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COMPARISON OF 21st CENTURY SKILLS AMONG SCIENCE AND ARTS SECONDARY STUDENTS OF ISLAMABAD PAKISTAN

Sobia Kanwal * & Dr. Farkhunda Rasheed Choudhary**

Abstract

To cope up with this competitive digital era, students' top priority should be tech-fluency. Therefore, education system must be embedded with essential 21st century skills to confront the life challenges in this competitive 21st century. The study delimited to three skills out of most highlighted fifteen components of 21st century skills. These three essential abilities were Critical and Logical Thinking Skill, Digital Literacy Skills and 3Rs Skills. Population of the study consisted of 151 F.G. secondary schools of Islamabad. The number of sampled science students was 100. The number of sampled arts students was 100. Therefore, 200 sample of students was taken for data collection through stratified random sampling. The survey approach using scales to measure the perceived level of critical thinking skill, digital literacy skill and 3Rs skill was employed in the study design. Hypotheses were tested by taking alpha 0.05, as level of significance. Data was analyzed using t-test. The findings revealed that there was no significant difference in the overall perceived level of 21st century skills among secondary schools students when compared according to their academic stream. It was also found that science group students were higher on digital literacy, whereas students showed non-significant difference was found in the perceived level of critical thinking. It is concluded that the significant difference was found with respect to digital literacy skill.

Keywords: *21st century skills, critical thinking skills, digital literacy skills, 3R*

Introduction

* Science teacher, station high school #3, sobiaftabb@gmail.com
**Assistant Professor EPPSL Department Allama Iqbal open university Islamabad farkhunda.rasheed@aiou.edu.pk

To achieve success in the twenty-first century, the era of digital globalization, students need new skills and knowledge at every stage of life. Children must avail opportunities to learn 21st-century skills from cradle to career for success in school, career, and life (Ross, 2017).

21st-century skills composed of capabilities, competencies, and learning tendencies that have been recognized as needed for progress in the 21 st century by educators in every field of life. The 21 st century skills for a globalized world, focusing on students to be proficient in development for success in rapidly modifying digital society.

Critical thinking is a worldly recognized essential skill across academia. Frequent discussions are held on the significance of vital goals of developing critical thinking through education and the implementation of a goal. However, there are several reservations to deny and challenge critical thinking in current education. Still, students in schools are not taught how to think critically and are under criticism of public debate (Radulovic & Stannic, 2018). School systems need to revise the curriculum to develop a solid foundation of critical thinking skill in high school students and seek more progress after secondary school (Acharya, 2018).

Digital Literacy means having the competency required to move in a society where dissemination and globalization are boosting through digital mechanization and telecommunication like the internet, media and digital devices. In addition to digital literacy skills, the classic, “3Rs” i.e reading, writing, and arithmetic are also essential.

Among all students, the development of academic subjects' knowledge and understanding can only be attained by implementing 21st century skills. Only students with a strong base of academic subjects' knowledge have critical thinking and effective communication. Education is primarily based on educating students the foundation of reading, writing, and arithmetic i.e., "3 Rs" with social studies and language subjects. The class takes less interest in the traditional teaching model based on teacher-centered when repetition of content made class boring by writing or saying the same thing repeatedly. Massive information is memorized by students from primary level to enhance their knowledge through teacher-centric model. Therefore, teacher-centric model for educating student playing vital role in sharpen their rote learning. To know students' learning level, student knowledge is assessed at the end of the year by using

tests and quizzes. However, curriculum designers are now aware of the importance of development in teaching methods to attain educational goals in equipping students for their future (Alismail & McGuire, 2015). For a successful life, students must have essential skills, knowledge, and expertise.

Students' involvement in class and their motivation to learn is positively related to technology in our classes (Roslaniec, 2018). As students can get direct access to information and knowledge conveniently using technology, the importance of technology cannot be denied. Teachers should allow students to research and develop skills through technology. Technology can enable students to learn effectively using different Websites (Alismail & McGuire, 2015). Drew (2013) argued that "Students need to be prepared as skilled and strategic readers, writers, and communicators in online environments."

