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Quantitative Analysis of ICT's Role in Communication, Collaboration, Creativity, and Critical Thinking: Perspectives of Students and Teachers

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Abstract

This research aims to ascertain how FG students and teachers interpret the role of ICT in the areas of Communication, Collaboration, Critical thinking, Creativity, Advantages, and limitations of ICT use in the Classroom. The objectives of the study are to analyze students' insights into the role of ICT in the 21st Century Classroom and determine teachers' perceptions of ICT's role within the same environment. The other objective is also to investigate, for selected subjects within the curriculum, the advantages and disadvantages of using ICT in the classroom for both teachers and students. The population of the study consisted of 2880 (Students Population) and 127 (Teachers Population), out of which 246 (Sampled Students) and 14 (Sampled Teachers) were selected through the Simple Random Sampling Technique. The data was collected through a close-ended questionnaire Consisting of 30 items main facets, Communication, Collaboration, Creativity, and Critical thinking. The findings of the study reveal that both teachers and students agree on the significant role of ICT in enhancing communication, collaboration, creativity, and critical thinking in 21st-century secondary school classrooms. However, concerns about its limitations, including cheating, misinformation, and accessibility issues, are widely recognized. Major recommendations of the study are (1) ICT should be integrated into the curriculum to enhance communication, collaboration, creativity, and critical thinking in secondary school classrooms, (2) Its use should be time-regulated to avoid distractions, made accessible to all students, and include checks for the authenticity of information sources, (3) teachers may be trained to effectively incorporate ICT into their lessons.

Key Words

Information and Communication Technology (ICT), Communication, Collaboration, Creativity, Critical Thinking, Secondary School Education, Curriculum Integration, Khyber Pakhtunkhwa

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Introduction

According to UNESCO (2002), "technology used in information and communication (ICT) is a management strategy utilized in the handling of information and its application to social, economic, and cultural issues.". ICT

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has initiated a permanent change in our occupies and in acting so it has made the world a more customer-ambitious place. Technology drives our every day, and its use has simplified and facilitated the lives of people from all walks of life. (Semenov, 2005). It is safe to say that educators are the mainstay of any functioning the world. They guide today's youth for a better and flourishing future, hence playing a vital role in the upbringing and ultimately the future of these students. They possess the capabilities that provide simplification to complex concepts and give way to abstract concepts that become accessible and understandable to the students.

Educators use various methodologies to educate learners and make them interested in the subject being taught. They are the leading sources of inspiration as well as motivation for the pupils. The different teaching methods employed by teachers include many assisting class activities that are conducive to an effective learning environment. (Nair, 2022) Internet, cable networks, TV, digital media, and other social platforms including Facebook; Twitter; LinkedIn; Igo, Line, WeChat, etc. all offer students easy access to a wealth of knowledge. Saving 21st-century teacher preparation programs requires extensive use of information and communication technologies. A teacher's classroom can't be considered fully functional until they have a solid grasp of information and communication technology (Spiteri, 2018).

Statement of the Problem

First, the utilization of ICT in teaching was introduced to schools in the 20th century when the first computer was designed. Over the past five years, steps for enhancement in FG schools of Pakistan have included increased utilization of ICT. All teacher- and student-related information has been updated in its database. This system includes technologies designed to enhance learning, such as tablets, computers, multimedia, and LCDs, which aim to engage students and foster participation. (Lim et al., 2013) found in his study that Nepali secondary school students are weak in their use of ICT. Gil-Flores et al. (2017) in Spain discovered that the availability of software, teacher ICT training, and collaboration among teachers influence ICT use in the classroom. Saleem & Zahra (2018) conducted a study on the effects of ICT in private secondary schools in Punjab, revealing that user ability is positively related to student learning. Numerous studies have been conducted in Pakistan on ICT's role in effective teaching, digital literacy (considering gender, school, and class), evaluation of ICT education, ICT and students' performance, ICT integration, use of ICT, and barriers to its usage.

Therefore, the researcher was interested in finding out the interpretations of FG students and teachers respectively on the role of ICT in the following areas: Communication, Collaboration, Critical thinking, Creativity, Advantages and limitations of using ICT in Classroom.

