A COMPUTERIZED APPROACH TO ENHANCE LEARNING EXPERIENCE OF O/L STUDENTS IN ICT EDUCATION

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DECLARATION

I declare that this thesis is our own work and has not been submitted in any form for another degree or diploma at any university or other institution of tertiary education. Information derived from the published or unpublished work of others has been acknowledged. Due references have been provided on all supporting works of literature and resources.

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Abstract

Different types of challenging activities should be given to the student by the teacher through technology and the learner should be engaged in thinking. Learners of modern computer-based technologies have significant potential to provide meaningful learning experiences for knowledge building. The purpose of this study is to suggest and develop an effective e-learning framework for strengthening the online learning environment with an e-learning model to enhance online connectivity and learning.

In this study, 100 ICT students studying in Grade 11 were divided into two groups of 50 each and the governing body was given 5 TEL learning materials based on the lessons related to the GCE (O / L) syllabus. The other group learned the relevant 5 lessons using the Zoom technology using the standard classroom learning-teaching methodology. The lessons used in the TEL material were adapted to the TPACK concept, allowing the student to face the assessments given at the beginning and end of a lesson for the final assessment of the lesson. Each lesson is done at the beginning and end of the lesson. Students in the controlled group are required to engage in self-study by following the links provided in these sequential lessons. At the end of the above process, Google Forms will provide two questionnaires for the students involved in the TEL material and the parents of 20 of those students. Before starting this study, all stakeholders will attend an online consultation and conclude the analysis of qualitative and quantitative data obtained using the Weka software.

Keywords:- TEL material, Online education, TEPACK concept, self-learning

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Chapter 01

Introduction

1.1 Introduction

The advancement of new information technology has brought about significant changes in many sectors of society over the past two decades. As a result, the process of connecting with the outside world, as well as the pace of modern life, has accelerated. The Internet, which provides access to information and educational resources around the world, has enabled people to create and develop remote jobs. These innovations have had an impact on education, as demonstrated by the use of Internet resources, Internet services, many online educational programs, installed applications, and other forms of distance learning by instructors and students.

1.2. Background of the study

As a computer, Internet, and multimedia medium, information and communication technology software is employed. It is a method of disseminating information for educational assistance and improvement. This data can be in the form of sound or video, automated text, or a picture. Information and communication technology, according to research conducted throughout the world, not only increases our reputation but also has a good influence on the way we educate in school. ICT exhibits increased knowledge, improved presenting skills, and increased inventiveness. Different types of challenging activities should be given to the student by the teacher through technology and the learner should be engaged in thinking. Learners of modern computer-based technologies have significant potential to provide meaningful learning experiences for knowledge building [1]. The use of computer technology and the introduction of information technology to all aspects of contemporary production, these changes which are essential elements of every society in daily life and in social life have caused the epidemic situation faced by the present society to affect the entire education system. Distance learning was the method of educating the child in the face of the Kovid-19 epidemic. But with the introduction of information technology into the learning process, the possibilities for privatizing and modifying the learning process and redirecting it to develop thinking and imagination as key processes necessary for successful learning

emerged. The ability to work on a computer provides an effective organization of students' cognitive functioning. Improving the quality of training and the productivity of knowledge. The teacher and students are the active participants and partners in the educational process in which this interaction takes place. An integral part of the interactive education process is the continuous evolution of specialized relationships between its subjects, activities, activities, and personal interaction between teachers and students, including goals, motivations, activities, and activities that integrate subjects[1, 2].

The purposeful use of networked information and communications technology in teaching and learning is known as e-learning. This technique of teaching and learning is also referred to by a variety of different labels. Online learning, virtual learning, distributed learning, networked learning, and web-based learning is some of them. Fundamentally, they're all educational procedures that use ICT to mediate asynchronous and synchronous learning and teaching activities [3].

The United Nations Educational, Scientific, and Cultural Organization (UNESCO) have played a critical role in guiding us through the current condition of education, which has seen rapid technological advancement. Technology, according to UNESCO, allows universal access to education, bridges the gap, helps teachers, improves learning quality, encourages inclusion, and improves education, administration, and governance. The Government and other stakeholders have benefited from UNESCO's assistance for ICT-based learning. Capacity building, publication, fieldwork, and international conferences are all part of it. Various gadgets are utilized to deliver course materials such as ICT, storage, cloud-based management system, inverted classroom, tablet computer, audio player, projector, and so on. The need for these classroom learning facilities is growing. Information and communication technology (ICT) will revolutionize or bring about change, according to policymakers [4]. In the sphere of education, information and communication technology will attract exceptional students who will help to facilitate social interaction and contribute to the global economy [5].

The use of technology, pedagogical attitudes, and content preparation are all required competencies for integrating information and communication technologies (ICT) into the teaching-learning process. These credentials are intertwined and should not be seen in

isolation[6]. ICT and TPACK abilities are critical for ICT integration in this environment. The International Society for Technology Education's (ISTE) educator standards specifies the ICT abilities that teachers should have as designers and facilitators [7]. ICT literacy, digital literacy, and ICT competence are the frameworks in which these criteria are assembled [4]. The study's definition of ICT competence is the integrated and functional use of digital knowledge, skills, and attitudes [8].

The learning and teaching process needs to move away from teacher-centered to active student-centered educational methods. But the school has still failed to deviate from the traditional methodology. This has become more complex and a social problem in the face of the current catastrophic situation. Today, the student who has studied in an active learning environment while maintaining teacher-student interaction using different learning methods in the classroom has to pursue distance education. Teacher-centeredness in online education is a cause for distraction for the student who participates in academic activities in the home environment. Therefore, in online education, the student is actively involved in the learning process and the teacher must participate in it as a facilitator [9].

This research seeks to explore the possibility of using a TPACK concept to create a TEL (Technology Enhanced Learning) material that can help students learn technology (Technology is not used to deliver instruction. Technology can only support learning.)[1].

