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Impact of Students' Ubiquitous Learning through Web 2.0 Tool on Students' 21st Century Skills: Critical Thinking and Collaboration

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Abstract

Ubiquitous learning is transforming education by enabling human-focused learning through seamless access to resources from anywhere. In addition, these tools enhance context understanding and make it easy to interact between real and digital learning resources, all while offering individualized learning opportunities. This research surveyed public sector university teachers in the Sindh and Punjab provinces of Pakistan to gather their opinions on how Web 2.0 tools and ubiquitous learning are affecting the development of 21st-century learning skills in students. The research aimed to assess the impact of Web 2.0 tools for ubiquitous learning (UL) on the critical thinking and collaboration skills of graduate-level students. To collect data, the study administered a self-developed questionnaire with 50 items rated on a 7-point Likert-type scale to 500 university teachers. This constituted the primary data for the research. According to the findings, ubiquitous learning has a noteworthy effect on fostering critical thinking and collaboration skills in university students. To make ubiquitous learning successful, both private and public sector universities must have adequate ICT infrastructure and provide teacher training that focuses on ICT-based teaching methods. The study can assist university teachers in establishing a ubiquitous learning (UL) environment that employs web 2.0 tools, thereby enabling students to effectively enhance their 21st-century learning skills, including critical thinking and collaboration.

Keywords: Personalized Learning, Web 2.0, Collaboration Skills, Ubiquitous Learning, Critical Thinking Skills.

Introduction

U-learning systems foster an interactive learning environment that facilitates student-teacher communication whenever necessary. These systems also provide learning activities that enhance the student's skills and understanding. By promoting technology-integrated learning, U-learning helps teachers develop 21st-century skills: collaboration and critical thinking. Web 2.0 is a term that describes the current state of the internet, which has shifted towards allowing users to generate more content and enjoy greater utility compared to the previous version. The term was coined in 1999 when the internet began becoming more interactive and engaging for users. Web applications, self-publishing platforms such as Wiki, and social media sites like Facebook, Twitter, and countless blogs emerged as a result of Web 2.0. These platforms have transformed the way information is shared and delivered, and social media has enabled users to interact and engage with each other by sharing their thoughts, perspectives, and opinions. On these platforms, users can tag, share, tweet, and like content, among other things (Urooj, & Farooq, 2023).

The draft National Educational Technology Plan 2010 suggests the need for adopting new techniques of evaluation that give detail about the evolving learner experience: Various technology and information literacy frameworks have been developed globally, nationally, and locally to provide a set of standards for curriculum reforms. These frameworks aim to establish benchmarks for the outcomes of technology and information literacy education.

The term "ubiquitous learning" describes a personalized learning environment that utilizes the features of "web 2.0" learning resources and ubiquitous computing. This approach differs from traditional learning contexts, such as the Internet, desktop computers, and multimedia classrooms. In the current era of ubiquitous computing, the personalized ecological learning context is a ubiquitous network where two or more participants engage in collaborative learning scenarios using intelligent

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learning resources. This approach enables differentiated and individualized learning experiences that cater to each student's knowledge structure needs, as opposed to a fixed, uniform curriculum and mandatory classroom teaching. As computing technology has entered the ubiquitous computing era, forming a ubiquitous network, this approach has been integrated into the teaching field, and academia has introduced the concept of ubiquitous learning. This study aims to analyze the impact of ubiquitous learning on the development of critical thinking and collaboration skills, which are essential 21st-century learning skills. The research specifically focuses on how U-learning can help teachers incorporate technology into teaching and learning processes to develop these skills among university students in Pakistan. The ultimate goal is to contribute to the betterment of Pakistan's economy and society, as well as globally.

Objectives of the Study:

1. Find out the impact of ubiquitous learning environments at higher levels on students' critical thinking & collaboration skills.
2. Analyze the critical thinking & collaboration skills among students when engaging in Web 2.0 tools.
3. Investigate the effectiveness of Web 2.0 technology tools to develop the ubiquitous learning environment at a higher level.
4. Determine how the use of Web 2.0 tools for ubiquitous learning affects the development of 21st-century skills among students.
5. Analyze the importance of critical thinking & collaboration skills.
6. Evaluate the importance of Web 2.0 tools in education settings.

Research Hypothesis:

H0: There is no significant impact of using Web 2.0 tools for ubiquitous learning on students' critical thinking skills.

H1: There is a significant impact of using Web 2.0 tools for ubiquitous learning on students' critical thinking skills.

H0: There is no significant impact of using Web 2.0 tools for ubiquitous learning on students' collaboration skills.

H2: There is a significant impact of using Web 2.0 tools for ubiquitous learning on students' collaboration skills.

Research Questions of the Study:

1. How does the use of Web 2.0 tools for ubiquitous learning affect the development of 21st-century skills among students?
2. Is there a significance of critical thinking and collaboration skills for students in the current educational context?
3. How do web 2.0 tools in education settings help to develop a Ubiquitous learning environment?