After having a long work experience in Higher Education in Pakistan, Hoodbhoy (2009) argued that Pakistan's educational system has an inadequate condition. Students are knowledge recorders, and memorizers and exams are the test of knowledge retained by them. Essential skills, such as, the evaluation of knowledge, information manipulation, ideas synthetization for interconnection of classroom learning and practical world are lacked in them. Therefore, regarding this, the National Education Policy (NEP, 2009) acknowledged the vital role of essential skills and their connection with subject knowledge. It emphasized the crucial need for worldwide skills, including critical thinking as a curriculum objective to reduce memorization and usage of Information Communication Technologies (ICTs) to strengthen progressive education. The National Policy (2009) documented the implementation of a curriculum designed to develop critical thinking, digital literacy, and knowledge application to enable students to deal with the worldwide challenges they encounter in an industrial and advanced technological society and global economy.

Our education system is responsible for equipping students in a proper way, so they are able to cope with the twenty-first century's worldwide challenges. Nonetheless, acknowledging the significance of 21st century skills originate its affiliation with the education system to succeed at every stage of life. By keeping in view, the need of the time, National Curriculum Council of Pakistan (2020) with logo ONE NATION, ONE CURRICULUM is working on Single National Curriculum. The promotion and development of the twenty-first century skills is the key consideration of SNC. Therefore, for the very

first time Pakistan's Ministry of Federal Education took initiative of designing Single National Curriculum for quality education, as in SNC all the content strands are underpinned by strands, having the same benchmark i.e., development of the 21st century skills.

21st century skills are being executed in the western education system. They ultimately enable the young generation to deal with the worldwide challenges they face in an industrial and advanced technological society and global economy. In Western countries, and now in Pakistan, policymakers and curriculum planners also significantly focus on designing secondary school curriculum to develop 21st century skills. Generally, secondary school students' academic achievements are affected due to a lack of critical thinking skill, digital literacy skill, and 3Rs skills. For effective and progressive education at the secondary level, 21st century skills can be served as tools and result in enhancement of students' mental and physical abilities. For being globally competent, secondary school students must strengthen education to develop and acquire 21st century skills.

Statement of Problem

To live in this century demands that everyone must be equipped with 21st century skills. There are very few studies which were conducted to explore the status of 21st century skills among secondary school students. Therefore, this study examined the acquisition of 21st-century skills among science and arts secondary school students. In this study, three components of 21st century such as critical thinking, digital literacy, and 3Rs were examined and comparison was made among secondary schools' students.

Hypotheses of study

The following were the hypotheses of the study:

$^{1}H_0$ There is no significant difference in science and art students' critical thinking skills at the secondary level.

$^{2}H_0$ There is no significant difference in science and art students' digital literacy skills at the secondary level.

$^{3}H_0$ There is no significant difference in the 3Rs skill of science and art students at the secondary level.

$^{4}H_0$ There is no significant difference in the overall perceived level of 21st-century skills among science and art students at the secondary level.

Review of literature

It is globally acknowledged that for any nation, education is the best investment. It is the key to open the door to the development and socio-economic growth of a nation. The education sector is the source of progress of any country. Therefore, policymakers, curriculum designers, and educators concluded that successful life's goal could only be achieved through progressive education, pathway of development of twenty-first century skills among school students. If the students acquired essential survival skills i.e., the 21st century skills, success of students in higher education and career is guaranteed (Lamb, Maire & Doecke, 2017).

For a successful life, students must have essential skills, knowledge, and expertise. Essential skills are vital, and survival competencies and abilities are considered essential worldwide for a better existence in the 21st century. Furthermore, there is a great emphasis on identifying and developing twenty-first-century skills among secondary school students in this context.The educational enforcement of 21st century skills at the secondary level should be the initiative of educationists to understand curriculum-based academic subjects, leading to progressive education. Fasasi (2011) highlights that at all levels, the educational institutes' fundamental objective is to provide progressive education, which can develop skills, abilities, competencies in students to cope up with the challenges of the 21st century and ultimately result in the socio-economic glorification of any nation. Scott (2015) enlightens that education transformation according to 21st century education is essential to ensure the acquisition of critical thinking skill, digital literacy skill and 3Rs skills altogether with other 21st century skills by students to be globally competent.