1.2. TPACK: technical, pedagogical, and content knowledge

The most popular technology integration paradigm among educational academics is TPACK. The purpose of TPACK is to give educators a framework for understanding the role of technology in the educational process. TPACK is based on the idea that educators interact with three forms of core information regularly: technical, pedagogical, and content knowledge. Knowledge of one's topic field, such as science, math, or social studies, is referred to as content knowledge. Knowledge of how to educate is referred to as pedagogical knowledge. Technical knowledge, on the other hand, is the ability to employ technological tools [10, 11]

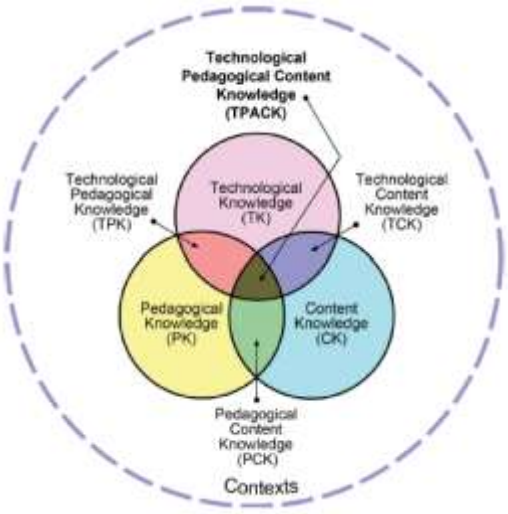


Figure 1.1, Technological Pedagogical Content Knowledge (TPCK)

The intricate interplay of three basic types of knowledge: content (CK), pedagogy (PK), and technology (T) lie at the heart of the TPACK paradigm (TK). The TPACK method goes beyond looking at these three knowledge sets separately. The TPACK framework goes even further by emphasizing the types of knowledge that exist at the crossroads of three primary forms: Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), and Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPCK) (TPACK). [10, 11]

As TPACK is seen as a dynamic relationship between technology, pedagogy, and content, teachers are expected to evaluate technology, pedagogy, and content knowledge as a whole in the process of integrating ICT. TPACK is defined as all of the knowledge required for teachers involved to present the content they handle with appropriate pedagogy and technology [11].

The development of awareness to the dynamic, transactional link between various components of knowledge located in distinct settings is required for effective technology integration for pedagogy around the specific subject matter. Individual teachers, grade levels, school-specific circumstances, demographics, culture, and other considerations ensure that each scenario is unique, and no one mix of material, technology, or

methodology will work for every teacher, every course, or every teaching philosophy[10].

2020 EDUCAUSE Horizon Report[12] Teaching and Learning Edition report shows that profiles key trends and emerging technologies and practices shaping the future of teaching and learning and envisions several scenarios and implications for that future. [4] defined science courses enhanced with a web-based learning tool have a positive effect on students' academic success for students if their achievement scores are interpreted as success in acquiring the knowledge in the course content Traditionally, technology has been used to deliver instruction or teach the students, based on the assumption that students learn from technology. Accordingly, knowledge was transmitted from expert teachers to passive learners, by embedding them into technology-based lessons. However, current views emphasize that technology can only foster and support learning and that students should take control of their learning.

This study aims to provide student-centered active education through online education, aligning with the concept of TPACK, by analyzing the interactive patterns of learners and their functioning.

1.4 Aim and Objectives

The aim and objectives of this study are as follows.

1.4.1 Aim:

To identify the impact of aligning the learning activities with the TPACK concept on student learning in distance learning environments.

1.4.2 Objectives:

1. Analyze the impact of the TEL material on the TPACK concept towards ICT subject performance in providing online education to O/L students.
2. Identify the most suitable methodology for ICT subject performance in O/L students' online education.
3. Exploring the impact of the use of TEL material based on the TPACK concept in the O/L students' self-study process

4. Examine students' and parents' perceptions of the use of TEL material in the teaching-learning process.

1.5 Research Questions

1. Can a computerized approach be used to enhance the online learning experience of O / L students in ICT education?
2. Is online education having a positive impact on the ICT subject performance of O/L students?
3. What is the impact of TEL material on the concept of TPACK in the self-study process?
4. What are the perceptions of students and parents about the learning experience gained by the TEL material based on the TPACK concept?

Table 1.1, Results of ICT subject (G.C.E.-O/L) – 2019
(Excerpt: Department of Examinations, Sri Lanka)

Table 2.4.3 (Contd.) G.C.E.(O.L.) Examination - 2019
Results by Grades in Each Subject - School Candidates