Statement of the problem

The study aims to examine the impact of a ubiquitous learning environment at a higher level on students' critical thinking & collaboration skills. It also analyzes the critical thinking and collaboration skills among students when engaging in Web 2.0 tools. It further investigates the effectiveness of Web 2.0 technology tools in developing the ubiquitous learning environment at higher level, determine how the use of Web 2.0 tools for ubiquitous learning affects the development of 21st-century skills among students, analyze the importance of critical thinking & collaboration skills, and evaluate the importance of Web 2.0 tools in education settings.

Significance of the study

The study is significant for the students who are involved in self-learning through e-learning. It is also helpful for teachers to gain knowledge about any topic through e-learning. Students and teachers at the university level need to be informed about 21st-century skills, particularly critical thinking and collaboration.

Figure 1

Conceptual Framework

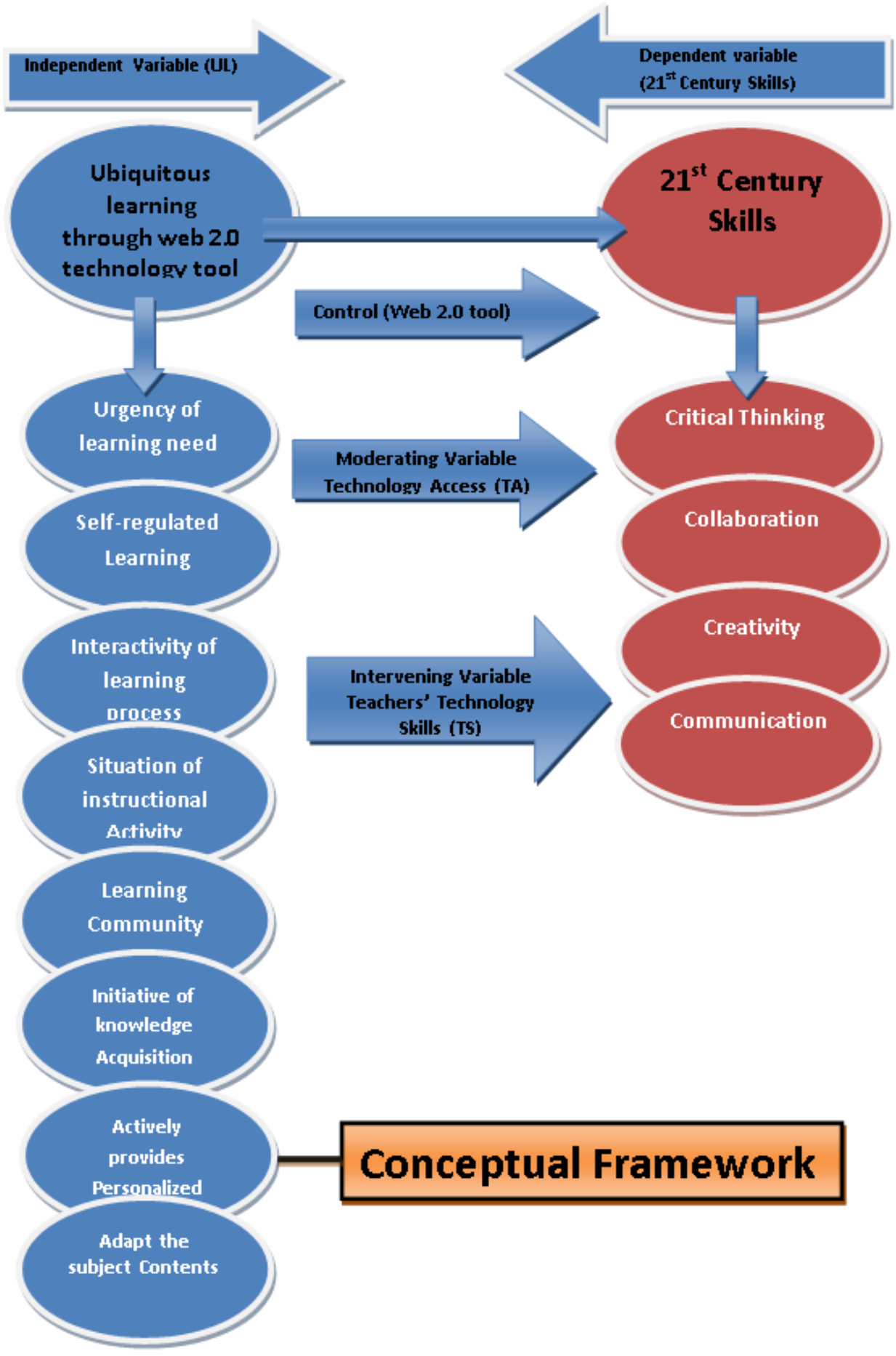
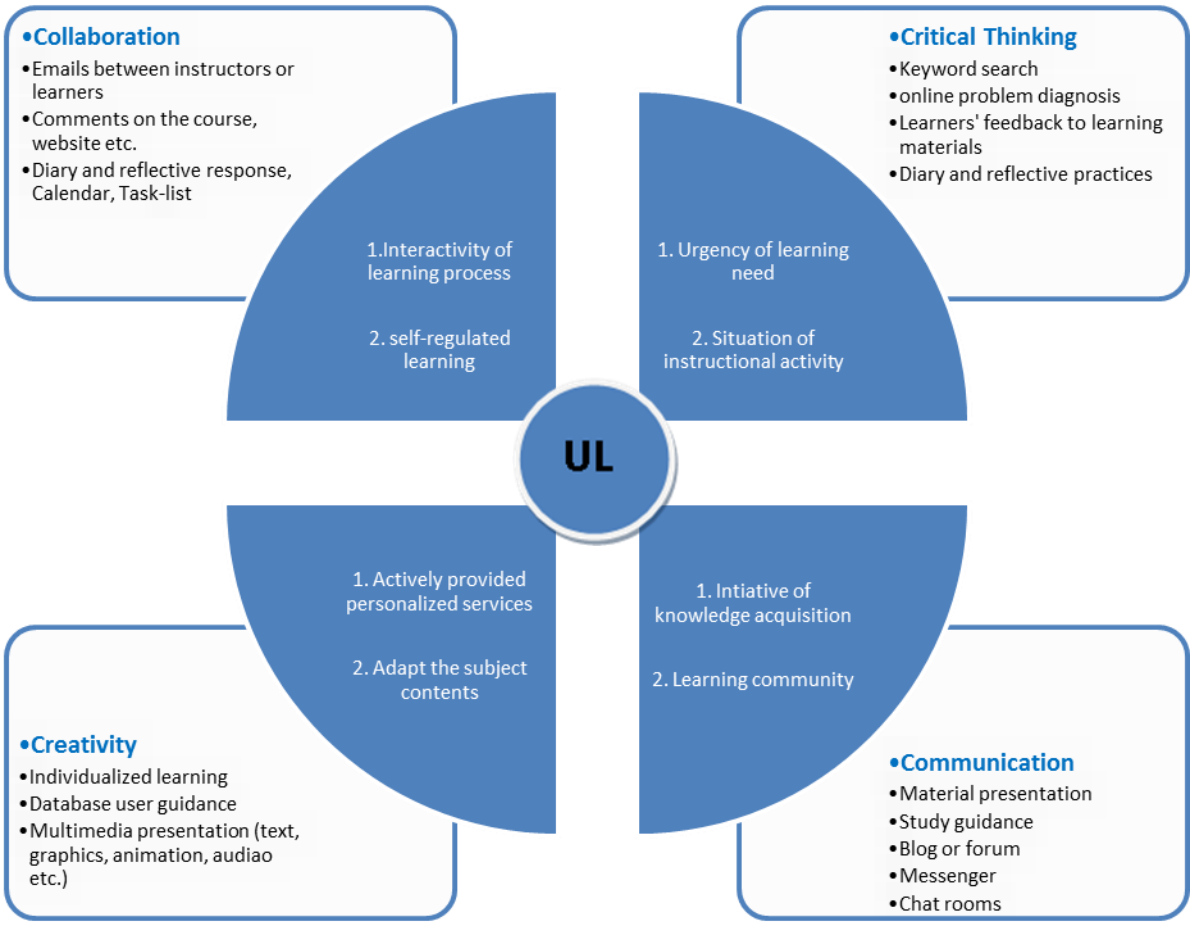

