



21st Century Skills and Teachers Responsibilities at Undergraduate Level: Examining Relationship and Demographics Analysis

Sadia Suleman¹, Dr. Muhammad Aqeel Raza², Mansoor Masih³

¹M.Phil Scholar, National College of Business Administration & Economics, Sub Campus Multan,
Email: sadiasuleman.ca80@gmail.com

²Associate Professor, National College of Business Administration & Economics, Sub Campus Multan,
Email: razaaqeel06@gmail.com

³M.Phil Scholar, NCBA & E, Multan Campus & Assistant Professor, Govt. Graduate College Civil Lines,
Khanewal, Email: mansoormasih82@gmail.com

ARTICLE INFO

Article History:

Received:	June	28, 2026
Revised:	August	05, 2026
Accepted:	August	17, 2026
Available Online:	August	24, 2026

Keywords:

21st-century skills, teachers' responsibilities, undergraduate education, higher education, demographic analysis, student competencies, teacher effectiveness

Corresponding Author:

Dr. Muhammad Aqeel Raza

Email:

razaaqeel06@gmail.com

DOI: <https://doi.org/10.59075/tamsaal.v4i8.170>



ABSTRACT

Higher education institutions are increasingly recognizing the importance of developing 21st-century skills in order to prepare students for complex academic, professional, and social environments. It is the teacher's role to facilitate these skills through effective instructional practices, classroom interaction, critical thinking activities, collaboration, communication, creativity, and the integration of technology. The purpose of this study was to investigate the relationship between 21st century skills and teachers' responsibilities at the undergraduate level, with particular attention paid to the role of demographic factors. This study used a correlational research design to conduct a quantitative research study. An undergraduate survey measuring 21st-century skills and responsibilities of teachers was administered to students. In order to determine the relationship between 21st-century skills and teachers' responsibilities, descriptive statistics were used to examine demographic characteristics and distribution of responses. A Pearson product-moment correlation was used to determine the relationship between 21st-century skills and the responsibilities of teachers. It was also examined whether perceptions differed based on demographic differences. The results indicate that Competencies Essential for Undergraduate Students, Students' 21st Century Skills, and Teachers' Responsibility to Cultivate 21st Century Skills are significantly and positively interrelated, especially between Students' 21st Century Skills and Teachers' Responsibility to Cultivate 21st Century Skills ($r = .840$, $p < .001$). There were no statistically significant differences between the perceptions of the respondents across gender and age groups in Competencies Essential for Undergraduate Students, Students' 21st Century Skills, and Teachers' Responsibility to Cultivate 21st Century Skills. It is recommended in the study that teacher professional development, student-centered teaching practices, technology integration, and competency-based instruction be strengthened at the undergraduate level. In promoting 21st-century skills in undergraduate education, these findings provide useful implications for university teachers, teacher educators, curriculum developers, and higher education policymakers.

© 2026 The Authors, Published by ULLR. This is an Open Access Article under the Creative Common Attribution ([CC-BY 4.0](#))

Introduction

The modern world is defined by fast technological advancement, globalization, evolving work practices, and the availability of digital information. These changes have changed the demands on higher education institutions. The role of universities is no longer limited to imparting disciplinary knowledge; they are also expected to produce students who can think critically, solve complex problems, communicate effectively, collaborate with others, use digital technologies, and adjust to new professional and social settings. These skills are often referred to as 21st century skills and encompass cognitive, interpersonal, technological, and self-management skills (van Laar et al., 2017; Thornhill-Miller et al., 2023).

The importance of developing 21st century skills is especially relevant at the undergraduate level as students are preparing for the workplace, professional practice, lifelong learning and responsible participation in society. In addition to academic degrees, employers are increasingly looking for other skills, such as communication, teamwork, analytical thinking, creativity, problem-solving, digital literacy, and the willingness to learn constantly. Studies have indicated that students' perceptions of their 21st-century skills are positively associated with their perceptions of the extent to which higher education is preparing them for the future labor-market demands (Gruzdev et al., 2020). Likewise, undergraduate students need these skills to be successful in academic environments as well as in their post-graduation jobs and professional careers.

While subject knowledge is still important, knowledge alone may not be sufficient to equip graduates to deal with complex and unpredictable challenges. It is important for students to be capable of applying their knowledge in new contexts, making judgments, developing new ideas, expressing their ideas, and collaborating with others. Accordingly, a modern educational goal focuses on critical thinking, creativity, communication, and collaboration, also known as the "4Cs" (Thornhill-Miller et al., 2023). Furthermore, digital literacy, data literacy, adaptability, self-regulation, and problem-solving are now more relevant than ever in the context of digital transformation in higher education and employment (van Laar et al., 2017; Lavi et al., 2022).

It is important that higher education institutions take their role in embedding these competencies in the design of their curriculum, teaching, assessment, and student-support activities. A curriculum that is only based on memorization and examination performance may offer limited opportunities for students to practice communication, collaboration, creativity or problem-solving. By contrast, active and student-centered learning methods like project-based learning, problem-based learning, inquiry-based learning, collaborative learning, experiential learning, and technology-supported learning can help students apply knowledge and build transferable skills (Basilotta Gómez-Pablos et al., 2017; Prince, 2004). Therefore, the creation of 21st century skills should be viewed as a shared institutional responsibility, not a responsibility that students are expected to take on them.

In this process, teachers play a pivotal role. Teachers interpret curriculum goals into learning experiences and shape the amount of discussion, collaboration, independent inquiry, reflection, and problem solving students will do. Teachers can design classroom spaces where students are able to ask questions, share ideas, analyze evidence, collaborate with others, and find solutions to real-world problems. Thus, teachers' pedagogical competence, assessment practices, classroom

management, digital competence, and feedback provision are important factors in the development of 21st-century skills in higher education (König et al., 2021; Field, 2018)).