Subject	No.Sat	Grades											
		A	%	B	%	C	%	S	%	A+B+C+S	%	W	%
62.Citizenship Education & Governance/ Civic & Gov.	109,861	11,373	10.35	14,756	13.43	31,257	28.45	29,554	26.90	86,940	79.14	22,921	20.86
63. Entrepreneurship Studies	7,116	949	13.34	1,121	15.75	1,991	27.98	1,852	26.03	5,913	83.09	1,203	16.91
64. Second Language (Sinhala)	13,379	4,841	36.18	3,394	25.37	2,769	20.70	1,730	12.93	12,734	95.18	645	4.82
65. Second Language (Tamil)	26,683	6,853	25.68	4,840	18.14	6,895	25.84	6,329	23.72	24,917	93.38	1,766	6.62
66. Pali	28	4	14.29	2	7.14	9	32.14	10	35.71	25	89.29	3	10.71
67. Sanskrit	6	-	0.00	-	0.00	1	16.67	1	16.67	2	33.33	4	66.67
68. French	752	99	13.16	119	15.82	217	28.86	158	21.01	593	78.86	159	21.14
69. German	302	113	37.42	60	19.87	65	21.52	37	12.25	275	91.06	27	8.94
70. Hindi	204	93	45.59	34	16.67	27	13.24	31	15.20	185	90.69	19	9.31
71. Japanese	1,271	798	62.79	125	9.83	124	9.76	104	8.18	1,151	90.56	120	9.44
72. Arabic	616	373	60.55	62	10.06	78	12.66	72	11.69	585	94.97	31	5.03
73. Korean	240	20	8.33	21	8.75	38	15.83	65	27.08	144	60.00	96	40.00
74. Chinese	91	21	23.08	18	19.78	21	23.08	15	16.48	75	82.42	16	17.58
75. Russian	5	1	20.00	1	20.00	3	60.00	-	0.00	5	100.00	-	-
80. Information & Communication Technology	61,525	25,055	40.72	12,058	19.57	13,784	22.40	7,788	12.66	58,665	95.35	2,860	4.65
81. Agriculture & Food Technology	53,221	6,217	11.68	6,700	12.59	13,651	25.65	16,945	31.84	43,513	81.76	9,708	18.24
82. Fisheries & Food Technology	714	49	6.86	118	16.53	249	34.87	209	29.27	625	87.54	89	12.46
84. Arts & Crafts	3,159	842	26.65	721	22.82	934	29.57	463	14.66	2,960	93.70	199	6.30
85. Home Economics	36,267	1,384	3.82	3,647	10.06	14,180	39.10	10,582	29.18	29,793	82.15	6,474	17.85
86. Health & Physical Education	146,193	48,136	32.93	30,304	20.73	36,211	24.77	20,814	14.24	135,465	92.66	10,728	7.34
87. Communication & Media Studies	6,437	576	8.95	969	15.05	1,936	30.08	1,810	28.12	5,291	82.20	1,146	17.80
88. Design &Con. Technology	4,130	192	4.65	454	10.99	1,759	42.59	1,268	30.70	3,673	88.93	457	11.07
89. Design & Mec. Technology	3,561	447	12.55	562	15.78	1,232	34.60	859	24.12	3,100	87.05	461	12.95
90. Design & Elec. & Elec. Technology	1,286	87	6.77	73	5.68	292	22.71	450	34.99	902	70.14	384	29.86
92. Electronic Writing & Shorthand (Sinhala)	15	-	0.00	2	13.33	5	33.33	7	46.67	14	93.33	1	6.67

Table 1.2 Results of ICT subject (G.C.E.-A/L)-2020
(Excerpt: Department of Examinations, Sri Lanka)

Table 15.2 : G.C.E.(A.L.) Examination - 2020 (OLD)
All Candidates - Results by Grades in Each Subject

	Subject No.	Subject	No. Sat	A		B		C		S		(A+B+C+S)		F	
				No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1	1	Physics	10323	193	1.87	652	6.32	2597	25.16	4104	39.76	7546	73.10	2777	26.90
2	2	Chemistry	11679	888	7.60	1410	12.07	2751	23.56	3923	33.59	8972	76.82	2707	23.18
3	7	Mathematics	72	5	6.94	1	1.39	12	16.67	19	26.39	37	51.39	35	48.61
4	8	Agricultural Science	3381	56	1.66	337	9.97	1209	35.76	1205	35.64	2807	83.02	574	16.98
5	9	Biology	9109	1012	11.11	1448	15.90	2765	30.35	2529	27.76	7754	85.12	1355	14.88
6	10	Combined Mathematics	3249	194	5.97	326	10.03	701	21.58	1177	36.23	2398	73.81	851	26.19
7	11	Higher Mathematics	2	-	0.00	-	0.00	-	0.00	-	0.00	0	0.00	2	100.00
8	13	General English	14465	1572	10.87	1508	10.43	2585	17.87	3909	27.02	9574	66.19	4891	33.81
9	14	Civil Technology	103	-	0.00	5	4.85	40	38.83	44	42.72	89	86.41	14	13.59
10	15	Mechanical Technology	7	-	0.00	1	14.29	3	42.86	1	14.29	5	71.43	2	28.57
11	16	Electrical, Electronic & Information Technology	16	-	0.00	4	25.00	5	31.25	4	25.00	13	81.25	3	18.75
12	17	Food Technology	25	1	4.00	1	4.00	2	8.00	11	44.00	15	60.00	10	40.00
13	18	Agro Technology	418	1	0.24	28	6.70	187	44.74	131	31.34	347	83.01	71	16.99
14	19	Bio Resource Technology	13	-	0.00	-	0.00	3	23.08	7	53.85	10	76.92	3	23.08
15	20	Information & Communication Technology	1536	5	0.33	37	2.41	235	15.30	660	42.97	937	61.00	599	39.00
16	21	Economics	1956	260	13.29	199	10.17	457	23.36	527	26.94	1443	73.77	513	26.23
17	22	Geography	2877	250	8.69	459	15.95	850	29.54	865	30.07	2424	84.25	453	15.75
18	23	Political Science	3510	210	5.98	386	11.00	996	28.38	1234	35.16	2826	80.51	684	19.49
19	24	Logic & Scientific Method	466	9	1.93	49	10.52	121	25.97	127	27.25	306	65.67	160	34.33
20	25A.	History of India	899	214	23.80	190	21.13	249	27.70	159	17.69	812	90.32	87	9.68
21	25B.	History of Europe	341	28	8.21	47	13.78	118	34.60	84	24.63	277	81.23	64	18.77
22	25C.	History of Modern World	18	-	0.00	2	11.11	1	5.56	1	5.56	4	22.22	14	77.78
23	28	Home Economics	560	84	15.00	229	40.89	210	37.50	36	6.43	559	99.82	1	0.18
24	29	Communication & Media Studies	2985	118	3.95	378	12.66	1017	34.07	945	31.66	2458	82.35	527	17.65
25	31	Business Statistics	18	-	0.00	-	0.00	2	11.11	1	5.56	3	16.67	15	83.33
26	32	Business Studies	1696	49	2.89	161	9.49	500	29.48	518	30.54	1228	72.41	468	27.59
27	33	Accounting	1518	79	5.20	120	7.91	299	19.77	595	39.19	1003	66.07	515	33.93