Independent Variable (UL)
Dependent variable (21st Century Skills)
Ubiquitous learning through web 2.0 technology tool
21st Century Skills
Control (Web 2.0 tool)
Urgency of learning need
Moderating Variable Technology Access (TA)
Critical Thinking
Self-regulated Learning
Collaboration
Interactivity of learning process
Creativity
Intervening Variable Teachers' Technology Skills (TS)
Situation of instructional Activity
Communication
Learning Community
Initiative of knowledge Acquisition
Actively provides Personalized
Conceptual Framework
Adapt the subject Contents

Figure 2

Development of 21st century 4Cs learning skills through ubiquitous learning environment



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Review of Literature

Theoretical Foundation:

The study is based on connectivism and online collaborative learning theory, which acknowledge the impact of Internet technology on learning. Connectivism, introduced by George Siemens in 2004, recognizes the shift in the way knowledge and information are shared through vast data communication networks. Linda Harasim's theory (OCL) suggests that the Internet can be utilized to facilitate collaborative learning and knowledge construction. It also proposes that the use of the Internet can transform education in the knowledge age, including both formal and informal settings. Siemens and Harasim in 2012 agreed on the advantages of shifting education to the internet and implementing networked education on a large scale.

Ubiquitous learning:

UL is typically well-defined as learning that is context-aware and can cater to the personalized learning needs of individuals, enabling them to learn anytime and anywhere (Ramaprasad, 2009). Notwithstanding this common thread, there are numerous and diverse definitions of ubiquitous learning. Jones and Jo (2004) take the view that ubiquitous learning permits total immersion by students in their learning environment. The integration of ubiquitous tools and their utilization for educational purposes leads to the expansion of the traditional e-learning model into a new concept known as mobile learning or, consequently, ubiquitous learning. Motiwalla (2007), the widespread availability of m-devices has a significant influence on everyday learning behavior in higher education.

According to Terry T. Kidd (2011, P. 138), Zhan and Jin (2005) outlined five parameters that define **u-learning,** which are: ***u-Contents, u-Environment, u-Behavior, u-Interface, and u-Service.***

A ubiquitous learning environment (ULE) is an educational setting where learning occurs seamlessly and pervasively, often without the learner being aware of the process. This is made

possible by ubiquitous sources of information and embedded devices. Ubiquitous computing extends beyond connecting people across distances and time, as it also combines physical and virtual spaces and integrates computing into public and social spaces through portable devices. In the realm of education, it is important to recognize that learning activities increasingly occur online and that learners can access information on a wide range of topics. This means that anyone can experience learning, regardless of their location or background. Therefore, According to Cope and Kalantzis (2009), the definition of ubiquitous learning needs to be expanded to incorporate the concept of knowledge creation and construction.

Ubiquitous learning is a learning paradigm, that uses ubiquitous devices, software, and services to support teaching and learning anytime and anywhere, offering the potential of instructing and learning anything at any time in any place. While this declaration is unrealistic at the moment, given the constraints of current implementing technology (computational, networking, and storage). Some researchers have updated the definition of u-learning to focus on teaching the appropriate content, at the right time, in the most relevant location. Additionally, Po-Sheng, Yen-Hung, Yueh-Ming, and Tzung-Shi (2008) have identified a list of characteristics that define u-learning. After reviewing and synthesizing similar projects by different researchers (e.g., Chen & Chang & Kao, 2002; Chen, Chang, & Wang, 2008; Hwang, 2006; Ogata & Yano, 2004; Yang, 2006). Note that these characteristics are presented in the framework of u-learning environments, though they have applications throughout many instructional contexts:

- *Immediate learning need* — a U-learning environment can be utilized to meet the immediate learning requirements. On-demand or in-time learning is an interpretation of this u-learning characteristic and traits.
- *Motivation of knowledge acquisition* — a ubiquitous learning system can promptly provide information in response to a learner's request.
- *The interactivity of learning process* — u-learning interfaces facilitate effective communications between learners and peers, teachers, and professionals.
- *The situation of instructional activity*—u-learning involves situated interaction. The learning system is embedded deeply into the natural phenomena of everyday activities.
- *Context-awareness*—learners' interplay with the u-learning environment is managed by context—person, location, time, interest, activity, and so forth.
- *The activity provides personalized services*—learners are provided personalized learning activities by using the U-learning system based on the surrounding context.
- *Self-regulated learning*—e-learning environment allows the learner to actively control their learning progress and captures this behavior as learner context for future use.
- *Seamless learning*—learning activities can progress seamlessly as pupils move from place to place.
- *Learning community*—u-learning devices can access networked content and services to improve the learning interplay among pupils and instructors.
- *Adjust the subject contents*—learner interaction with the u-learning environment can take place through the usage of numerous learning devices.

Ubiquitous learning is a type of education that utilizes wireless communication technologies, sensors, and location-tracking devices to immerse learners in their environment. The utilization of Web 2.0 tools not only improves the capacity for innovative class design but also fosters student creativity. As an educator in an online higher education setting, providing students with options for completing work has not only been helpful but also inspires creativity. Although u-learning is a relatively new area, previous research provides a broad perspective and highlights specific topics of interest, such as cross-cultural understanding and language learning, as identified by Kukulska-Hulme's (2010) analysis of 44 referenced works between 2005 and 2010.

The Web 2.0 Tool and Education

In today's knowledge society, Web 2.0 tools like social networks, blogs, wikis, podcasts, and multimedia-sharing platforms such as YouTube have opened up new avenues for lifelong learning and the development of personalized learning environments. (Cobo & Pardo, 2007). These tools enable individuals to generate digital content and collaborate with others without requiring specialized programming skills. Web 2.0 tools can help utilize information in the academic environment. These tools have a beneficial influence on the use of information and communication technology (ICT) in

academic settings. Educators play an essential role in instructing students on how to appropriately assess and filter online content, as well as determining its authenticity. The use of a blog can help students demonstrate critical thinking, creativity, and effective communication skills (Duffy & Bruns, 2006). Through the use of these tools, students can develop creative and innovative talents, and acquiring communication and collaborative skills can be beneficial for individuals in both educational and professional settings. As a result, students are more capable of showing that the skills acquired in education are not limited to their areas of specialization but provide them with an open mind and flexible ability to adapt to new environments.