Due to globalization and the growing potential of technology, various developments in the economy and society have occurred. The influence of this development is not only on the workforce but also on the entire society. Therefore, the responsibility of students in this current society has been raised. They must seek progressive education to develop 21st century skills from school to contribute to society for a bright future by making their careers (Fisser & Thijs, 2015).

The Critical thinking skill is one of the first categories of twenty-first-century skills, i.e., learning and innovation. For success in education and at the workplace, twenty-first-century skills are essential and are of great importance. One of these twenty-first-century skills is that critical thinking is considered as the major aim of higher education learning (Flores, Matkin, Burbach, Quinn & Harding, 2012). Critical thinking skill is an abstract thinking

consisting of a set of abilities, including awareness and competences. Even with the established critical thinking skills, many scholars still concluded that critical thinking is not well developed among secondary school students (Hosler&Arend, 2012).

Pangrazio (2016) argues that digital literacy is deeply interlinked with students' success as, in the future, they will be noble citizens and successful employees. Redmond (2015) claims that in the 21st century, students could develop the knowledge, skills, and dispositions by providing them with digital literacy to contribute in the digital world. However, Techataweewan & Prasertsin (2018) identify that improving students' learning by adopting digital literacy skills is positively associated with providing a better digital learning environment. Nevertheless, Murray & Pérez (2017) point out that digital literacy is not nearly equal to reading, writing, and arithmetic for foundational literacy in many educational institutions.

The 3Rs skills are the fourth category of twenty-first-century skills, i.e., Academic Subjects' Knowledge (Chalkiadaki, 2018). Arnold (2018) interestingly explains 3Rs, which covers all aspects of academic subjects of 21st-century skills that students learn from their mistakes. By only making mistakes, they become aware of their mistakes and try to do correction, so learning happens. If students are always right, then the instruction is meaningless as they know everything. Great confidence is required to admit mistakes. Useful instructions based on reading, writing, and arithmetic skills raise academic subjects' knowledge and ultimately result in productive evaluation.

In the era of 21st century, education is an investment in knowledge for the future, which will pay the best interest for upward mobility, leading to better jobs and improved lifestyle. Wrahatnolo and Munoto (2018) state that students' future depends on several essential skills, including critical thinking, digital literacy, and 3Rs. Education that is emphasizing only content, is a big obstacle in achieving life and career skills. Therefore, education systems provide students with knowledge-based education with essential ability such as critical thinking, reading, writing, arithmetic and digital literacy skills to cope with future challenges. Unfortunately, the current education system cannot fulfill students' requirements, ultimately students suffer the skills gap and resulting in a lack of job opportunities.

Methodology

Descriptive research design was used for this study. The study was conducted through a quantitative research method. Because, a quantitative approach was most suitable to measure the perceived level of 21st century skills. In survey approach, for testing hypothesis, quantitative research is most reliable (Sreefkerk, 2019). Since this study was a comparative study, therefore, stratified sampling was used in this study. To reduce the risk of bias selection, stratified random sampling is best approach and also area based randomized sampling allows to collect balanced sample in a comparative study (Carrie, 2020). A sample of 200 students was collected through random sampling from each strata i.e science students and arts students. Survey approach was used for this research, as it was practically feasible for the researcher. Three Scales were used to collect data from students. Collected data was analyzed through quantitative analysis techniques.

Population and Sampling

Federal government secondary schools in Islamabad ensure quality education based on constructive teaching methods, the right learning environment, and formative assessments. Therefore, the survey approach was employed to measure the perceived level of three components of twenty-first century skills i.e., critical thinking skill, digital literacy skill, and 3Rs skills are being developed among federal government secondary schools' students of Islamabad. For the survey, 200 students were selected from 20 Federal government secondary schools out of 151 Federal government secondary schools of Islamabad. Ten schools were selected by applying random sampling from each male and female F.G. secondary school of Islamabad. Five science students were selected by random sampling from each selected school. Five art students were selected by random sampling from each selected school. Therefore 100 science students and 100 art students were sampled from selected schools. Equal sample collection from both groups is necessary for fair comparison (Alamolhoda, Ayatollahi, Taghi & Bageheri, 2017).