School Performance Indices - G.C.E. (O / L) Examination - 2019 and Performance of candidates, G.C.E. (A / L) Examination - 2020 an analytical analysis of ICT performance in Sri Lanka can be made from the following tables excerpted. G.C.E. has been involved in the teaching-learning process at the school in recent years. Out of 61525 students who appeared for the (O / L) examination, 2860 failed the subject. G.C.E. (A / L) Examination - 39% pass percentage in ICT subject in 2020 examination. The inability to go to school due to the current epidemic has the potential to cause a very high percentage of children to fail. Many parents say that online education at home away from

the teacher is a failure. As a solution to this, the student actively uses various digital tools to use self-learning tools [13].

1.6 Summary

Considering all of the above, the Technology-Advanced Learning Material (TEL) ensures that space is provided for the use of technology for teaching and learning. TEL material translates and enhances students' motivation, unique counseling skills, support for new counseling approaches, and increased teacher productivity that are unrecognizable by organizing learning opportunities. Therefore, it cannot be ignored. Technology-enhanced learning material (TEL) is very important in exploring why TEL is important for educators. It is important not only to achieve the standard of education that is desired today but also to improve the overall education system.

Chapter 02

Literature review

2.1. Introduction

Psychologists have come up with various learning theories for feedback and practical activities in organizing the learning-teaching process. Among the theories of behavior, cognition, and social learning, cognitive theorists consider learning to be closely related to cognition. They, therefore, define learning in terms of reorganizing a person's cognitive or mental world. It is the result of one's efforts to create a sense of the world. People do not react like machines to gain an understanding of the world. They are active products of learning. The child we meet in school begins with the learning experience, seeks information to solve problems, and identifies what they know to gain new learning experiences. This enables the child to manipulate their learning experience with the TEL material.

2.2. Related work

According to Gestalt's theory, learning is about creating new patterns or changing existing patterns in a child's mind. If the present patterns are meaningful the person will try to maintain them in the future. Imposing a meaningful Gestalt is a mental task. It represents a change in the way a person perceives their environment. After creating a Gestalt, it leads to the development of insight. Cognitive theorists argue that intelligent learning lasts longer than rumors. Accordingly, TEL material can facilitate intelligent learning for the child[14].

Isabel,[14] who presents acceptance learning theory, points out that behavioral theories, like other cognitive psychologists, cannot satisfactorily determine and explain meaningful learning. Accordingly, of all the factors that affect learning, the most important is the person's prior knowledge and his existing cognitive structure. Cognitive structure refers to the ability, clarity, and reorganization of a learner's subject knowledge through a given discipline. A person's cognitive structure is organized hierarchically, and learning is compared to meaningful learning. The most essential motivations for meaningful learning begin with learning and the student strives to acquire new

knowledge and skills. Similarly, the learning experience gained through the TEL material also motivates the student to acquire new knowledge and skills and engage in a self-study process.

According to Brunner's theory of discovery, a person does not react indifferently to changes in the environment. They are actively involved in the process of acquiring knowledge and processing that knowledge to produce their knowledge. For people to be active, learning experiences must be organized as problems. They need to be able to gain an understanding of the problem situation to find solutions. Therefore, the knowledge gained in this way lasts a long time in the memory and it is easy to acquire knowledge from it. "Discovery learning provides better communication effects than other learning," Brunner further argues. Therefore, according to this study, it can be said that the learning obtained by the student himself with the help of TEL material is more effective [14].

With the digitalization of education increasing, the relationship between student engagement in Technology-enhanced Learning (TEL) and digital skills has remained largely unexplored. There is a strong consensus that engagement is necessary for students to succeed in school[2]. As education uses increasing numbers of digital technologies, students are directed to engage in learning mediated in this way. However, the study [2] shows that they found significant correlations between students' digital skills and engagement in TEL, showing that the possession of high levels of digital skill is related to engagement in TEL. Interestingly, digital skills were not related to disengagement. This suggests that students reporting both high and low levels of digital skills disengage to some extent when learning with technologies. They e also identified variables reflecting both engagement and disengagement in TEL that predict student performance as measured via final grades, implying that to understand and support students who learn with technologies, a broader understanding of the factors influencing engagement and disengagement is key[2, 15].

According to this study [16] to develop and integrate a technology-engagement teaching strategy (TETS) with the aid of clickers by classifying the learning styles of students in Mathematics I. To establish the changes in participants' academic performance, clicker continuous assessments were conducted. The results showed that the useful

implementation of TETS with the aid of clickers improved students' academic performance [16].

[17] Shows that in their study the Students expressed clear desires for the more consistent and more frequent use of TEL within lectures. Further, students felt that the potential of TEL to encourage and facilitate interactions, both within their University and with external stakeholders, has thus far gone unexploited. Implications for teaching practice and future research are discussed. The study [18] defined science courses enhanced with a web-based learning tool have a positive effect on students' academic success for students if their achievement scores are interpreted as success in acquiring the knowledge in the course content. Moreover,[19] science courses enhanced with a web-based learning tool may be used to minimize the lack of knowledge of the previous year's content of science topics and to improve students' success in science education in secondary schools. Nawaz, [20] the developing countries have to consider all the aforementioned aspects of e-learning and plan everything in their true perspective. Both technological and human factors must be explored, analyzed, and fed into digital plans so that the true benefits of ICTs could be realized. The experiences around the world, as explained in the aforementioned pages, clearly suggest that the availability of technology is not the guarantee for successful e-learning. Furthermore [21] the effect of web-based project applications on students' attitudes towards chemistry and the relationship between these attitudes and students' performance, it has been determined that the mentioned applications increased students' attitudes towards chemistry positively.