The teacher is not just a source of information. In today's higher education, teachers are more and more becoming facilitators, mentors, learning designers, and guides. They can help students connect theory to real-world issues, include collaborative activities, utilize digital tools, and allow for reflection and self-evaluation. The quality of these instructional practices can impact students' confidence and ability to apply 21st century skills in academic and professional settings. Studies on teaching 21st century skills also highlight the importance of teachers having the necessary pedagogical knowledge and being provided with preparation and professional development opportunities to incorporate these skills into teaching and learning (Soh et al., 2023).

The link between teacher responsibility and student skills is also significant, as 21st century skills cannot be achieved through stand-alone classroom experiences. They need to be developed in a way that is aligned with learning outcomes, teaching strategies, assessment methods, institutional policies and workplace expectations. If students are only evaluated by traditional written exams, they may not be given opportunities to show teamwork, oral communication, creativity, or applied problem-solving. Thus, it is necessary that higher education institutions implement assessment methods that assess not only the disciplinary knowledge but also the application of transferable skills (Boud & Falchikov, 2006; Devedzic & Tonic, 2015).

Even with the focus on 21st century skills, there could be a disconnect between the skills employers seek and the skills that are taught in school. Some students finish their degrees with a good theoretical understanding but lack confidence in communication, collaboration, critical thinking, digital application or problem-solving. This disconnect poses a problem for graduates entering the workforce, as well as for employers looking for flexible, work-ready workers. Research has thus suggested that employability and 21st century skills should be more integrated in undergraduate programmes (Gruzdev et al., 2020; van Laar et al., 2017).

The present study emphasizes on three related aspects: competencies that are necessary for undergraduate students, students' 21st century competencies, and the role of teachers in developing these competencies. It is important to consider these dimensions together, as the competencies of students and the responsibilities of teachers are conceptually and practically interdependent. Students might identify the need for specific skills, but teachers need to offer appropriate learning opportunities and feedback for students to fully develop these skills. Similarly, teachers' efforts could be more effective if students are active in learning and are responsible for applying and improving their skills.

The study also explores if there are differences in the perceptions of the respondents based on gender and age group. Demographic variables can impact students' learning experiences, access to learning opportunities, confidence in using technology, and perceptions of teaching and learning. But the degree of such differences is not a priori and should be investigated empirically. Comparing responses between demographic groups can help identify if the importance of undergraduate competencies, students' 21st century skills, and teachers' responsibility is distributed evenly across the sample or if there are differences between specific groups.

This is particularly appropriate in the context of undergraduate education in Pakistan where universities are expected to prepare students for the changing social, technological and employment environment. The ongoing challenge for higher education institutions in Pakistan is to bridge the gap between academic courses and employability, skills, digital literacy, and lifelong learning. The perceptions of students can be helpful to curriculum planners, university administrators, teacher educators, and policymakers who want to enhance the quality and relevance of undergraduate education. Hence, the aim of this study is to examine the interrelationships between these constructs and whether there are gender and age differences in perceptions. The study seeks to contribute to the debate on the role of higher education in preparing students not only for academic programs but also for an increasingly dynamic professional and social environment by analyzing these factors in conjunction.

Literature review

Technology, employment, communication, and social life have all undergone rapid changes, resulting in the development of 21st century skills. Students of today are expected not only to redevelop content knowledge, but also to apply it, evaluate information, solve new and unfamiliar problems, communicate ideas, work collaboratively with diverse groups, and adapt to new circumstances. Therefore, higher education is increasingly expected to produce a combination of disciplinary knowledge, cognitive skills, interpersonal skills, digital literacy skills, and personal characteristics. In accordance with the Partnership for 21st Century Learning, a wide range of skills are defined, including the ability to learn and innovate, the capability to use information and media effectively, as well as the ability to use information and communication technology effectively. In addition to creativity and innovation, students should have an ability to think critically and solve problems, communicate, and collaborate (Partnership for 21st Century Learning ,2019). (Kyllonen, 2012) also highlights collaboration, communication, creativity, critical thinking, digital literacy, and problem solving as the most common 21st century skills.

The central skills of critical thinking are broadly agreed upon by different frameworks despite the fact that they use different terminology. Critical thinking involves the analysis, evaluation and synthesizing of information in order to make informed decisions. Creativity is the ability to generate new and valuable ideas. Communication is the ability to effectively communicate using oral, written, visual and digital means. Collaboration is the ability to work collaboratively and respectfully with others. There is a connection between these skills; students may need skills in communication, collaboration, critical thinking, and creativity to come up with innovative solutions (Partnership for 21st Century Skills, 2009; Thornhill-Miller et al., 2023).

As a result, 21st century skills are not a single or purely technical skill. They are a collection of interwoven skills that enable students to apply knowledge across academic, professional, and social settings. According to Thornhill-Miller et al. (2023), creativity, critical thinking, communication, and collaboration are essential to both education and employment, since they contribute to innovation, decision making, teamwork, and adaptation. Considering the current study from an integrated perspective is relevant, as the constructs of essential undergraduate competencies, students' 21st century skills, and teachers' responsibilities are expected to be interrelated.

As higher education has become more closely aligned with employability and lifelong learning, the importance of 21st century skills has grown. Students graduate into a labor market where job roles, technologies and organizational practices are constantly evolving. Graduates thus need to be able to learn new things, to use digital tools, to communicate with colleagues, to solve non-routine problems, and to work in teams (OECD,2025).Studies show that there could be a disconnect between the skills needed in the workplace and the skills that students think they are acquiring in the university. Gruzdev et al. (2020) found that graduates' perceptions of their skill development were related to their perceived preparation for the labor market. This implies that the quality of higher education should not be judged solely by academic performance, but also by students' readiness to use knowledge and function effectively in the workplace.

