Farah Rashid (Ph.D Scholar)

Dr. Sajid Ali Yousfazai (Thesis Supervisor)

Appendix E

Change of supervisor

NATIONAL UNIVERSITY OF MODERN LANGUAGES
FACULTY OF SOCIAL SCIENCES
DEPARTMENT OF EDUCATION

M.L.1-3/Edu/2021

Dated: 02-07-2021

To: Farah Rasheed,
773/PhD/Edu/F-18

Subject: **Approval of Change of Supervisor**

1. The Competent Authority has approved the removal of Dr. Sajid Ali Yousafzai from the responsibility of supervisor and assigned of Dr. Aisha Bibi as a new supervisor on the recommendation of Faculty Board of Studies vide its meeting held on 04-05-2021 and Board of Advanced Studies and Research dated 02-06-2021.

2. You may continue your research work on the given topic under the guidance of your supervisor submit the thesis for evaluation within the stipulated time. It is to inform you that your thesis should be submitted within described period by 31st August 2023 positively for further necessary action please.

3. As per policy of NUML, all MPhil/PhD thesis are to be run on turnitin by QEC of NUML before being sent for evaluation. The university shall not take any responsibility for high similarity resulting due to thesis run from own sources.

4. Thesis is to be prepared strictly on NUML's format that can be taken from Coordinator, Department of Education.

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Dr. Wajeeha Shahid
Head,
Department of Education

CC:

Dr. Aisha Bibi
Ms. Farah Rasheed

Appendix F

Validity of Questionnaire

Certificate for Tool Validation

CERTIFICATE OF VALIDITY

(Integration of web 2.0 technology into instructional practices at higher education level: post pandemic situational analysis)

NATIONAL UNIVERSITY OF MODERN LANGUAGES

INTEGRATION OF WEB 2.0 TECHNOLOGY INTO INSTRUCTIONAL PRACTICES AT HIGHER EDUCATION LEVEL: POST PANDEMIC SITUATIONAL ANALYSIS

By Ms. Farah Rashid

PhD Scholar, Department of Education National University of Modern Languages, Islamabad, Pakistan

It is hereby certified that the tool Teachers' Attitudes Toward Computers TAC (6.1) by Christensen and Knezek(2009), Technology proficiency self assessment scale C21 (TPSA-C21) developed by (Christensen and Knezek 2017) Apple Classrooms of Tomorrow (ACOT) survey (Dwyer et al. 1989), Stages of Adoption of Technology (Stages) by Christensen (2002), Concerns-Based Adoption Model Level of Use (CBAM LoU) by Hall et al. (1975). adapted by the scholar for her research topic "Integration of web 2.0 technology post pandemic into instructional practices at higher education level: situational analysis" has been assessed and it is found appropriate for the data collection process. All the items in the tool are meeting the objectives and addressing the research question and research hypothesis. Face and content validity are also assured, and it may be used by the researcher for the data collection process.

Name Dr. Jameela Ashraf

Designation Assistant Professor

Institute NUML, Islamabad

Signature

Date 26-01-2022.

Certificate for Tool Validation

CERTIFICATE OF VALIDITY

(Integration of web 2.0 technology into instructional practices at higher education level: post pandemic situational analysis)

INTEGRATION OF WEB 2.0 TECHNOLOGY INTO INSTRUCTIONAL PRACTICES AT HIGHER EDUCATION LEVEL: POST PANDEMIC SITUATIONAL ANALYSIS

By Ms. Farah Rashid

PhD Scholar, Department of Education National University of Modern Languages, Islamabad, Pakistan

It is hereby certified that the tool Teachers' Attitudes Toward Computers TAC (6.1) by Christensen and Knezek(2009), Technology proficiency self assessment scale C21 (TPSA-C21) developed by (Christensen and Knezek 2017) Apple Classrooms of Tomorrow (ACOT) survey (Dwyer et al. 1989), Stages of Adoption of Technology (Stages) by Christensen (2002), Concerns-Based Adoption Model Level of Use (CBAM LoU) by Hall et al. (1975). adapted by the scholar for her research topic "Integration of web 2.0 technology post pandemic into instructional practices at higher education level: situational analysis" has been assessed and it is found appropriate for the data collection process. All the items in the tool are meeting the objectives and addressing the research question and research hypothesis. Face and content validity are also assured, and it may be used by the researcher for the data collection process.

Name Dr Farkhanda Tabassum

Designation AP

Institute NUML Islamabad.

Signature [illegible]

Date 26-1-22

Appendix G

Validity of Interview protocol

UNIVERSITY OF EDUCATION, ATTOCK CAMPUS
DEPARTMENT OF EDUCATION

TO WHOM IT MAY CONCERN

Subject: Validation of Interview Protocols / Questions

It is to certify that I have participated in the content validation of the interview protocols / questions developed by Farah Rashid, Reg # 773-Ph.D/Edu/F18, for her PhD thesis titled "Integration of Web 2.0 technology into Instructional Practices in Higher Education: Post Pandemic Situational Analysis". It is apprised that the interview protocols are suitable for data collection for the issue in question. The PhD scholar may collect data with fair amount of confidence on the above mentioned protocol.