It is based on the insights and knowledge of a worldwide panel of higher education experts from around the world. This year's edition is all new! In the case of educational technology, readers will see that the time-to-adoption framework of the past has been replaced with facts, data, and scenarios that explain what the future may look like. There's also a new section that shows how the report's results are affecting various sizes and types of institutions throughout the world. 2020 EDUCAUSE Horizon Report[22] shows that It purpose was also to provide a report that would allow readers to understand, plan, and act on all that is shaping higher education teaching and learning today and in the future. Education is said to be the biggest user of computer software;

however, the main thrust of research on the role of information and communication technologies (ICTs) in education is to answer the question, of how far these technologies have affected the learning process and outcomes. However, educational technologies (ETS) are increasingly becoming accepted as important tools for supporting teaching, and educational and organizational learning [23]. [24] Describes that to make effective use of web-based learning, the features of the site must be designed to be parallel to the goal of the relevant utility. Content should be summarized to minimize computer readings with adequate charts and pictures without navigation support as well as download issues. Also, when it comes to visual design, every web page should be designed in such a way that each page provides a minimalist consulting and creative element mix. Furthermore, the researchers found that the use of self-assessment tools for students played an important role in student motivation and interaction, showing that it is the key to web-based learning success [24, 21].

[25] The study further classifies teachers 'professional knowledge as the result of their ability to enhance students' creativity and the ability of teachers to design digital age assessments. The study concludes that the integration of information and communication technology plays a vital role in enhancing student creativity and helps teachers develop criteria that meet the criteria of the digital learning age [25]. [26] The results show that self-efficacy, creative cognition, and an effective attitude can have a significant impact on student's academic performance in e-learning applications. This study [26] takes a different view and shows that learning facilitates the regulator of the learning process during learning. Web-based learning should not be used to replace traditional methods, but it should happen mentions Therefore, this study recommends using web-based learning methods along with traditional teaching methods.

2.3. Summary

According to the results of the research on online education conducted by researchers in various subjects, it is clear that digitized modern methods must be followed to achieve a successful education. This research will reveal whether it is appropriate to use TEL (Technology Enhanced Learning) material to get a successful online education in Sri Lanka as well.

Chapter 03

Method

3.1 Introduction

This chapter presents a clear description of the methodology followed for the study and the selection of the sample. Moreover, the third chapter gives a sense of the chosen technique that was used holistically for our research. It also explains how the selected techniques differ from those selected in the past literature**.**

3.2 Research design

The study was conducted on two groups of students from two different schools. Studying ICT in those two schools. 100 students out of 50 students studying GCE (O / L) and 20 parents were selected under the easy sampling scheme. . The students were then divided into two groups of 50 students, one from each school and 25 from the other, into a controlled and experimental group. This study was conducted to explore information on five research objectives, including determining the effectiveness of the use of tel material. Five syllabus-related lessons were conducted using the Zoom technology for the group controlled by the online methodology to determine the learning outcomes of the students following the classroom learning methodology. Lessons were implemented for the research team using TEL material based on the TPACK concept.

For all the students, the assessment sheet for the final assessment of the lesson was provided by a link at the beginning as well as at the end of the lesson and used for the analysis of the relevant marks. The results of the survey questionnaire were examined to test students' learning behaviors and cognition and were obtained from a parental cognitive questionnaire. The experimental group was exposed to the treatment and the controlled group was not exposed to the treatment. Resources, learning materials, assignments, quizzes as well as the test platform were available and students used a variety of digital tools in using the Tell material. (Eg Scrative, Padlet, Flipgrid, Formative, Kahoot, Nearpod, poll Everywhere, etc)

3.3 Sample

According to the survey layout, 100 students from each of the two schools were selected in the easy-to-sample sampling system and 20 parents were selected from the student's parents. Accordingly, the total sample selected for this study was 120.

However, the currently selected sample is a group of ICT students studying in GCE (O/L) classes who have no technical problems and have used digital tools, and have good knowledge of computer use.

3.4 Data collection

This chapter describes how students and parents participated in the collection of qualitative and quantitative data.

3.4.1 Methodology

School principals and teachers are made aware of the importance of this study and then students are selected. After selecting twenty parents who would like to join the study from the parents of the students, a WhatsApp team will be formed and a zoom meeting will be held involving all sample members. There they were informed about the study and letters of consent were obtained from parents.

Students' evaluations are obtained through TEL material and Google forms provided at the end of each lesson. Parental observations are made as students join the lesson from their home self-study online. The student's evaluation marks are obtained by linking the TEL material and Google form to the same assessment at the beginning and end. This marks analysis measures the child's previous knowledge of the lesson and analyzes the extent to which the learning results have been completed after the study. TEL materials information is revised based on information obtained from students through the Feedback Form. The evaluation scores of the two control and experimental groups selected for the sample were compared through Weka software. Weka software is also used to analyze the quizzes given to the students and their parents at the end of the five TEL materials.

After preparing the basic plans, the subject matter experts are directed to prepare and test the questionnaire as an evaluation tool. Due to the current epidemic situation in society, the Google form offers a Questionnaire for parents and a Questionnaire for students.

3.5 Technologies to be used

Weka -Weka is a tool for data mining that is primarily supported by the Weka system. To do machine learning activities directly, users can utilize Weka's GUI or their own Java-consuming API. Data pre-processing, classification, regression, clustering, association rules, and visualization are all features of Weka. Weka with GUI has been selected as the tool for this project's model fitting procedure. Weka fulfills all project requirements, including data pretreatment, all classification models, and analysis tool findings. A Knowledge Flow tool is also included with Weka's GUI, which can assist users in managing their model-fitting workflow [27]. The main reasons we chose Weka were its robust features, open-source nature, and simple user interface.