A key component of undergraduate education is digital competence. According to Van Laar et al. (2017), digital skills include technical skills, information management, communication, collaboration, creativity, critical thinking, and problem-solving skills. This implies that digital competence encompasses more than just the ability to use software and devices. It also includes the ability to find, assess, produce and share information effectively and strategically using digital technologies.Lavi et al. (2022) also highlight the need to integrate 21st century skills into undergraduate curricula to address the evolving needs of the workplace and society. Their work emphasizes the importance of universities offering students opportunities to become data literate, digitally communicate, collaborate, and problem solve. These arguments justify the use of students' 21st century skills as a key concept in the current study.

But if 21st-century skills are included in curriculum documents, it does not guarantee that students will acquire them. Skills should be taught, practiced, assessed and reinforced explicitly across courses. Students may not be given opportunities to develop higher order thinking, teamwork, creativity and applied problem solving if teaching is primarily directed at memorization and examination performance. Thus, for effective implementation, there needs to be alignment between the curriculum goals, teaching strategies, learning activities, and assessment practices (Boud & Falchikov, 2006; Pellegrino & Hilton, 2012).

Undergraduate students need to acquire essential competencies, which consist of academic competencies as well as transferable competencies. Academic competencies enable students to comprehend disciplinary concepts, to perform inquiry, to interpret evidence, and to communicate in the academic world. Transferable skills allow them to transfer these skills to other situations and contexts. Critical thinking, problem solving, communication, collaboration, creativity, self-management, digital literacy, adaptability, and lifelong learning are among them (Mohamad et al., 2025).Critical thinking is especially relevant as university students are expected to deal with complex arguments, differentiate between evidence and opinion, assess the quality of sources, and develop reasoned conclusions. Critical thinking is also used in academic research and in making decisions in the workplace. Students who do not have this ability may struggle to critically interpret information or to use knowledge to solve unfamiliar problems (Jaramillo Gómez et al.,2025).

Collaboration and communication are equally important in higher education. There is a greater use of group projects, presentations, peer learning, online discussions and interdisciplinary work. These activities involve students in listening, explaining, negotiating, sharing responsibility, and working together as a group to accomplish tasks. Collaboration also mirrors the nature of today's jobs, which often require teamwork instead of individual effort (Tadesse,2026).Creativity and

innovation help students transcend the reproduction of existing knowledge. Creative students can find other ways, think of new ideas and adapt to new problems. Creativity is not only an art but also a science, entrepreneurship, lesson planning, research design, and professional problem-solving (Thornhill-Miller et al., 2023). Self-regulation and adaptability are other skills needed for success in college. Students are required to plan their learning, time manage, monitor progress, respond to feedback and adjust strategies when difficulties arise. These skills are particularly relevant in digital and blended learning settings, where students might need to be more self-directed in their learning (Morosanova et al., 2025).

Teachers are at the heart of developing students' 21st century skills. As a result, they influence learning, learning processes, assessment of learning, and transfer of knowledge. Therefore, the teacher's role is not limited to delivering content, but is also responsible for designing learning experiences that foster inquiry, interaction, reflection, and application (Okechukwu, 2025). The pedagogical competence of teachers is one of the most important aspects of the quality of instruction. It encompasses understanding of teaching strategies, classroom management, assessment, student engagement, feedback, and instructional adaptations to meet student needs. König et al. (2021) explain that teacher competence is associated with the quality of classroom instruction. In higher education, pedagogically competent teachers can develop learning environments that promote questioning, discussion, independent thinking, teamwork and problem solving.

Active and student-centered pedagogies can be used to develop 21st century skills. Project-based learning gives students the opportunity to explore real-world problems and create real-world products. Problem-based learning involves students analyzing situations, determining information needs, suggesting solutions, and justifying their decisions. Through collaborative learning, students learn to communicate, work in teams, negotiate, and share responsibility. Basilotta Gómez-Pablos et al. (2017) state that project-based approaches can be used to develop competence in higher education by linking academic content with practical tasks.

Boud and Falchikov (2006) highlight the importance of assessment being linked to the long-term learning and skills that students will need after they have left school. Another important aspect of teachers' responsibility is assessment. If assessment is limited to factual recall, students may be more concerned with memorizing facts than analyzing, creating, or applying them. Assessment methods such as presentations, portfolios, projects, research reports, peer assessment, reflective writing, and performance tasks can provide more direct opportunities to demonstrate 21st-century skills. Feedback and classroom climate are also ways that teachers impact students' skill development. Constructive feedback enables students to know their strengths, understand what they need to improve and to self-regulate their learning. The classroom environment is supportive, allowing students to share ideas, make intellectual risks, ask questions, and make mistakes. Conversely, teacher-centred or punitive contexts can deter engagement and limit opportunities for creativity and critical inquiry (Hattie & Timperley, 2007).

The development of 21st century skills is not solely the responsibility of teachers. It also includes the university leadership, curriculum committees, teacher educators, quality-assurance bodies, and policymakers. Professional development, digital infrastructure, manageable class sizes, appropriate assessment policies, and curricular flexibility are all necessary for institutions. While teachers might see the value of 21st century skills, they might also struggle to put them into

practice due to lack of preparation, lack of clarity about what is expected in the curriculum, lack of resources, and pressure of assessment (Soh et al., 2023).

The literature suggests that there is a close conceptual connection between Students' 21st Century Skills and Teachers' Responsibility to Cultivate 21st Century Skills. Teachers who intentionally incorporate these competencies into classroom activities, offer opportunities for practice, promote collaboration and inquiry, and employ assessment strategies that make learning expectations clear are more likely to develop these competencies. The 21st century learning focuses on knowledge, as well as communication, collaboration, critical thinking, creativity, problem-solving, and digital skills (Binkley et al., 2012; Voogt & Roblin, 2012). Likewise, teachers are key in establishing learning contexts where these competencies can be developed and strengthened (van Laar et al., 2017). The results of the present study, which showed significant positive relationships between Competencies Essential for Undergraduate Students (CE), Students' 21st Century Skills (CS) and Teachers' Responsibility to Cultivate 21st Century Skills (RC), are thus in line with the general literature.