Instruments

Critical thinking scale (CTS) scale comprising of 42 factors to gauge the apparent degree of basic reasoning expertise. Digital literacy skills (DLS) scale is consisting of 35 items to monitor the perceived level of digital literacy skills. Each item of both scales was

scored on a five-point Likert scale with self-reported truth response items: 1) Strongly Disagree 2) Disagree 3) Undecided 4) Agree 5) Strongly Agree.

But 3Rs scale was comprising of 40 subject based questions. Therefore, mean score of 3Rs skills was calculated on the basis of true/false option (scores obtained in three domains). T-test were applied to compare mean scores of sciences and arts groups. The data was tabulated, and results were interpreted.

Data analysis

The study's purpose was to examine the acquisition of 21st-century skills among secondary school students and determine the perceived level of 21st-century skills concerning three components, i.e., critical thinking, digital literacy, and 3Rs among secondary school students. Also, the aim of the study was to compare the perceived level of these 21st century skills among science and arts students at the secondary level.

Table 4. 1

Demographic Frequency and Percentage of Research Participants (n = 200)

Demographic Variables	*N*	%
Study Groups		
Science Students	100	50
Arts Students	100	50

Table 4.1 provides an overview of demographic information. The data shows the frequency and percentage of research participants. The representative sample of target population consists of 200 secondary school students concerning gender and study group.

Hypotheses Testing

[1]H_0 There is no significant difference in science and arts students' critical thinking skill at the secondary level.

Table 4.2

Compare Students group-wise on perceived level of CTS

Strata	n	Mean	t value	Df	*p* value
Science Students	100	3.4562			
			-1.292	198	.198

Arts Students	100	3.4995

Table 4.2 indicated that *t* value was -1.292 whereas, *p* value (.198) of science and of arts students was greater than 0.05. Thus null hypothesis was accepted and alternate hypothesis was rejected at 0.05 level of significance. So, it was concluded after testing that no significant difference was found in science and arts students' critical thinking skill at the secondary level.

The mean score of science student's responses (3.4562) was almost equal to the arts students' responses (3.4995). Which shows that science students and arts students have almost same perceived level of critical thinking skill.

$^{2}H_0$ There is no significant difference in science and arts students' digital literacy at the secondary level.

Table 4.3

Compare Students group-wise on perceived level of DLS

Strata	n	Mean	t value	Df	*p* value
Science Students	100	3.4923	9.226	198	.000
Arts Students	100	3.1637			

Table 4.3 indicated that *t* value was 9.226, whereas *p* value (.000) of science students and of arts students was less than 0.05. Thus null hypothesis was rejected and alternate hypothesis was accepted at 0.05 level of significance. So, it was concluded after testing that significant difference was found in science and arts students' digital literacy at the secondary level.

The mean score of science students' responses (3.4923) was greater than arts students' responses (3.1637). Which shows that science students have better views about digital literacy skill than arts students.

$^{3}H_0$ There is no significant difference in the 3Rs skill of science and arts students at the secondary level.

Table 4.4

Compare Students group-wise on perceived level of 3RsS

Strata	n	Mean	t value	*Df*	*p* value
Science Students	100	20.68	-1.540	198	.125
Arts Students	100	21.45			

Table 4.4 indicated *t* value was -1.540 whereas *p* value was .125 of science and of arts students was greater than 0.05. Therefore, null hypothesis was accepted, and alternate hypothesis was rejected at 0.05 level of significance. Therefore, it was concluded after testing that significant difference was not found in the 3Rs skill of science and arts students at the secondary level.

The mean score of arts student's responses (21.45) was greater than the mean score of science students' responses (21.45). This shows that arts students have better views about 3Rs skill than science students.

[4]H_0 There is no significant difference in the overall perceived level of 21st century skills among science and arts students' at the secondary level.