All data were analyzed using the AddExpression attribute.:-

AddExpression - An instance filter that creates a new attribute by applying a mathematical expression to existing attributes.

Weka.gui.GenericObjectEditor shows that the description of

Weka.filters.unsupervised.attribute.AddExpression

NAME -weka.filters.unsupervised.attribute.AddExpression

SYNOPSIS -An instance filter that creates a new attribute by applying a mathematical expression to existing attributes. The expression can contain attribute references and numeric constants. Supported operators are :

+, -, *, /, ^, log, abs, cos, exp, sqrt, floor, ceil, rint, tan, sin, (,)

Attributes are specified by prefixing with 'a', eg. a7 is attribute number 7 (starting from 1).

Example expression : a1^2*a5/log(a7*4.0).

OPTIONS - debug -- Set debug mode. If true then the new attribute will be named with the postfix parse of the supplied expression.

name -- Set the name of the new attribute.

expression -- Set the math expression to apply. Eg. a1^2*a5/log(a7*4.0)

doNotCheckCapabilities -- If set, the filter's capabilities are not checked before it is built. (Use with caution to reduce runtime.)

Digital Tools - The use of learning tools strengthens students' autonomy, as it creates engaging genuine language activities, engages learners in decision-making processes where they direct their own learning with peers, and expand the learning experience outside the classroom. These activities simultaneously improve students' language and automated learning skills.[1] The advantage of digital tools is that many things are easily accessible. Educators and students have access to information from anywhere, anytime, the material is up-to-date and there are so many choices that every student and every teacher can find something relevant to them. Students can look for opportunities to experiment with new tools and methods and engage students in decisions. (Eq- Scrative, Padlet, Flipgrid, Formative, Kahoot, Nearpod, poll Everywhere)

Google forms- Google forms for collecting data, Zoom technology, WhatsApp

3.6 Ethics

- Awareness - Adequate information about the research is provided in a way that is understandable to the individual and allows them to make a voluntary decision to participate in a research study.
- Self-determination - Participants will be given the right to decide their participation in the research, including the right to refuse to participate in the research and the right to withdraw at any time.
- Damage minimization- Researchers will make sure that participants are not harmed or harmed in any way.
- Anonymity- Participants' identities are always protected.
- Confidentiality- Research has ensured that every data record is always kept confidential

3.7 Summary

This chapter describes the technology and tools available and the methodology used to achieve a computerized approach to the ICT subject performance of general education students. The next chapter shows the analysis of the data obtained by the methodology to select the appropriate method through the technique used.

Chapter 04

Data Analysis and Evaluation

4.1 Introduction

The methodology adopted for this study was discussed in the third chapter on the use of technology. This chapter presents a detailed analysis of quantitative data obtained from lesson evaluations using TEL material and Zoom technology, as well as qualitative data obtained from parents and students.

4.2 Quantitative data

Quantitative data were obtained from student assessments and students were scheduled to face the same test before and after the lesson. Thus the marks for the 10 assessments faced by the students in all 5 lessons were coded into arff data file format and analyzed by Waka software.