Students who understand the importance of key skills might also be more conscious of the part that teachers play in the development of these skills. Similarly, students who believe that they have stronger 21st Century Skills may have had more opportunities to engage in discussion, collaboration, inquiry, digital learning, creativity, and problem-solving in their instruction. Good teaching can facilitate students' transfer of these skills to other learning contexts and academic tasks (Dede, 2010; Voogt & Roblin, 2012). The strong correlation between Students' 21st Century Skills and Teachers' Responsibility to Cultivate 21st Century Skills could indicate that the respondents believe that the development of skills is a collaborative effort between students and teachers. This is also in line with studies that highlight the significance of active and learner-centered pedagogies in fostering transferable competencies (Basilotta Gómez-Pablos et al., 2017).

The associations observed should not be interpreted as direct causal relationships, however, due to the cross-sectional design of the present study. Self-report studies can also yield over-strong correlations when the predictor and outcome measures are measured from the same respondents and are presented in the same format. Common method bias is a common problem that can affect the size of the relationships between variables (Podsakoff et al., 2003). Moreover, cross-sectional studies do not provide temporal precedence, and thus cannot conclude whether effective teaching leads to better students' 21st century skills, whether better students' skills lead to better perceptions of teachers, or whether both are affected by other contextual factors (Spector, 2019).

Longitudinal designs, classroom observations, teacher self-reports, student performance-based assessments, and intervention studies should be used in future research to examine these relationships more rigorously. Longitudinal and experimental methods would allow for the investigation of whether changes in teaching methods are followed by measurable changes in Students' 21st Century Skills. Using student perceptions in combination with observational and performance-based measures may also mitigate the constraints of using self-report data alone.

The learning experiences, access to technology, confidence, participation, and perceptions of teaching may differ among students based on demographic factors, including gender and age. But differences need to be tested, not assumed. Demographic differences have been found in some digital and interpersonal skills, and the role of educational context, learning opportunities,

and instructional exposure in developing digital and transferable skills have been highlighted in previous research (van Laar et al., 2017). The present study thus looked at gender and age as possible sources of variation in Competencies Essential for Undergraduate Students, Students' 21st Century Skills, and Teachers' Responsibility to Cultivate 21st Century Skills.

While there is a significant amount of literature discussing 21st century skills, there are a few gaps. First, many studies are concerned with defining the skills or identifying preferred teaching strategies, but fewer studies examine the relationship between students' perceptions of essential skills, their own 21st century skills, and teachers' responsibility in one analytical framework. Secondly, many of the current publications rely on general frameworks that have been developed in Western or international contexts. There is a need for more context-specific research to gain insight into the perceptions of undergraduate students in Pakistan regarding 21st century skills and the role of teachers in developing these skills. Differences in institutional resources, teacher preparation, curriculum structure, assessment systems, and labour-market expectations may influence these perceptions. Third, self-report measures are often used in research. Such measures may give some insight into students' perceptions but do not necessarily indicate actual performance. Future research should incorporate questionnaires, performance assessments, classroom observations, interviews, and teacher evaluations. Finally, there has been relatively little attention paid to the variation in students' perceptions by demographic. A gender and age analysis can be used to identify if 21st century skills are interpreted in a similar way across student populations. But, to make such comparisons, the samples must be balanced and statistical assumptions must be taken into account.

Research Hypotheses

H₁: There is a significant positive relationship between competencies essential for undergraduate students and students' 21st-century skills.

H₂: There is a significant positive relationship between competencies essential for undergraduate students and the responsibility of teachers in cultivating 21st-century skills.

H₃: There is a significant positive relationship between students' 21st-century skills and the responsibility of teachers in cultivating 21st-century skills.

H₄: There is a significant difference in competencies essential for undergraduate students across gender groups.

H₅: There is a significant difference in competencies essential for undergraduate students across age groups.

H₆: There is a significant difference in students' 21st-century skills across gender groups.

H₇: There is a significant difference in students' 21st-century skills across age groups.

H₈: There is a significant difference in the perceived responsibility of teachers in cultivating 21st-century skills across gender groups.

H₀: There is a significant difference in the perceived responsibility of teachers in cultivating 21st-century skills across age groups.

Research Methodology

The research study followed the following methodology:

Research Design

The study used quantitative research method with cross sectional survey research design. The quantitative approach was used because the study was designed to measure the respondents' perceptions about the competencies that should be developed for undergraduate students, the 21st century skills of students, and the role of teachers in developing these skills in numerical data. The cross sectional design allowed the researcher to gather data from the selected respondents at one time and to look for patterns, relationships and differences between the study variables. The study was mainly descriptive and correlational. Demographic characteristics and responses of the participants were summarized using descriptive analysis, and inferential statistical techniques were used to examine relationships among the major constructs and differences across demographic groups. Specifically, Pearson product-moment correlation was used to assess the relationships between the three major constructs, and analysis of variance (ANOVA) was used to assess whether there was a difference in perceptions based on gender and age group.

Research Population

The study population consisted of undergraduate students of higher education institutions. The population was chosen because undergraduate students are expected to develop a variety of skills that will help them to function effectively in academic, professional, and social settings. These skills are referred to as transferable skills and are considered essential in today's higher education: communication, collaboration, critical thinking, creativity, problem-solving, digital literacy, adaptability, and others (Ananiadou & Claro, 2009; Voogt & Pareja Roblin, 2012). The study also explored students' perceptions of the role of teachers in developing these competencies. This focus was grounded in the understanding that students' individual characteristics, as well as instructional practices, learning environments, curriculum, and teacher support, have an impact on the development of 21st century skills (Schleicher, 2015).