Name: Shafqat Ali Khan

Designation: Assistant Professor

Institute: University of Education

Signature: Shafqat

Assistant Professor
University of Education
Attock Campus

Appendix H

Training Manual: Empowering University Teachers with Web 2.0 Technology

Overview and objectives

The training module "Empowering University Teachers with Web 2.0 Technology" seeks to provide university instructors the know-how, abilities, and innovative outlook they need to successfully incorporate web 2.0 technology into their pedagogical approaches. After completing this extensive program, participants will acquire a thorough grasp of the development and effects of Web 2.0 technology on education, realizing how it may improve learning results and student engagement. This will help to set the path for specific improvements and increased tech competency. Teachers may create personal objectives for continued Web 2.0 technology integration and continue their learning journey independently with access to a well-chosen collection of online resources, courses, and communities. This training program aims to improve university instructors' technical proficiency while also encouraging a proactive and innovative attitude to using web 2.0 technologies to improve the quality of teaching and learning.

Schedule

Here's a suggested outline for the module:

Title: Empowering University Teachers with Web 2.0 Technology	
Modules	**Work on the platform**
Module 1: Introduction to Web 2.0 Technology **(2 hours)**	**Understanding Web 2.0:** Describe the idea of Web 2.0 technology, its development, and how it affects learning. Talk about the benefits and difficulties of using Web 2.0 technologies in the classroom.
Module 2: Identifying Comfort Zones (1 hour)	**Self-Assessment:** Encourage educators to consider how they currently use and feel about technology. Lead a conversation in which educators relate their struggles and experiences.
Module 3: Exploring Popular Tools (2 hours)	**3.1 Google Meet and WhatsApp:** Examine how these technologies are used, highlighting how they may be used for interactive

	communication and instruction. **3.2 Hands-On Practice:** Give a comprehensive lesson on how to use Google Meet and the WhatsApp's more advanced functions for learning.
Module 4: Beyond the Basics **(2 hours)**	**4.1 Creative Integration:** Motivate educators to come up with creative ways to incorporate these resources into their lessons. **4.2 Group Activity:** Divide teachers into smaller groups and give particular circumstances to brainstorm innovative ways to use the resources.
Module 5: Exploring Less Popular Tools (2 hours)	**5.1 Introduction to Blogs:** Describe the advantages of blogs for learning and how they might improve instruction. **5.2 Blogging Platforms:** Explore several blogging systems and give participants practical experience starting and running a blog.
Module 6: Integrating Blogs Creatively (2 hours)	**6.1 Blogging Strategies:** Talk about diverse blog usage tactics for various subject areas. **6.2 Blogging Workshop:** Permit educators to launch their personal blogs and try to writing and sharing material.
Module 7: Becoming Self-Sufficient (1 hour)	**7.1 Self-Learning Resources:** Give instructors access to a list of online groups, courses, and resources so they can keep learning. Motivate educators to make personal objectives for using Web 2.0 technologies in their instruction.
Module 8: Assessment and Certification (1 hour)	**8.1 Final Projects:** Request that educators develop a project or lesson plan that uses Web 2.0 technologies. **8.2 Evaluation**: Evaluate and comment on the

	completed projects. **8.3 Certification**: Provide a certificate of completion to those who finish successfully.
Module 9: Ongoing Support (1 hour)	**9.1 Community Building:** Encourage educators to become members of a Web 2.0 education community or group on the Internet. **9.2 Q&A Session:** Organize a live Q&A session with attendees to clear up any lingering ambiguities or queries.
Module 10: Reflection and Future Planning (1 hour)	**10.1 Reflection:** Ask educators to consider their own educational experiences and offer their perspectives. **10.2 Action Plans:** Help educators develop plans of action for ongoing enhancement in the incorporation of Web 2.0 technologies.

To guarantee active participation, the module will priorities group discussions, practical application, and hands-on activities. For additional learning, there will be articles, case studies, and video lessons available.

Benefits

Developing a module centered around providing Web 2.0 technologies to university instructors can have several advantages and improve learning in general. These are few possible benefits:

1- The module aims to enhance university teachers' understanding of Web 2.0 technology, promoting advanced hands-on practice and enhancing their technological proficiency.

2- Web 2.0 platforms offer a vast array of educational materials, enabling teachers to enhance the quality of education by incorporating interactive information and current resources into their teaching modules.

3- The provision of self-learning resources, continuous support, and encouragement fosters a culture of continuous learning among university teachers, crucial for staying updated in the rapidly evolving educational technology landscape.

4- The module encourages online community building, fostering a network of educators for support, collaboration, and sharing best practices.

5- The module facilitates ongoing professional growth for teachers by incorporating technology, instructional approaches, and educational trends through webinars, workshops, and collaborative projects, ensuring their effectiveness and knowledge.

6- Web 2.0 technology enables teachers to create flexible, customized learning experiences by utilizing resources like online assessment platforms, virtual classrooms, and learning management systems, catering to diverse student learning styles.

Note: This module is based on the study findings and the samples and information can be customized to meet the unique requirements and tastes of university instructors.