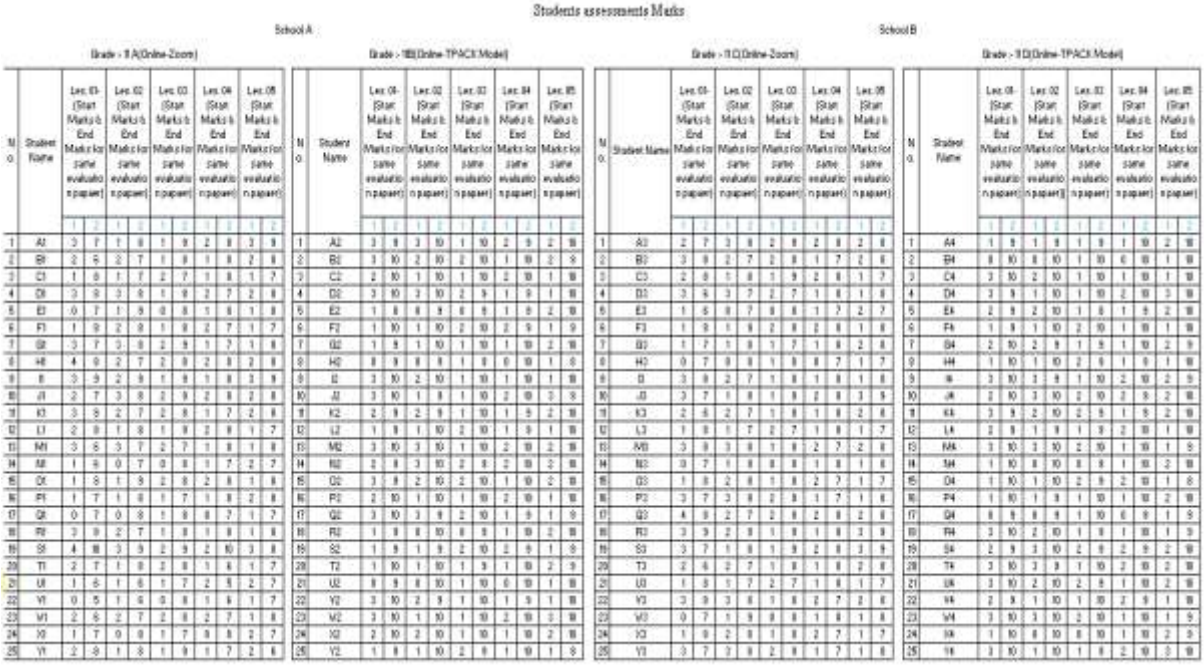
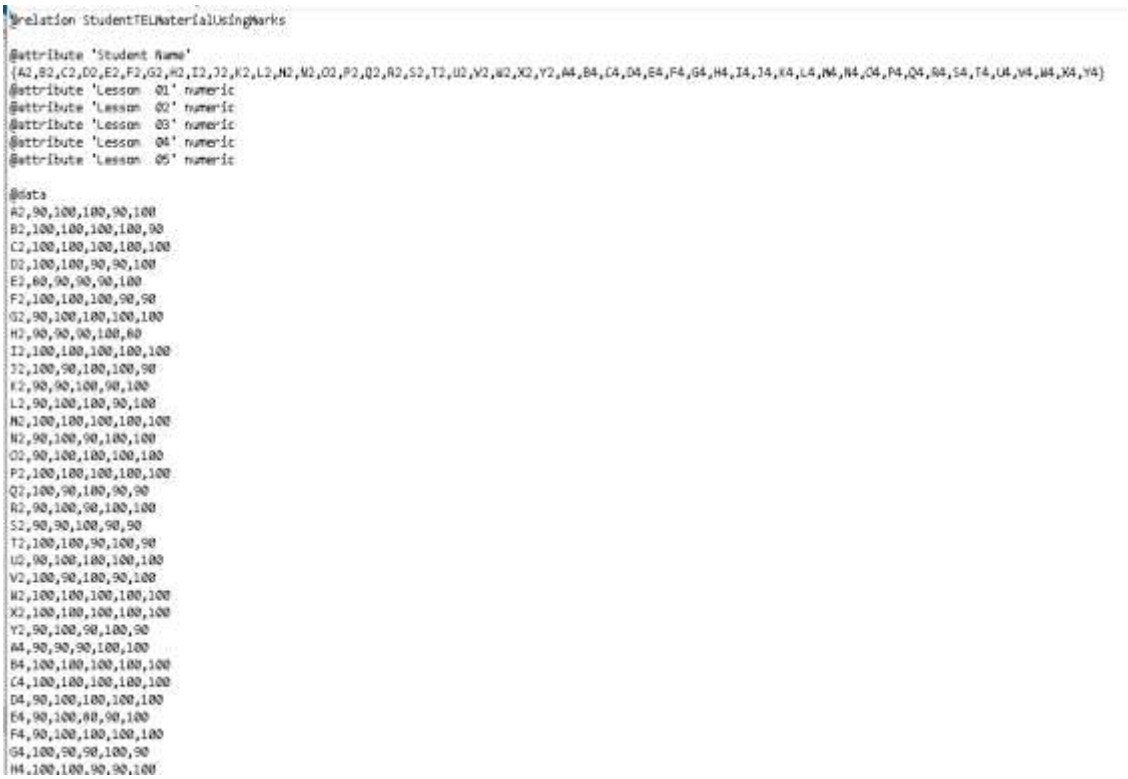


Figure 4.1,. Students' Assessments marks.

Students' post-test marks(TEL material) coded into arff file format



```
@relation StudentTELMaterialUsingMarks

@attribute 'Student Name'
{A2,B2,C2,D2,E2,F2,G2,H2,I2,J2,K2,L2,M2,N2,O2,P2,Q2,R2,S2,T2,U2,V2,W2,X2,Y2,A4,B4,C4,D4,E4,F4,G4,H4,I4,J4,K4,L4,M4,N4,O4,P4,Q4,R4,S4,T4,U4,V4,W4,X4,Y4}
@attribute 'Lesson  01' numeric
@attribute 'Lesson  02' numeric
@attribute 'Lesson  03' numeric
@attribute 'Lesson  04' numeric
@attribute 'Lesson  05' numeric

@data
A2,90,100,100,90,100
B2,100,100,100,100,90
C2,100,100,100,100,100
D2,100,100,90,90,100
E2,80,90,90,90,100
F2,100,100,100,90,90
G2,90,100,100,100,100
H2,90,90,90,100,80
I2,100,100,100,100,100
J2,100,90,100,100,90
K2,90,90,100,90,100
L2,90,100,100,90,100
M2,100,100,100,100,100
N2,90,100,90,100,100
O2,90,100,100,100,100
P2,100,100,100,100,100
Q2,100,90,100,90,90
R2,90,100,90,100,100
S2,90,90,100,90,90
T2,100,100,90,100,90
U2,90,100,100,100,100
V2,100,90,100,90,100
W2,100,100,100,100,100
X2,100,100,100,100,100
Y2,90,100,90,100,90
A4,90,90,90,100,100
B4,100,100,100,100,100
C4,100,100,100,100,100
D4,90,100,100,100,100
E4,90,100,80,90,100
F4,90,100,100,100,100
G4,100,90,90,100,90
H4,100,100,90,90,100
```

Figure 4.2, Students' post-test marks (TEL material) coded into arff file format

Each item in the questionnaire was presented as a statement revolving around one of the four dimensions of the objectives mentioned below:

1. Analyze the impact of the TEL material on the TPACK concept towards ICT subject performance in providing online education to O / L students.
2. Identify the most suitable methodology for ICT subject performance in O / L students' online education.
3. Exploring the impact of the use of TEL material based on the TPACK concept in the O / L students' self-study process
4. Examine students' and parents' perceptions of the use of TEL material in the teaching-learning process.

The concept underlying this study is TPACK, which has three basic knowledge: Technical Knowledge (TK), Educational Knowledge (PK), and Content Knowledge (CK). There is an interaction between each of these two pieces of knowledge and all of this knowledge. In the TEL (Technology Enhanced Learning) material, which combines

all of the above knowledge, the evaluation marks of the students who took part in the lessons were compared with the control group's marks.