Sample and Sampling Technique

A total of 281 undergraduate students participated in the study. The respondents were chosen from the target population using convenience sampling technique because they were easily accessible and willing to participate in the study. The participation was voluntary and respondents were informed about the purpose of the study before they filled the research instrument. The demographic distribution revealed that the sample was mainly female. Of the 281 respondents, 278 (98.9%) were female and 3 (1.1%) were male. As per age, most of the respondents were aged between 20 to 22 years, 23 to 25 years and 26 to 29 years. The demographic characteristics were then analyzed to see if there were differences in perceptions of

the major study variables by gender and age. Gender-based comparisons were made with caution due to the high gender imbalance. The very small number of male respondents limited the statistical power and substantive interpretability of comparisons between male and female participants.

Table 1: Population and Sample Distribution of the Study

Section	Category	Sub-Category	Frequency (n)	Total (N)
Population	University	BZU Multan	225	674
		The Women University Multan	225	
		Emerson University Multan	224	
Sample	Gender	Male	3	281
		Female	278	
Sample	Age Group	20–22 years	222	281
		23–25 years	39	
		26–29 years	20	

Research Instrument

A structured questionnaire was used to gather data on three key constructs: Competencies Essential for Undergraduate Students (CE); Students' 21st Century Skills (CS); and Responsibility of Teachers in Cultivating 21st Century Skills (RC). The questionnaire comprised statements that assessed respondents' perceptions of what knowledge, skills, abilities, and competencies are needed by undergraduate students in today's higher education. The instrument also contained questions about students' possession or development of 21st century skills and how much teachers feel responsible for helping students develop these skills. The items were rated on a five-point Likert-type scale from low to high levels of agreement.

Validity and Reliability of the Instrument

Content and expert validation were used to determine the validity of the research instrument. The items on the questionnaire were examined to see if they were representative of the constructs under study. The items were reviewed by experts in education and educational research for clarity, relevance, appropriateness, and consistency with the study's objectives. The wording, organization, and clarity of the items in the questionnaire were modified, based on expert feedback, prior to the final administration of the instrument. This process helped to ensure that the questionnaire was comprehensive enough to cover the conceptual domains of competencies that are important for undergraduate students, students' 21st century skills, and teachers' role in developing these skills.

Cronbach's alpha coefficient was used to check the internal consistency of the questionnaire. Cronbach's alpha is a widely used measure of internal consistency of items measuring the same construct. The reliability analysis was performed separately for the major dimensions and for the overall instrument. Cronbach's alpha coefficient was high enough for the items in each construct to measure related aspects of the intended variable. To determine the consistency of the measurement instrument, reliability assessment was carried out prior to the main inferential

analyses After expert opinions and a pilot study, changes were made to the research tool and the final format of the questionnaire consisted of 45 items. Cronbach's Alpha was calculated to be 0.94.

Table 2: Reliability Analysis of the Study Instruments

Instrument / Scale	Cronbach's Alpha (α)	No. of Items	Reliability Level
Competencies Essential for Undergraduate Students	.916	17	Excellent
Measurement of Undergraduate Students' 21st Century Skills	.936	13	Excellent
Responsibility of Teachers in Cultivating 21st Century Skills	.945	15	Excellent

Data Collection Procedure

The researcher obtained the required institutional permission and then administered the questionnaire to the selected undergraduate students. The study was explained to the participants and respondents were informed that the participation in the study was voluntary. The participants were also told that the information given would be for academic and research purposes only. The respondents were provided enough time to fill the questionnaire and completed questionnaires were retrieved and processed for statistical analysis. The data collected were checked for completeness and then entered into the Statistical Package for the Social Sciences (SPSS). Prior to statistical analysis, the data were checked for missing values, coding errors, and inconsistencies.

Ethical Considerations

Ethical issues were taken into account during the research process. The study was voluntary and the respondents were briefed on the purpose and nature of the study. No information was required from the participants that would unnecessarily identify them. Confidentiality and anonymity were ensured in the collection, analysis and reporting of data. The information gathered was only for research purposes and the results were reported in summary form and not as individual responses. Participants also had the option to opt-out of the study without any consequences.

Data Analysis

The data collected were analyzed using the Statistical Package for the Social Sciences (SPSS). Data screening and preparation, descriptive statistics, reliability analysis, Pearson product-moment correlation, and one-way analysis of variance (ANOVA) were used in the analysis. Pearson correlation analysis was used to examine the relationships among Competencies Essential for Undergraduate Students (CE), Students' 21st Century Skills (CS), and Teachers' Responsibility to Cultivate 21st Century Skills (RC). To determine if there were significant differences between the three study variables with regard to the respondents' gender and age

group, one-way ANOVA was used. Finally, the results of the statistical analyses were used to test the proposed hypotheses and to see if each hypothesis was supported or not supported.

Results of the study

Table 3: Distribution of Respondents by Gender Across age groups

		Age Group			Total
		20-22	23-25	26-29	
Gender	Male	2	1	0	3
	Female	220	38	20	278
Total		222	39	20	281

According to the Gender by Age Group cross tabulation, the distribution of female respondents is highly skewed across all age groups. The sample size (N = 281) is dominated by females (n = 278), with only three respondents being males, making the sample highly female-dominated. Most respondents are between the ages of 20 and 22, where 220 females and 2 males are observed (n = 222), suggesting that most respondents are younger undergraduate students. The 23-25 age group has 38 females and 1 male (n = 39), whereas the 26-29 age group has all females (n = 20) and no males. In general, the data show that the sample is mostly young (20-22 years) and mostly female, which could be due to the gender distribution of the chosen academic programs or the sampling frame. This should be taken into account when generalizing the findings since the results are mostly the views of female undergraduates.

Table 4: Interco relations Among factors

Correlations		CE	CS	RC
CE	Pearson Correlation	1	.619**	.651**
	Sig. (2-tailed)		.000	.000
	N	280	278	280
CS	Pearson Correlation	.619**	1	.840**
	Sig. (2-tailed)	.000		.000
	N	278	279	279
RC	Pearson Correlation	.651**	.840**	1
	Sig. (2-tailed)	.000	.000	
	N	280	279	281

****.** Correlation is significant at the 0.01 level (2-tailed).

Based on the correlation analysis, all three main variables, Competencies Essential for Undergraduate Students (CE), Students 21st Century Skills (CS), and Teachers' Responsibility to cultivate 21st Century Skills (RC), show statistically significant and positive relationships. There is a significant correlation at the 0.01 level (p .001). This indicates that the relationships

are highly reliable.