Objectives of the Study

Objectives of the study were:

1. To analyze the student's perception to know the function of ICT in 21st Century Classroom.
2. To resolve educator's perception regarding the role of ICT in 21st-century Classrooms.
3. To examine the rewards and restrictions of spending ICT in the classroom for educators and students in nominated subjects in the curriculum.

Hypotheses of the Study

Null hypotheses of research were:

Ho1. There are no discernible differences between the perspectives of students about the function of ICT in the 21st Era at the secondary school level.

Sub-Hypotheses

Ho1a. There are no discernible differences between the perspectives of students about the function of ICT regarding communication in 21st-century classrooms at the Secondary-School Level.

Ho1b. There is no discernible difference between how students feel about the role of ICT regarding collaboration in the 21st-century classroom at secondary School level.

Ho1c. There is no discernible difference between students' perspectives on the role of ICT regarding Creativity in 21st-century classrooms at the Secondary School level.

Ho1d. There is no discernible difference between how students feel about the role of ICT regarding Critical thinking in 21st Century Classroom at secondary School stage.

Ho2. There is no noticeable change in the perception of educators about the function of ICT in the 21st Era at the secondary school level.

Sub-Hypotheses

Ho2a. There isn't a substantial difference among the views of teachers about the function of ICT regarding communication in the 21st Era at the secondary school level.

Ho2b. There isn't a substantial change in the views of teachers about the role of ICT regarding collaboration in the 21st Century at the Secondary School level.

Ho1c. There isn't a substantial change in the view teachers of about the role of ICT regarding Creativity in the 21st Century at the Secondary School level.

Ho1d. There is no important alteration among the views of teachers about the role of ICT regarding Critical thinking in 21st Century Classroom at secondary School level.

Ho3. There isn't a substantial change in the views of Students about the advantages of ICT in 21st-century classrooms at the secondary school level.

Ho4. There isn't a substantial difference among the views of students about the limitations of ICT in 21st-century classrooms at the secondary school level.

Ho5. There isn't an important modification among the views of Teachers about the advantages of ICT in 21st-century classrooms at the secondary school level.

Ho6. There isn't significant variance among views of Teachers about the limitations of ICT in 21st-century classrooms at the secondary school level.

Methods and Procedure

Research Design

Survey Research Design was used.

Population And Sampling

The study was carried out in federal public schools in south KP, Pakistan. A Simple Random Sampling approach was utilized for Sample Selection. The total number of participants in this study was (400) students and (127) teachers from federal public schools.

Table 1

The Detail of the Sample for Students is Provided in Table

S.No	Name of School	Total Students	Sample Size
1	FG Public School (Boys), Bannu Cantt	400	35
2	FG Public School (Girls), Bannu Cantt	350	30
3	FG Junior Public School, Bannu Cantt	300	12
4	FG Public School No.01, Kohat	850	50

S.No	Name of School	Total Students	Sample Size
5	FG Girls STC No.3 School, Kohat	310	62
6	FG Public School No 02, Kohat	400	40
7	FG Public School No 04, Kohat	270	17
Total		2880	246

Table 2

The Composition of the Sample Size for Teachers was as Follows

S.No	Name of School	Total Teachers	Sample Size
1	FG Public School (Boys) Bannu Cantt	22	2
2	FG Public School (Girls) Bannu Cantt	15	2
3	FG Junior Public School Bannu Cantt	20	2
4	FG Public School No.01 Kohat	18	2
5	FG Girls STC No.3 School Kohat	16	2
6	FG Public School No.02 Kohat	17	2
7	FG Public School No.4 Kohat	19	2
Total		127	14

Research Instrument

For the data collection process, two survey questionnaires were distributed one for students and the other for teachers. Both questionnaires contained a total of 60 items, with 30 items in each questionnaire. The respondents were instructed to select their responses using a five-point Likert scale.

The questionnaire consisted of 30 items and was divided five two main facets.