Table 1

Benefits of Using Flickr for Design Education Robbie & Zeeng, (2008).

Teaching the Digital Student	Flickr Platform Web 2.0 Technology offers various features
Strong visual orientation	• Allowing for sharing of uploaded images • Limiting the number of images to avoid careless production • Tagging images for easy categorization and access by teachers and students • Adding metadata during the image capture process to provide information about the image, such as its quality, quantity, and the time it was uploaded.
Active learning and student-centeredness	• Opportunities for collaborative learning among peers • Ability to provide beneficial feedback and analysis on the work of others and oneself • Interaction and engagement between students • Ownership and control of discussion forums • Flexibility for new topics to be added and posted by any member of the group • Options for both private and public communication within the platform.
Engaging and supporting students	• Utilization of social networking features • Option for students and teachers to comment on any photograph • Opportunity for more introverted students to gain confidence through online communication • Support for international students with availability in 8 languages • Elimination of the constant and expensive need for printing.
Flexibility	• anytime, anywhere access • Convenience without being restricted to timetabled class times. • immediacy of feedback
Sense of community	• Creation of accounts within a private teaching space • Display of student profiles featuring their name and portrait • Emphasis on identity, not anonymity • Interaction across the entire student cohort • Exposure to a global community

21st-century skills

According to Binkley, 21st-century skills refer to a set of teachable abilities and characteristics that improve various aspects of thinking, learning, working, and living in the world. These skills encompass creativity, innovation, critical thinking, problem-solving, decision-making, metacognition, communication, teamwork, information literacy, digital literacy, citizenship (both local and global), career and life skills, and personal and social responsibility, which includes cultural awareness and competence.

Learning and Innovation Skills:

These competencies and skills are commonly referred to in the context of the 21st century and are gaining more recognition as qualities that set apart students who are prepared for the progressively intricate work and life settings of this era.

- **Critical Thinking and Problem Solving:** This skill involves the ability to analyze and evaluate evidence, arguments, claims, and beliefs effectively. It also involves the capability to resolve different types of unfamiliar problems using both traditional and innovative approaches.
- **Communication:** Communication skill involves the capacity to articulate ideas and thoughts effectively using both written and oral communication skills in various forms and contexts.

- **Collaboration:** Collaboration skills entail the capacity to collaborate successfully and respectfully with diverse groups to accomplish a shared objective.
- **Creativity and Innovation:** Creativity and Innovation skills involve the use of a wide range of idea-creation strategies to develop new and valuable ideas.

Table 2

The following is a list of abilities associated with each of the 21st-century skills, adapted from P21's 2009 framework.

Skill Sets	Learning and Innovation	Digital Literacy	Life and Career Skills
Core Subjects	Content Knowledge	Computer Basics	Flexibility and Adaptability
Critical Thinking	Creativity and Innovation	Online Research	Initiative and Self-Direction
Problem Solving	Inquiry and Analysis	Digital Citizenship	Social and Cross-Cultural Skills
Communication	Communication Skills	Digital Communication	Productivity and Accountability
Collaboration	Collaboration Skills	Technology Use	Leadership and Responsibility

Utilizing Web 2.0 technology tools for ubiquitous learning to improve critical thinking in the teaching-learning process:

According to Halpern (1998) and MacKnight (2000), collaborative inquiry into real-world problems can stimulate critical thinking. Moreover, the use of web-based tools has proven to be effective in developing critical thinking skills (Eales-Reynolds et al., 2012; Varaki, 2006). Mcloughlin and Lee (2007) found that Web 2.0 tools can improve students' creativity, critical thinking, communication, and collaboration skills, ultimately enhancing their ability to adapt to new situations.

Varaki (2007) asserts that challenge-based instruction and related instructional designs are essential for developing critical thinking, which is a higher-order thinking skill. However, the promotion of critical thinking in social studies will not be effective if teachers do not recognize its importance and lack the knowledge and skills to incorporate it into their classroom instruction.

Keskin (2010) conducted a study to investigate the impact of integrating Web 2.0 tools on the critical thinking skills of 8th-grade students using the curriculum book provided by the Ministry of Education. The study was conducted to determine whether the use of these tools could enhance the student's critical thinking abilities.