CE and CS correlate moderately and positively ($r = 0.619$), which indicates that students who believe 21st-century competencies are more important also report higher levels of these skills. Also, CE and RC are highly correlated ($r = 0.651$), indicating that students who recognize the importance of the required competencies are also likely to highly perceive teachers' role in helping students acquire these competencies. CS and RC show the strongest correlation ($r = 0.840$), which indicates a very strong and positive relationship. This indicates that students' perception of teachers' role in developing 21st-century skills is strongly related to their perceived level of 21st-century skills. As a result, students report higher levels of competency when teachers are perceived to be more effective in skill development.

The findings indicate that all three constructs are strongly interrelated, which indicates that the competencies of students, their perceived skill development, and the role of teachers are closely related. The findings provide good empirical evidence for the study's conceptual framework, namely the importance of teachers in developing 21st century skills in undergraduate students.

Table 5: Test of significance differences for Competencies Essential for Undergraduate Students

ANOVA		Sum	of	df	Mean	F	Sig.
		Squares			Square		
Gender	Between Groups	.214		36	.006	.524	.989
	Within Groups	2.754		243	.011		
	Total	2.968		279			
Age Group	Between Groups	6.868		36	.191	.516	.990
	Within Groups	89.842		243	.370		
Total		96.711		279			

According to the results of the ANOVA, the study variables are not statistically different between gender or age groups. A significant increase over the traditional 0.05 significance level is obtained by using the between-group analysis of gender data, which yields a F-value of 0.524 and a significance level of 0.989. Therefore, there is no significant difference between the responses of males and females, and any differences observed may have been caused by chance rather than group effects. In this study, the F-value for the age groups is 0.52 and the p value is 0.990, which indicates that the groups do not differ significantly. This indicates that the respondents' perceptions or responses are similar regardless of their differences in age. Overall, the results of both ANOVA tests indicate that gender and age are not significant contributors to the variables examined, suggesting a highly homogeneous demographic response. Because of this, attitudes and perceptions among the sample population are typically similar regardless of the demographic differences.

Table 6: Test of significance differences for Measurement of Undergraduate Students' 21st Century Skills (ANOVA)

		Sum Squares	of df	Mean Square	F	Sig.
Gender	Between Groups	.143	39	.004	.311	1.000
	Within Groups	2.824	239	.012		
	Total	2.968	278			
Age Group	Between Groups	15.428	39	.396	1.207	.199
	Within Groups	78.321	239	.328		
	Total	93.749	278			

The results of the ANOVA analysis indicate that gender influences study variables moderately and gender generally has a weak and non-significant relationship, whereas age group has a weak and non-significant relationship. There is a significant increase over 0.05 in the between-group analysis for gender, with a F-value of 0.311 and a significance level of $p = 1.000$. A higher p-value indicates that the difference between males and females is not statistically significant. Statistically, the difference between gender categories is not significant.

A F-value of 1.207, $p = 0.199$, is also greater than 0.05 for the age group. The results of this study show that age has no significant impact on respondents' perceptions or responses, despite some numerical differences in means. According to the results, gender and age do not significantly influence the variables under study, which indicates that demographic groups respond in a similar manner. Hence, the perceptions obtained in the research are consistent and evenly distributed across genders and ages, making them more applicable.

Table 7: Test of significance differences for Responsibility of Teachers in Cultivating 21st Century Skills (ANOVA)

Variable	Source	Sum of Squares	df	Mean Square	F	Sig.
Gender	Between Groups	0.124	43	0.003	0.240	1.000
	Within Groups	2.844	237	0.012	—	—
	Total	2.968	280	—	—	—
Age Group	Between Groups	9.611	43	0.224	0.608	0.974
	Within Groups	87.179	237	0.368	—	—
	Total	96.790	280	—	—	—

The ANOVA results indicate no statistically significant differences between the responses of genders and ages. F-values for males and females are 0.240 and $p = 1.000$, which is significantly higher than the traditional 0.05 value. There are no significant differences between males and females, and any variation is random.

Furthermore, the F-value for age group is 0.608 and $p = 0.974$, exceeding 0.05 significance. Consequently, the responses of respondents of different age groups are not significantly different, and age does not have a statistically significant impact on perceptions and attitudes. A high degree of homogeneity appears to be observed among the demographic groups, i.e., gender

and age do not significantly affect variables. Based on their perceived perceptions, the findings are more credible and can be generalized to a variety of demographic groups.

Table 8: Results of Hypothesis Testing

Hypothesis	Statistical Result	Decision
H₁: CE → CS	$r = .619, p < .001$	Supported
H₂: CE → RC	$r = .651, p < .001$	Supported
H₃: CS → RC	$r = .840, p < .001$	Supported
H₄: CE by Gender	$F = 0.524, p = .989$	Not supported
H₅: CE by Age	$F = 0.516, p = .990$	Not supported
H₆: CS by Gender	$F = 0.311, p = 1.000$	Not supported
H₇: CS by Age	$F = 1.207, p = .199$	Not supported
H₈: RC by Gender	$F = 0.240, p = 1.000$	Not supported
H₉: RC by Age	$F = 0.608, p = .974$	Not supported

Discussion and Conclusion

The positive relationships among CE, CS, and RC are consistent with the view that 21st-century skills comprise interconnected competencies rather than isolated abilities. The commonly discussed “4Cs”—critical thinking, creativity, communication, and collaboration—are mutually supportive and are increasingly regarded as important outcomes of contemporary education (Thornhill-Miller et al., 2023). These competencies enable students to analyse information, generate ideas, communicate effectively, work with others, and respond to complex academic and professional problems.