(1) Communication ; (2) Collaboration; (3) Creativity; and (4) Critical thinking

Data Collection

The questionnaires were created and modified by the researchers very carefully before being distributed to the intended population or audience. Following Morgan's sample selection rules, 450 questionnaires were distributed to all respondents, with teachers filling out 130 of them. The respondents were given 30 minutes to complete the questionnaires and then return them to the researchers for data analysis. This aided the researchers in their interpretation of the study's findings. The responses of 400 respondents were chosen out of 450, and the responses of 50 students were declined due to missing information. In the case of teachers, 127 responses were chosen from a total of 130.

Table 3

Response Rate

S.No	Participants	Category	Delivered	Not Returned	Returned	Unusable	Usable	%age
1.	Students	Questionnaire	430	16	414	14	400	93%
2.	Teachers	Questionnaire	135	5	130	05	125	94%

Data Analysis Process

Statistics from the survey respondents were analyzed with SPSS 26. This research utilized inferential as well as descriptive analyses. For Inferential Statistics, Chi-square was used.

Data Analysis

For the whole collection of data, descriptive statistics and inferential analysis are provided in this section. This

section examines the in-depth findings of the questionnaire that was given to students and teachers to determine how information and communication technology is affecting secondary school classrooms. The majority of the results agree with earlier studies.

Teachers Response

Table 4

Teachers' Views Regarding the role of ICT Regarding Communication in 21st Century Classroom (N = 400)

S.No	Statement	F	SDA	DA	UD	A	SA
1.	ICT is used for organizing information for students in a class.	O	0	12	15	75	23
2.	ICT is used to exchange information among colleagues.	O	0	0	0	40	85
3.	ICT is used to exchange information between teachers and students.	O	0	5	15	70	35
4.	ICT is helpful for communication with the students and peer learning.	O	5	10	15	52	43
5.	ICT is used to address the students' queries.	O	0	4	10	43	68
6.	ICT is used to send/receive Homework.	O	0	10	14	66	37
Overall		O	5	41	69	346	291
		E	150	150	150	150	150

Table No. 4 demonstrates that the observed and predicted frequencies differ significantly, $X^2 = 113.2$ and p-value = .00. Majority of the teachers "**agree**" that the ICT role regarding communication in 21st 21st-century classroom is important in organizing, collecting, exchanging, and presenting new information is high at secondary school level.

Table 5

Teachers' Views on Role of ICT Regarding Collaboration in 21st Century Classroom (N = 400)

S.No	Statement	f	SDA	DA	UD	A	SA
1.	ICT is the main source of Collaboration and networking among students of all backgrounds.	O	0	4	6	78	37
2.	ICT having virtual collaboration helps expand access and ease towards education.	O	0	12	10	63	40
3.	Through ICT, teachers collaborate with the students.	O	0	16	4	70	35
4.	In schools, ICT promotes and strengthens digital culture.	O	0	7	8	95	15
5.	ICT in education promotes student engagement and knowledge retention	O	0	25	22	64	14
6.	ICT enhances the level of participation of individual students among themselves and with the teachers.	O	0	31	19	48	27
Overall		O	0	95	69	418	168
		E	480	480	480	480	480

Table No. 5 demonstrates that the observed and predicted frequencies differ significantly, $X^2 = 196.1$ and p-value = .00. Majority of the teachers "**agree**" that ICT role regarding collaboration in 21st Century classrooms is important in promoting student engagement, enhances the level of participation of individual students among themselves and with teachers.

Table 6

Teachers' Views about the Role of ICT Regarding Creativity in 21st Century Classroom (N = 400)

S. No	Statement	F	SDA	DA	UD	A	SA
1.	ICT has a strong link with creativity	O	2	15	13	68	27
2.	ICT helps in discovering new knowledge	O	0	11	10	44	60
3.	ICT helps in explaining concepts to the students with the help of images and videos	O	0	15	17	48	45
4.	ICT usage supports creative teaching and learning experiences.	O	14	22	17	72	3
5.	ICT usage improves the quality of education.	O	16	1	11	42	55
Overall		O	32	64	186	274	190
		E	480	480	480	480	480

Table No. 6 demonstrates that the observed and predicted frequencies differ significantly, $X^2 = 121.09$ and p-value = .00. Majority of the teachers "**agree**" that ICT's role regarding creativity in 21st Century classroom is important in creating, discovering, and explaining concepts, and improve the quality of education.