Table 4.5

Compare Students group-wise on perceived level of 21st Century Skills

21st Century Skills of Strata	n	Mean	t value	Df	*p* value
CTS Science	100	3.4562	-1.292		.198
CTS Arts	100	3.4995			
DLS Science	100	3.4923	9.226	198	.000
DLS Arts	100	3.1637			
3Rs Science	100	20.68	-1.540		.125
3Rs Arts	100	21.45			

Note. CT = Critical thinking; DL = Digital literacy; 3Rs= Reading, writing & arithmetic skill

Table 4.5 indicated that t value of CTS, DLS and 3RsS was -1.292, 9.226 and -1.540 respectively, whereas, *p*-value of CTS (.198) described students' perceiving level of critical thinking skill and *p* value of 3RsS(.125) showed the performance in 21st century skills was highly insignificant but p value of DLS(.000) showed significant perceived level of digital literacy in 21st century skills among science and arts students at secondary level.

Therefore, critical thinking skill and 3Rs skills are insignificant determinants, whereas, digital literacy skill is non-significant determinant of 21st century skills.

Hence, it is concluded that there is no significant difference in the overall perceived level of 21st century skills among science and arts students at the secondary level.

Discussion

This research was conducted to examine perceived level of 21st-century skills, i.e., critical thinking, digital literacy, and 3Rs skills between two groups (science and arts) among secondary school students. The findings of the study revealed significant results of digital literacy skills for science and arts students and non-significant results of critical thinking skill and 3Rs skills. The result indicated that digital literacy is significant determinant of 21st century skill, as 21st century is the era of advance technology, so students' focus is more on digital appliances i.e., mobile phones and computers than reading books. Because of circumstances, when (COVID-19) was spreading, online study in the world was becoming famous and this thing is common now a days, if students find any problem regarding study, they just like to google their problem rather than thinking critically. In this situation, students need to enhance their critical thinking skill and 3Rs skills. Also, the results indicated the average scores of students in 3Rs skills. According to situation, when school were closed due to COVID-19, no on-line studies were introduced in federal government schools, the syllabus of all the subject were reduced and afterward it was decided that the papers of only elective subjects will be taken in final federal board examination, then it is not a shocking result that students have gained average score in assessment of their 3Rs skills. This result in critical thinking skill and 3Rs skills as non-significant determinants of 21st century skills.

The findings of the study also indicated non-significant results

of critical thinking skill and 3Rs skills on study groups. So, in general, teaching regarding development of 21st century skills must be applied in classrooms of primary and secondary schools (Fiore, 2019). Research has illustrated that adaption of some useful strategies is beneficial to instruct competencies such as collaboration and communication in the classroom (ibid.). In addressing the teaching of 21st Century Abilities, Care et al. (2017b) expressed that the two key components for instructors to mark are (1) to distinguish what illustration of any of the 21st century skills might see like, and (2) to recognize how to draw out performances so that instructors know which perspectives of those skills, the student is prepared to memorize.

There is non-significant difference found in science and arts students' perceived level of 21st century skills at the secondary level. Hence the hypothesis stands approved. A number of practical guidelines about classroom approach for the advancement of problem-solving skills and critical thinking skills among students are provided by Mills and Kim (2017). In their view, it is not necessary that problem solving skills and critical thinking skills are naturally created, and instead have to be explicitly instructed in a way that can be transmitted over different situations and contexts. In keeping with Care et al. (2017b), they highlight the significance of creating a standard classroom culture for developing problem solving and critical thinking skills through language and exercises that empower students to think around achieving a specific objective, and oversee their mental abilities in tending to this. Initially, this incorporates peer-to-peer interaction to share problems, and express consultation of what was done to solve those problems. Mills and Kim (2017) state that, by unraveling the problems themselves, students can be more confident and productive as they apply and adjust their considering when they get engage in future assignments.