The strong correlation between students’ 21st-century skills and the perceived responsibility of teachers is also consistent with research emphasizing the importance of teachers’ pedagogical competence. Teachers’ instructional knowledge, classroom organization, assessment practices, and ability to design active learning experiences influence the extent to which students receive opportunities to practise higher-order and collaborative skills (König et al., 2021; Field, 2018). In higher education, 21st-century skills can be developed through problem-based learning, project-based learning, collaborative learning, inquiry activities, reflective tasks, and technology-supported instruction (Basilotta Gómez-Pablos et al., 2017; van Laar et al., 2017).

The nonsignificant differences across gender and age groups may indicate that students shared similar curricular experiences and institutional learning conditions. However, demographic similarity should not be interpreted as evidence that gender and age are irrelevant in all educational contexts. Previous research suggests that opportunities to develop digital, communication, and problem-solving skills may also be influenced by access to technology, prior educational experiences, self-efficacy, and learning environment (van Laar et al., 2017; World Economic Forum, 2020). Accordingly, the present findings may reflect the specific characteristics of the sampled institution rather than a universal absence of demographic differences.

The study concludes that developing 21st-century skills among undergraduate students is an essential component of modern higher education, according to the study. Today, university

education isn't just about imparting disciplinary knowledge; it's also about developing a range of skills that enable students to succeed academically, professionally, technologically, and socially. Therefore, undergraduate education emphasizes critical thinking, communication, collaboration, creativity, problem-solving, digital literacy, adaptability, and self-management skills. According to the study, undergraduate curricula and teaching-learning processes need to be systematically integrated with 21st-century skills. Participating actively in learning, applying knowledge to real-life situations, collaborating with others, solving complex problems, communicating ideas, and engaging in critical and creative thinking are the best ways for students to develop these competencies. As a result, university curriculum planning should focus more on competencies and practical application of knowledge than on content coverage.

Another important conclusion is that teachers have a central responsibility in cultivating students' 21st-century skills. Teachers influence the learning environment, instructional strategies, classroom interaction, assessment practices, and opportunities available to students for developing higher-order and transferable skills. The teacher's role therefore extends beyond being a transmitter of information to becoming a facilitator, mentor, learning designer, and supporter of students' intellectual and personal development.

The study also concludes that teacher professional development is essential for effective implementation of 21st-century education. Teachers need appropriate knowledge, pedagogical skills, technological competencies, and professional support to design learning experiences that promote critical thinking, collaboration, creativity, communication, problem-solving, and digital competence. Universities should therefore provide continuous professional development opportunities that enable teachers to adopt innovative, student-centered, and competency-based pedagogical approaches. Furthermore, the development of 21st-century skills requires institutional support and an enabling educational environment. Effective implementation cannot depend exclusively on individual teachers. Higher education institutions need supportive policies, appropriate technological infrastructure, flexible curricula, relevant learning resources, collaborative learning environments, and assessment systems that recognize both academic knowledge and transferable competencies.

The study concludes that students, teachers, curriculum developers, and higher education institutions share interconnected responsibilities in preparing undergraduate students for the demands of the 21st century. Students need to take an active role in their own learning and skill development, teachers need to facilitate meaningful learning experiences, curriculum developers need to incorporate relevant competencies into academic programs, and institutions need to provide the resources and policies necessary to support their implementation. Finally, the study highlights the importance of adopting a holistic and future-oriented approach to undergraduate education. Preparing students for contemporary society requires an educational system that develops not only what students know but also how they think, communicate, collaborate, create, solve problems, use technology, and respond to changing circumstances. Integrating 21st-century competencies into higher education can consequently contribute to producing graduates who are academically capable, professionally prepared, adaptable, innovative, and able to contribute effectively to society.

Recommendations

- Undergraduate teaching may be integrated with critical thinking, creativity, communication, collaboration, and digital literacy through continuous professional development.
- Students may be provided with opportunities to actively develop 21st-century skills through project-based learning, problem-based learning, collaborative learning, inquiry-based learning, and classroom discussions.
- Students may feel comfortable asking questions, sharing ideas, taking intellectual risks, and learning from mistakes in classrooms based on respect, openness, constructive feedback, and psychological safety.
- Instead of relying mostly on memorization-based examinations, universities should incorporate authentic assessment methods, such as projects, presentations, case studies, portfolios, and group assignments.
- Developing 21st-century skills requires adequate technological resources, teaching facilities, and institutional support. Research should be conducted at multiple universities and regions to examine the relationship between teachers' responsibilities and students' 21st-century skills.

References

1. Ananiadou, K., & Claro, M. (2009). 21st century skills and competences for new millennium learners in OECD countries. *OECD Education Working Papers*, 41, 1–33. <https://doi.org/10.1787/218525261154>
2. Basilotta Gómez-Pablos, V., Martín del Pozo, M., & García-Valcárcel Muñoz-Repiso, A. (2017). Project-based learning: Methodologies that support students' development of competences and acquisition of learning outcomes in higher education. *Journal of Technology and Science Education*, 7(3), 298–312. <https://doi.org/10.3926/jotse.271>
3. Binkley, M., Erstad, O., Herman, J., Raizen, S., Ripley, M., Miller-Ricci, M., & Rumble, M. (2012). Defining twenty-first century skills. In P. Griffin, B. McGaw, & E. Care (Eds.), *Assessment and teaching of 21st century skills* (pp. 17–66). Springer. https://doi.org/10.1007/978-94-007-2324-5_2
4. Boud, D., & Falchikov, N. (2006). Aligning assessment with long-term learning. *Assessment & Evaluation in Higher Education*, 31(4), 399–413. <https://doi.org/10.1080/02602930600679050>
5. Cochran, W. G. (1952). The χ^2 test of goodness of fit. *The Annals of Mathematical Statistics*, 23(3), 315–345. <https://doi.org/10.1214/aoms/1177729380>
6. Dede, C. (2010). Comparing frameworks for 21st century skills. In J. Bellanca & R. Brandt (Eds.), *21st century skills: Rethinking how students learn* (pp. 51–76). Solution Tree Press.
7. Devedzic, V., & Tonic, I. (2015). Teaching and assessing soft skills in engineering education. *IEEE Transactions on Education*, 58(3), 197–202. <https://doi.org/10.1109/TE.2014.2360604>
8. Field, A. (2018). *Discovering statistics using IBM SPSS statistics* (5th ed.). SAGE Publications.