The Importance of Developing Thinking Skills

Thinking is a cognitive process that involves receiving information from the environment, storing it subconsciously or consciously, and then manipulating it to make decisions, form beliefs, or set goals (Baron, 1993). It involves the transfer of objects and events of the world into symbols, and the brain performs functions such as inferring meaning from symbols, establishing hypotheses, calculating, and producing symbols (Baron, 1993). The significance of thinking in education has been emphasized by Paul and Elder (2004), who argue that shoddy thinking can be costly both financially and in terms of quality of life, and that excellence in ideas and concepts must be organized and cultivated. As per Cotrell (2005), critical thinking is a skill that should be incorporated into all educational aspects, which involves using cognitive skills or strategies to increase the likelihood of achieving a desirable outcome. This skill utilizes mental processes like attention, categorization, selection, and judgment. Critical thinking is a crucial objective of education and a necessary tool for social and economic survival in today's world of rapid change, increasing complexity, and global interdependence, according to Bailin and Siegel (2003) and Paul (2006). As a result, schools have a critical role in developing individuals who can think critically and objectively, as well as present well-established arguments, according to Halpern (1999) and Judge (2009).

Enhancing Collaboration in the Teaching-Learning Process through Web 2.0 Technology Tools Using Ubiquitous Learning

Research has demonstrated that collaborative learning methods can be highly effective in improving information acquisition and communication skills, particularly when utilizing ubiquitous gaming based on team competition (Chen & Hwang, 2017) or social and collaborative models that leverage automation of pedagogical tasks (Araújo, 2017). The use of a ubiquitous learning environment can also support graduate and undergraduate students in developing their creative thinking skills through knowledge sharing and interaction with classmates (Sitthichai Laisema & Panita Wannapiroon, 2013). To enhance learner engagement, a variety of media should be used in collaborative presentations,

such as Web 2.0 tools that allow for the integration of audio, video, and images (Terry T. Kidd_2011, P. 205-206). Synchronous group planning can also be facilitated through video conferencing tools like Skype, chat tools within curriculum management systems, and collaborative editing and writing tools like Google Docs. This study also sought to describe teachers' beliefs about collaborative students and the characteristics teachers perceive to describe them. Collaboration at the conceptual level involves:

- **Awareness -** Refers to the ability to recognize and understand the common goal of the group and the need to work together in a collaborative effort.
- **Motivation -** Refers to the drive to achieve consensus and make progress towards the goal.
- **Self-organization -** Refers to taking initiative and responsibility for the tasks at hand and working towards completing them.
- **Participation -** Refers to actively taking part in group activities and expecting others to do the same.
- **Mediation -** Refers to the ability to negotiate and find common ground to reach a middle point that satisfies all parties involved.
- **Reciprocity -** Refers to the expectation that all participants will contribute and share resources and knowledge in a mutually beneficial way.
- **Reflection -** Refers to the process of thinking critically and considering different options before making decisions.
- **Engagement -** Refers to the active involvement and commitment of all members towards achieving the group's objectives.

Research Methodology

This study follows Positivism theory which relies on logic and sensory organs to explore natural phenomena. It supports this philosophy and seeks to identify the most influential independent variable. Research philosophy is crucial in social science investigations as it helps select methodology and theoretical framework, while a review of the literature identifies the philosophical approach. Philosophical approaches guide researchers in problem-solving, and intermediate philosophical approaches allow for a match between methodology, philosophy, and the research problem.

Research Method: By purpose, it is an applied research. By Approach, it is a quantitative research. Postpositive knowledge claims support the quantitative research approach. This study described the relationship of independent variables with dependent variables. Random sampling was used as the sampling technique in this research study. Descriptive and inferential statistics applied. For analysis reliability, correlation and regression test has been used through SPSS's latest version. Results have shown the level of significance.

Research Design: refers to the framework of research techniques that a researcher selects to investigate a particular topic. This design enables researchers to use appropriate research methods for their subject matter and establishes their studies to achieve success.

The current research is quantitative and descriptive in which the researcher revealed statistical conclusions to collect actionable insights. The current research has a regression model and through SPSS regression test has been run to test the hypothesis. There are four hypotheses in the current research in which the relationship of Students' Ubiquitous Learning and Students' 21st-century Century Skills has been analyzed. The sample of the current research focused only on public university teachers of Sindh and Punjab Province of Pakistan. Lahore and Karachi city have been selected as target populations. 05 public sector universities have been chosen for collecting data through simple random sampling as a target sample. The deductive approach has been used to analyze the data. This current research is quantitative and a close-ended questionnaire has been used for collecting data. The opinion of teachers has been taken through a questionnaire. From 05 universities 500 teachers have been selected randomly. For the Measurement of analysis, a close-ended questionnaire having a 07 Likert scale has been used to collect the survey opinion. Regression, correlation, and reliability test has been run through SPSS software for analyzing data in the current research. There have been no apparent objections to the research. The setting for the research study is natural. It was one year of cross-sectional research. The current research study is purely quantitative and has a deductive approach. In this research regression, correlation and reliability test has been run through SPSS software.

Population, Sample, and Sampling:

A research population refers to a clearly defined group of individuals or objects that share similar characteristics and are the primary focus of a scientific investigation. Conducting research is typically done for the benefit of the population being studied. For research findings to be meaningful and accurate, the sample selected for the study must be representative of the population being studied and must be of sufficient size to allow for statistical analysis. The population "provides" the sample, and the conclusions drawn from the study are then applied back to the population as a whole.