So, there is no significant difference in the 3Rs skill of science and arts students at the secondary level. Subsequently the hypothesis stands approved. Within the classroom environment, this moreover shows up that it is not the teachers' duty to work through the problems within the field of science and arts, students are responsible to work through the problems. The teachers are not responsible to solve problem on behalf of students, their duty is to provide support in understanding the problems. Mills and Kim (2017) also claim that this approach is beneficial for students so that the students will not only recognize the worth of hard work but also will be able to work smartly by practicing new and different strategies in solving

problems.

The current study stated no significant difference between science and arts students' critical thinking skill at the secondary level. The t-test analysis results also demonstrate that critical thinking had non-significant results concerning both groups among students. It means that a person's reasoning abilities accurately and efficiently will have critical thinking and would not be affected by subjectivity or boredom. A person having more curiosity toward exploring things would be a more critical thinker to analyze things deeply. Previous literature and empirical literature is also evident in this regard. However, Barnett et al. (2017) contend that, in utilizing this approach, instructors got to educate problem solving and critical thinking skill explicitly and systematically – a point resounded by Fiore (2019). At the foremost common level, collaborative problem-solving requires group individuals to set up and keep up a shared understanding of the circumstance they are confronting. Basically, there's an uneven dissemination of information inside groups. Individuals must keep up communication to assist each other share and simplify factors of the problem. Advance steps can incorporate laying out group subtasks based upon parts, or making components to facilitate activities. At last, collaborative problem-solving requires keeping the group organized by observing interlinkage and giving critique to each other. Integrally, in order to consider alternative views of problems' factors, as well as the skill to take others' perspective, group individuals require essential skills that offer assistance to them (Fiore, 2019).

Significant difference is found in secondary school students' digital literacy skills concerning their academic stream, i.e., science and arts and significant results concerning both study groups among students. Whereas, the science students have more exposure to digital literacy than arts students. The reason of higher digital literacy skills in science students is using scientific learning approaches. Working in laboratories became more exposed to real fieldwork, becoming scientific in their approach than arts students. Previous literature and empirical support also revealed that there is a significant difference present in digital literacy skills of science and arts students.

The current study stated that there is no significant difference in the 3Rs skill of secondary school students concerning their academic stream, i.e., science and arts. The t-test analysis results demonstrate that 3Rs skills had non-significant results concerning gender and both groups among students. However, previous literature is evident in the non-significant relation, so the hypothesis was accepted. It might be because there are the necessary skills present in every individual; we

can say that there are instinctual skills, so they have no relation with digital literacy. Whether a person is not efficient in computer knowledge, he can still have reading, writing, and arithmetic skills like children; they are not efficient in computers in their lowers grades but can read write well. Also, it is unnecessary that a person not having critical thinking ability would not be able to read, write or solve basic arithmetic questions However, it is recommended that students once in a while get significant instruction, modeling and input on collaboration, in spite of the fact that such inputs are considered as vital. In spite of the fact that instruction and feedback is provided by the classes that actualize collaborative problem-solving, is more likely to be the subject-based information than their cooperation (Fiore, 2019).

It was hypothesized that there is no significant difference in the overall perceived level of 21st-century skills between science and arts students. The t-test analysis results demonstrate that there is a non-significant relationship between critical thinking skill and 3Rs skills but significant results with digital literacy skill. Overall perceived level of 21st-century skills are found to be non-significant as two non-significant domains of 21st century skill i.e., critical thinking skill and 3Rs skills are non-significant.

Conclusion

This research aimed to analyze the 21st century skills in three domains critical thinking, digital literacy, and 3Rs skills among students. It is concluded that there is a non-significant difference between science and arts students' critical thinking skill and 3Rs skills but significant difference was found regarding digital literacy skills among secondary school science and arts students.

Recommendations

1. In this research, data were collected from a small sample. The sample was taken from a limited locale. The generalizability of the results of this study might be low due to the small sample size. Therefore, it is suggested that the researchers interested in studying the relationship of fear of performance failure with other variables in the future should take a large sample.
2. In the present study, CTS and DLS were measured based upon self-report measures, in which the respondents might not give accurate responses. Therefore, some suitable "tests" can be conducted

to find true picture of CTS and DLS among students.

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