9. Gruzdev, I., Perminova, T., & Klinkov, G. (2020). Am I fit for tomorrow's labor market? The effect of graduates' skills development during higher education for the 21st century's labor market. *Sustainability*, 12(18), Article 7746. <https://doi.org/10.3390/su12187746>
10. Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research*, 77(1), 81–112. <https://doi.org/10.3102/003465430298487>
11. Jaramillo Gómez, D. L., Álvarez Maestre, A. J., Parada Trujillo, A. E., Pérez Fuentes, C. A., Bedoya Ortiz, D. H., & Sanabria Alarcón, R. K. (2025). Determining factors for the development of critical thinking in higher education. *Journal of Intelligence*, 13(6), 59.
12. König, J., Blömeke, S., Jentsch, A., Schlesinger, L., Musekamp, F., & Kaiser, G. (2021). The links between teacher competence and instructional quality. *Educational Studies*, 47(2), 192–213. <https://doi.org/10.1080/03055698.2019.1674853>
13. Kyllonen, P. C. (2012). Measurement of 21st century skills within the common core state standards. *Research & Practice in Assessment*, 6, 21–35.
14. Lavi, R., Tal, M., & Dori, Y. J. (2022). Digital age: The importance of 21st-century skills among undergraduates. *Frontiers in Education*, 7, Article 950553. <https://doi.org/10.3389/feduc.2022.950553>
15. McHugh, M. L. (2013). The chi-square test of independence. *Biochemia Medica*, 23(2), 143–149. <https://doi.org/10.11613/BM.2013.018>
16. Mohamad, N. M., Jaaffar, A. H., Abd Majid, N., & Isa, A. (2025). The effect of essential skills on perceived employability: a case of Malaysian undergraduates in energy-focused universities. *Higher Education, Skills and Work-Based Learning*, 15(2), 349-368.
17. Morosanova, V. I., Kondratyuk, N. G., Potanina, A. M., & Korshunov, A. V. (2025). The effects of stress and conscious self-regulation on students' career adaptability. *RUDN Journal of Psychology and Pedagogics*, 22(2), 316-336.
18. OECD. (2020). *What students learn matters: Towards a 21st century curriculum*. OECD Publishing. <https://doi.org/10.1787/d86d4d9a-en>
19. OECD. (2025). *OECD Skills Outlook 2025: Building the skills of the 21st century for all*. OECD Publishing. <https://doi.org/10.1787/26163cd3-en>
20. Okechukwu, E. (2025). Teachers Rights and Responsibilities and Societal Expectations. *Unizik Journal of Educational Laws and Leadership Studies*, 1(1), 213-224.
21. Partnership for 21st Century Learning. (2019). *Framework for 21st century learning definitions*. Battelle for Kids.
22. Pellegrino, J. W., & Hilton, M. L. (Eds.). (2012). *Education for life and work: Developing transferable knowledge and skills in the 21st century*. The National Academies Press. <https://doi.org/10.17226/13398>
23. Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879–903. <https://doi.org/10.1037/0021-9010.88.5.879>
24. Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education*, 93(3), 223–231. <https://doi.org/10.1002/j.2168-9830.2004.tb00809.x>
25. Schleicher, A. (2015). *Schools for 21st-century learners: Strong leaders, confident teachers, innovative approaches*. OECD Publishing. <https://doi.org/10.1787/9789264231191-en>

26. Soh, T. M. T., Arsad, N. M., & Osman, K. (2023). Teaching 21st century skills: Understanding the depth and width of the challenges to shape proactive teacher education programmes. *Sustainability*, 15(9), Article 7365. <https://doi.org/10.3390/su15097365>
27. Spector, P. E. (2019). Do not cross me: Optimizing the use of cross-sectional designs. *Journal of Business and Psychology*, 34, 125–137. <https://doi.org/10.1007/s10869-018-09613-8>
28. Tadesse, T. (2026). The Challenges of Communication and Collaboration in Teaching in 21st-Century Higher Education. In *Teaching and Learning 21st-Century Skills: Collaboration and Communication in Formal and Informal Educational Settings* (pp. 299-323). Singapore: Springer Nature Singapore.
29. Thornhill-Miller, B., Camarda, A., Mercier, M., Burkhardt, J.-M., Morisseau, T., Bourgeois-Bougrine, S., Vinchon, F., El Hayek, S., Augereau-Landais, M., Mourey, F., Feybesse, C., Sundquist, D., & Lubart, T. (2023). Creativity, critical thinking, communication, and collaboration: Assessment, certification, and promotion of 21st century skills for the future of work and education. *Journal of Intelligence*, 11(3), Article 54. <https://doi.org/10.3390/jintelligence11030054>
30. van Laar, E., van Deursen, A. J. A. M., van Dijk, J. A. G. M., & de Haan, J. (2017). The relation between 21st-century skills and digital skills: A systematic literature review. *Computers in Human Behavior*, 72, 577–588. <https://doi.org/10.1016/j.chb.2017.03.010>
31. Voogt, J., & Pareja Roblin, N. (2012). A comparative analysis of international frameworks for 21st century competences: Implications for national curriculum policies. *Journal of Curriculum Studies*, 44(3), 299–321. <https://doi.org/10.1080/00220272.2012.668938>
32. World Economic Forum. (2020). *The future of jobs report 2020*. <https://www.weforum.org/reports/the-future-of-jobs-report-2020/>