Table 7

Teachers' Views about Role of ICT Regarding Critical Thinking in 21st Century Classroom (N = 400)

S.No	Statement	f	SDA	DA	UD	A	SA
1.	ICT usage makes the students think better and discuss their queries with the teachers.	O	0	24	18	74	9
2.	Critical thinking is developed among teachers and students by using ICT	O	11	5	13	60	36
3.	By Using ICT problem solving skills of the teaching staff are developed.	O	20	11	23	48	23
Overall		O	31	40	54	182	68
		E	480	480	480	480	480

Table No. 7 demonstrates that the observed and predicted frequencies differ significantly, $X^2 = 83.03$ and p-value = .00. Most of the teachers "**agree**" that the ICT role regarding critical thinking in 21st Century classroom is important to make the student think better, discuss queries with the teachers and develop critical thinking among teachers and students by using ICT.

Table 8

Teachers' views about Advantages of ICT in 21st Century Classroom (N = 400)

S.No	Statement	f	SDA	DA	UD	A	SA
1.	Integration of ICT in teaching enables the teachers to engage the students in learning.	O	6	27	12	48	32
2.	ICT helps to make teaching interesting.	O	1	5	3	39	77
3.	ICT reduces the expenses of the travelling of teaching staff.	O	7	23	13	47	35
4.	Using ICT reduces accommodation expenses.	O	35	15	5	66	4
5.	Teachers may use ICT to build dynamic classrooms and make lessons more enjoyable for students.	O	16	6	24	52	27
Overall		O	65	76	57	252	175
		E	480	480	480	480	480

Table No. 8 demonstrates that the observed and predicted frequencies differ significantly, $X^2 = 66.9$ and p-value = .00. Most of the Teachers "**agree**" that the Advantages of ICT in 21st Century classrooms are important to make teaching interesting, reduce accommodation, and building dynamic classroom and make lessons more enjoyable for students.

Table 9

Teachers' Views about Limitations of ICT in 21st Century Classroom (N = 400)

S.No	Statement	f	SDA	DA	UD	A	SA
1.	ICT can foster cheating	O	11	42	21	34	17
2.	ICT is expensive, not accessible to all	O	12	24	14	50	25
3.	ICT detracts students from social interactions or interaction with teachers.	O	55	45	21	4	0
4.	ICT provides misleading or wrong information most of the time	O	40	15	25	18	27
5.	ICT is not accessible everywhere due to poor connectivity	O	38	30	16	29	12
Overall		O	156	156	97	135	81
		E	480	480	480	480	480

Table No. 9 demonstrates that the observed and predicted frequencies differ significantly, $X^2 = 66.9$ and p-value = .00. The Majority of the Teachers "**agree**" that the Limitations of ICT in 21st-century classrooms are fostering cheating, providing wrong information, and not accessible to all.

Table 10

Students Views about Role of ICT Regarding Communication in 21st Century Classroom (N = 400)

S.No	Statement	f	SDA	DA	UD	A	SA
1.	ICT is used for organizing information	O	10	15	20	143	210
2.	ICT is used to exchange information	O	0	30	35	171	62
3.	ICT is used for presenting new information and discuss	O	12	36	28	214	136
4.	ICT is used for collecting information.	O	31	53	24	197	93
5.	Send our queries through ICT.	O	38	42	15	183	119
6.	Send homework through ICT.	O	32	42	35	163	26
Overall		O	123	218	157	1072	646
		E	480	480	480	480	480

Table No. 10 demonstrates that the observed and predicted frequencies differ significantly, $X^2 = 119.7$ and p-value = .00. Majority of the students "**agree**" that the ICT role regarding communication in 21st Century classroom is important in organizing, collecting, exchanging, and presenting new information is high at secondary school level.