The population for this study includes all teachers working in public sector universities in Pakistan. The sample of the current research focused only on public sector university teachers of Sindh and Punjab Province of Pakistan. Lahore and Karachi city have been selected as target samples of 05 public sector universities have been chosen for collecting data through simple random sampling. From 05 public universities, 500 teachers have been chosen as a target sample. In current research simple random sampling has been chosen. 05 public sector universities have been chosen for collecting data through simple random sampling.

Research Tool:

In this study, Ubiquitous learning is an independent variable 21st century skills (Critical thinking and Collaboration) are the dependent variable. There are 50 items in the close-ended questionnaire to measure variables. All the items have 07 sub-scale such as e.g. 1 [strongly disagree] to 7 [strongly agree].

Data Collection and Data Analysis Procedure:

Quantitative Method:

Quantitative research methods involve presenting data in numerical form and typically require mathematical calculations to arrive at conclusions. For example, using a questionnaire with closed-ended questions can produce numerical data that can be analyzed mathematically. Other quantitative methods include correlation and regression analyses, as well as calculating measures of central tendency such as the mean, mode, and median.

An online questionnaire has been floated among our social circle to gather the required responses through Google forms and other hand, physically fill up the questionnaire by respondent through survey method.

To gather the necessary responses for this study, an online questionnaire was distributed among our social circle using tools like Google Forms. In addition, a physical questionnaire was also made available to respondents through survey methods. The collected data was analyzed using SPSS v21, with statistical methods like reliability tests, and t-tests being used to analyze the variables based on the primary data obtained from the survey questionnaire.

Data Analysis and Interpretation

Frequency Table

Table 3:

University wise analysis

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Benazir Bhutto Shaheed University Liyari	100	20.0	20.0	20.0
	Federal Urdu University of Arts, Science & Technology, Karachi	100	20.0	20.0	40.0
	Punjab University Lahore	100	20.0	20.0	60.0
	Sindh Madressatul Islam University Karachi	100	20.0	20.0	80.0
	University Of Karachi	100	20.0	20.0	100.0
	Total	500	100.0	100.0	

Analysis: as per the frequency table value "University" was found as Benazir Bhutto Shaheed University Liyari 20%, Federal Urdu University of Arts, Science & Technology, Karachi 20%, Punjab University Lahore 20%, Sindh Madressatul Islam University Karachi 20% and University Of Karachi 20%.

Table 4:

Religion wise analysis

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Christian	9	1.8	1.8	1.8
	Hindu	8	1.6	1.6	3.4
	Islam	483	96.6	96.6	100.0
	Total	500	100.0	100.0	

Analysis: as per the frequency table value "Religion" was found as Christian 1.8%, Hindu 3.4%, and Muslim 96.6 %

Table 5:

Gender wise analysis

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	206	41.2	41.2	41.2
	Male	294	58.8	58.8	100.0
	Total	500	100.0	100.0	

Analysis: as per the frequency table value "Gender" was found as Males 41.2%, and Males 58.8 %

Table 6:

Age wise analysis

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	21 to 30 years	197	39.4	39.4	39.4
	31 to 40 years	303	60.6	60.6	100.0
	Total	500	100.0	100.0	

Analysis: as per the frequency table value "Age" both males and females were found as 21 to 30 years 39.4% and 31 to 40 years 60.6%.

Table 7:

Analysis of U-Learning & 21st Century Learning Skills

Group Statistics

	Gender	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
TotalCTUL	Male	294	23.912	9.3779	.5469
	Female	206	25.316	8.0706	.5623
TotalCOUL	Male	294	22.690	8.3251	.4855
	Female	206	25.636	7.7917	.5429
Gtotal	Male	294	46.602	17.703	1.0324
	Female	206	50.952	15.8623	1.1052

Analysis: From the calculated data it is clear that the males & females strongly agree & agree. The mean and standard deviation of the data were taken and proved, strongly agree & agree. So, it is accepted that Ubiquitous learning enhances 21st-century skills, critical thinking, and collaboration among university students.

Analyzing Independent Samples: The Effects of Ubiquitous Learning and 21st Century Skills.