Table 11

Students Views about Role of ICT Regarding Collaboration in 21st Century Classroom (N = 400)

S.No	Statement	f	SDA	DA	UD	A	SA
1.	ICT is the main source of Collaboration and networking	O	12	35	40	174	137
2.	ICT having virtual collaboration helps expand access to education	O	40	35	46	133	144
3.	Through ICT, students collaborate anytime, anywhere.	O	31	51	42	208	66

S.No	Statement	f	SDA	DA	UD	A	SA
4.	ICT cultivates collaboration among students of diverse communities	O	45	56	23	206	68
5.	ICT helps to collaborate for greater productivity and benefit	O	44	35	75	173	71
6.	ICT enhances the level of participation among individuals.	O	40	56	32	194	76
Overall		O	212	268	258	1088	562
		E	480	480	480	480	480

Table No. 11 demonstrates that the observed and predicted frequencies differ significantly, X^2 = 127.03 and p-value = .00. The difference is not statistically significant among views of pupils that the majority of the students "**agree**" that ICT role regarding collaboration in 21st Century classroom is important in promoting student engagement, enhances the level of participation of individual students among themselves and with teachers.

Table 12

Students Views about Role of ICT Regarding Creativity in 21st Century Classroom (N = 400)

S.No	Statement	f	SDA	DA	UD	A	SA
1.	ICT has a strong link with creativity and innovation	O	42	75	62	89	130
2.	ICT helps in discovering new knowledge and information	O	32	56	40	200	70
3.	ICT helps in understanding concepts with the help of images and videos	O	40	52	50	146	110
4.	ICT usage supports creative teaching and learning	O	23	45	36	177	117
5.	ICT usage improves the quality of education	O	19	52	31	243	53
Overall		O	156	280	219	855	480
		E	480	480	480	480	480

Table No. 12 demonstrates that the observed and predicted frequencies differ significantly, X^2 = 602.2 and p-value = .00. Majority of the students "**agree**" that the ICT role regarding creativity in 21st Century classroom is important in organizing, collecting, exchanging, and presenting new information is high at secondary school level.

Table 13

Students' views about the role of ICT regarding Critical Thinking in 21st Century Classroom (N = 400)

S.No	Statement	f	SDA	DA	UD	A	SA
1.	ICT usage makes students to think better and discuss	O	32	36	12	243	75
2.	Critical thinking is developed by using ICT	O	16	23	7	261	91
3.	Problem-solving skills are sharpened by ICT usage	O	45	29	13	235	76
Overall		O	93	88	32	639	242
		E	480	480	480	480	480

Table No. 13 demonstrates that the observed and predicted frequencies differ significantly, X^2 = 472.3 and p-value = .00. Majority of the students "**agree**" that the ICT role regarding critical thinking in 21st Century classroom is important in organizing, collecting, exchanging, and presenting new information is high at secondary school level.

Table 14

Students Views about Advantages of ICT in 21st Century Classroom (N = 400)

S.No	Statement	f	SDA	DA	UD	A	SA
1.	Due to ICT integration, students become more engaged in learning	O	49	36	18	286	9
2.	ICT helps to make learning interesting and knowledge is retained in the mind	O	16	26	18	194	147
3.	Using ICT reduces Travelling expense	O	45	102	3	184	62
4.	Using ICT reduces accommodation expenses.	O	55	92	8	173	70
5.	ICT promotes higher-order thinking skills	O	26	28	6	184	157
Overall		O	190	284	53	1023	445
		E	480	480	480	480	480

Table No. 14 demonstrates that the observed and predicted frequencies differ significantly, X^2 = 1431.7 and p-value = .00. Majority of the students "**agree**" that the Advantages of ICT in 21st Century classrooms are important to promote higher order thinking skills, make learning interesting and engaged students in learning.

Table 15

Students Views about Limitations of ICT in 21st Century Classroom (N = 400)

S.No	Statement	f	SDA	DA	UD	A	SA
1.	Using ICT can be a distraction from a given task	O	25	32	15	243	83
2.	ICT can foster cheating	O	65	60	45	126	102
3.	ICT is expensive, not accessible to all	O	45	75	30	131	117
4.	ICT detracts students from social interactions	O	75	163	24	86	50
5.	ICT provides misleading or wrong information most of the time	O	30	50	22	151	145
Overall		O	240	380	136	737	497
		E	480	480	480	480	480

Table No. 15 demonstrates that the observed and predicted frequencies differ significantly, X^2 = 1431.7 and p-value = .00. Majority of the students "**agree**" that Limitations of ICT in 21st Century classrooms are distracted from the given tract, fostering cheating, providing wrong information, and not accessible to all.

Findings

1. The observed and expected frequencies differ significantly. among teachers' views with X^2 = 113.2 and p-value = .00 about ICT regarding Communication in 21st Century classroom at Secondary school level. Hence, at a significance level of 0.05, the null hypothesis state is disproved. (See Table 4.1). Hence, at a significance level of 0.05, The null hypothesis does not hold true. (See Table- 4.)
2. There is a significant difference between the observed and expected frequencies among educators' views with X^2 = 196.1 and p-value = .00 about ICT regarding collaboration in 21st-century classrooms at the secondary school Level. Therefore, the null hypothesis is rejected at the 0.05 significance level. (See table 5)
3. The observed frequencies show a substantial deviation from the expected frequencies among teachers' views by X^2 = 121.09 and a value of p is 0.00 about ICT regarding creativity in 21st Century classrooms at the Secondary-School Level. Therefore, the null hypothesis is refuted at level significance 0.05(See table 6)
4. There is a notable inconsistency between the observed and expected frequencies among teachers' views by X^2 = 83.03 and p-value = .00 about ICT regarding critical thinking in 21st-century classrooms at the

secondary school Level. Therefore, the null hypothesis is disproved at a significance level of 0.05. (See table 7)

5. The observed frequencies show a substantial deviation from the expected frequencies among teachers' views by X^2 = 66.9 and p-value = .00 about ICT regarding advantages in 21st-century classrooms at the secondary school Level. Therefore, the null hypothesis is disproved at a significance level of 0.05. (See table 8)
6. The observed frequencies show a substantial deviation from the expected frequencies with X^2 = 66.9 and p-value = .00 about ICT regarding limitations in 21st-century classrooms at the Secondary-School Level. Therefore, the null hypothesis is disproved at a significance 0.05 level. (See table 9)
7. The observed frequencies show a substantial deviation from the expected frequencies among students' views with X^2 = 119.7 and p-value = .00 about ICT regarding communication in 21st-century classrooms at the secondary school Level. Therefore, the null hypothesis is disproved at a significance 0.05 level. (See table 10)
8. The observed frequencies show a substantial deviation from the expected frequencies among students' views with X^2 = 127.03 and p-value = .00 about ICT regarding collaboration in 21st Century classrooms at the Secondary-School Level. Therefore, the null hypothesis is disproved at a significance 0.05 level. (See table 11)
9. The observed frequencies show a substantial deviation from the expected frequencies among students' views with X^2 = 602.2 and p-value = .00 about ICT regarding creativity in 21st-century classrooms at the secondary school Level. Therefore, the null hypothesis is disproved at a significance 0.05 level. (See table 12)
10. The observed frequencies show a substantial deviation from the expected frequencies among students' views with X^2 = 472.3 and p-value = .00 about ICT regarding critical thinking in 21st-century classrooms at the secondary school Level. Therefore, the null hypothesis is disproved at a significance 0.05 level. (See table 13)
11. The observed frequencies show a substantial deviation from the expected frequencies among students' views with X^2 = 1431.7 and p-value = .00 about the advantages of ICT in 21st-century classrooms at the secondary school Level. Therefore, the null hypothesis is disproved at a significance 0.05 level. (See table 14)
12. The observed frequencies show a substantial deviation from the expected frequencies among students' views with X^2 = 1431.7 and p-value = .00 about ICT limitations in 21st-century classrooms at the secondary school Level. Therefore, the null hypothesis is disproved at a significance 0.05 level. (See Table 15)

Recommendations

Considering the conclusions, the following recommendations are made:

1. To enhance Communication, Collaboration, Creativity, and Critical thinking, ICT plays a vital role in 21st-century Classrooms, so it may be part of the curriculum of all secondary school levels.
2. There may be a fixed time to use ICT in the classroom as it may not distract the students from a given task.
3. ICT may be accessible for all students to use it.
4. One of the limitations of ICT is to disseminate wrong information, so the authenticity of information sources must be checked.
5. With the availability of ICT, teachers may also be trained to use ICT in their regular lessons.

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