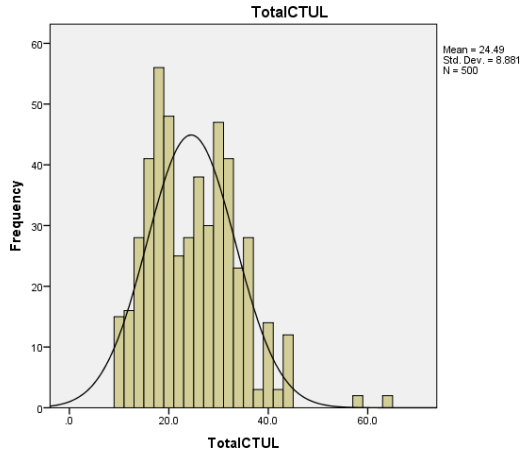
Table 8:

Test

	t-test for Equality of Means						
	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
TotalCTUL		-1.743	498	.082	-1.4040	.8053	-2.9862
TotalCOUL		-3.997	498	.000	-2.9454	.7369	-4.3932

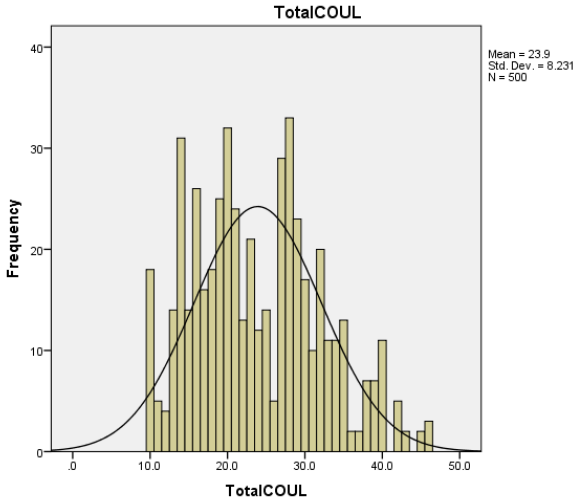
Analysis: Based on the results of the statistical calculation of the t-test Null hypothesis is rejected in this study and the research hypothesis is accepted. It means that there is a significant impact of students' Ubiquitous learning through Web 2.0 tools on students' critical thinking and collaboration. The finding shows a significant impact of U-learning in developing 21st-century skills critical thinking and collaboration among university students.

Graph 1
Critical Thinking and Ubiquitous Learning



Graph 3 shows that Mean=24.49, Std. Dev. = 8.881 regarding Critical Thinking and Ubiquitous Learning.

Graph 2
Collaboration Skills and Ubiquitous Learning



Graph 4 shows that Mean=23. 9, Std. Dev. = 8.231 regarding Collaboration and Ubiquitous Learning.

Results and Discussion

The current study found that Ubiquitous Learning (UL) has a significant positive impact on the development of 21st-century skills, particularly critical thinking and collaboration, among university students. UL involves various levels of interactions driven by intrapersonal and psychosocial processes. Task-oriented interactions, which focus on skill and ability development, are generated through processes of ability skill imitation, negotiation, and argumentation. Meanwhile, person-oriented interactions, which involve technology-mediated social and group dynamics, are generated through processes of impression formation, metalizing, social observation, and communication. UL enables the web teaching community to reflect on the interaction between the intra-individual reality and the external technology-intensive experience. The study suggests that there is a need to reconsider traditional views on university learning and to involve decision-makers in institutional policies on teaching and learning. Although the study's findings are consistent with international research studies, further research is necessary in Pakistan to enhance the quality and standard of education.

Conclusions

The research study has achieved its objectives as it has found a significant positive impact of Ubiquitous Learning (U-learning) on the development of 21st-century skills, such as critical thinking and collaboration, among university students. This suggests that U-learning can improve the development of these skills among students at the university level. The implications of this study are highly beneficial for the enhancement of the education process, teaching methods of teachers, and

learning outcomes of students. The findings of this research can assist teachers in implementing technology-based teaching-learning processes and fostering 21st-century skills among university students, which will contribute to the betterment of the economy and society in Pakistan and globally.

Recommendations

- Teachers and students should be provided with opportunities to engage in Ubiquitous Learning (U-learning).
- Efforts should be made to enhance the development of 21st-century skills among students, which are essential for survival in the modern era.
- Teachers should be provided with ICT-based training to effectively integrate technology into teaching and learning.
- Management of educational institutions should give serious attention to the use of ICT to face the challenges of the 21st century.
- The importance of ICT integration in education should be recognized by the management.
- Both public and private sector universities should promote the infrastructure necessary for U-learning among their students.
- Curriculum and Pedagogy: Curriculum developers and educators should consider integrating U-learning and 21st-century skills into the curriculum and pedagogy. This can be done through the creation of new courses, revision of existing courses, and the incorporation of U-learning tools and resources.
- Collaboration and Partnership: Collaboration and partnership among universities, private sector companies, government agencies, and non-governmental organizations should be encouraged to promote the integration of U-learning and 21st-century skills in education. These collaborations can help provide resources, support, and expertise to ensure the success of U-learning initiatives.
- Research and Development: Further research and development should be conducted to explore the potential of U-learning in enhancing other skills and competencies among university students. This can help identify new opportunities for U-learning and ensure that it remains a relevant and effective approach to teaching and learning in the 21st century.
- Funding and Resources: Universities, governments, and other stakeholders should allocate sufficient funding and resources to support U-learning initiatives and the development of 21st-century skills among university students. This can help ensure that U-learning is accessible and affordable to all students, regardless of their socio-economic background.

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