The concept underlying this study is TPACK, which has three basic knowledge: Technical Knowledge (TK), Educational Knowledge (PK), and Content Knowledge (CK). There is an interaction between each of these two pieces of knowledge and all of this knowledge. In the TEL (Technology Enhanced Learning) material, which combines all of the above knowledge, the evaluation scores of the students who took part in the lessons were compared with the control group's marks. Also available as However, the research team had a minimum of 90 points and a maximum of 100 points, with an average of 96.4 points and a standard deviation of 2.619. Analyzing this information, it is observed that the average methodology has reached a higher level than the student who studied online. Also, the pre-test marks (Min-4, Max -26, Mean-15.42, StdDev-5.565) show that the students mark high on the online methodology, with the highest scores (96.4%) of those using the TEL material in the lessons.

Analytical reports of pre-test mark obtained by the Weka software of the students who participated in the lessons through all methods

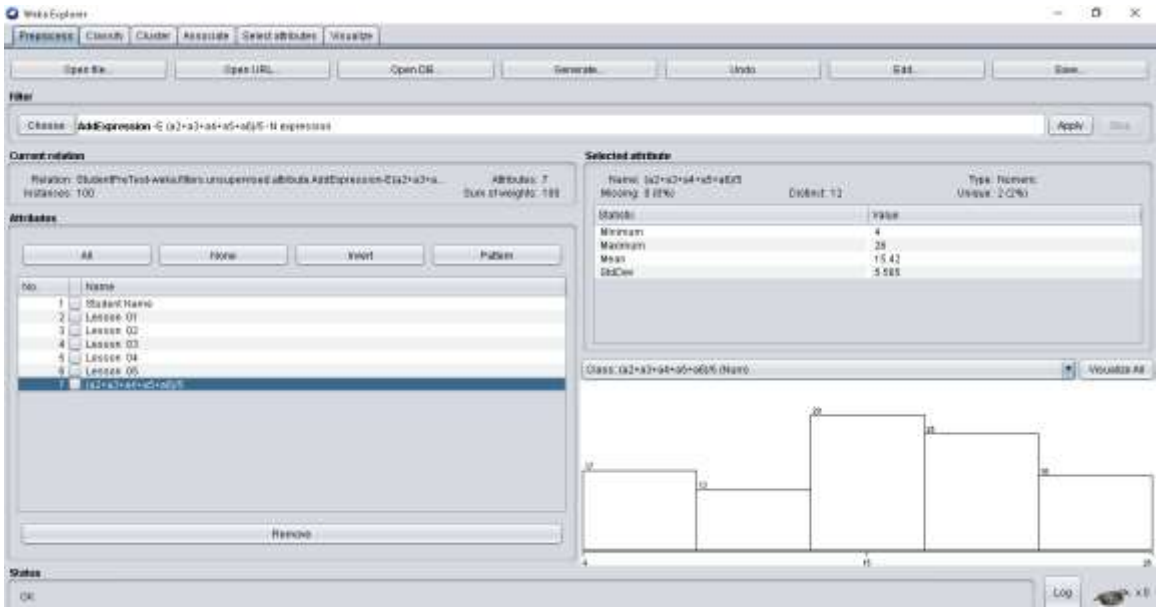


Figure 4.3, Weka Analyse of Students' pre-test marks

Analytical reports of post-test marks were obtained by the Weka software of the students who participated in the lessons through Zoom technology online.

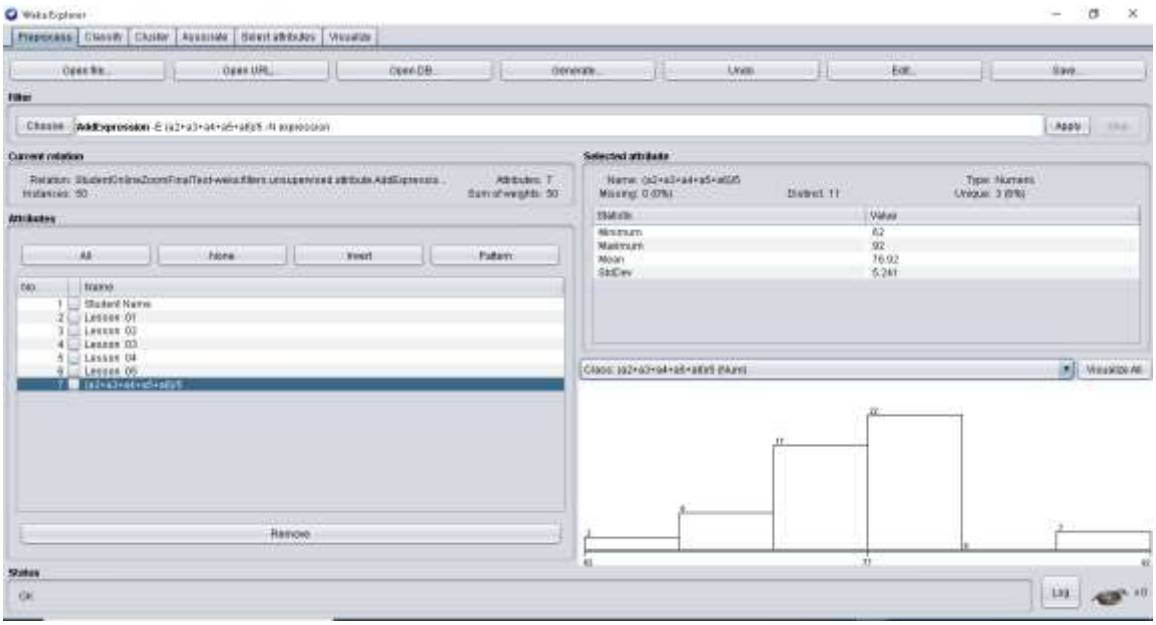


Figure 4.4, Weka Analyse of Students' marks (Online Zoom -test)

Analytical reports obtained from the post-test marks by the Weka software of the students who participated in the lessons through the online TEL material

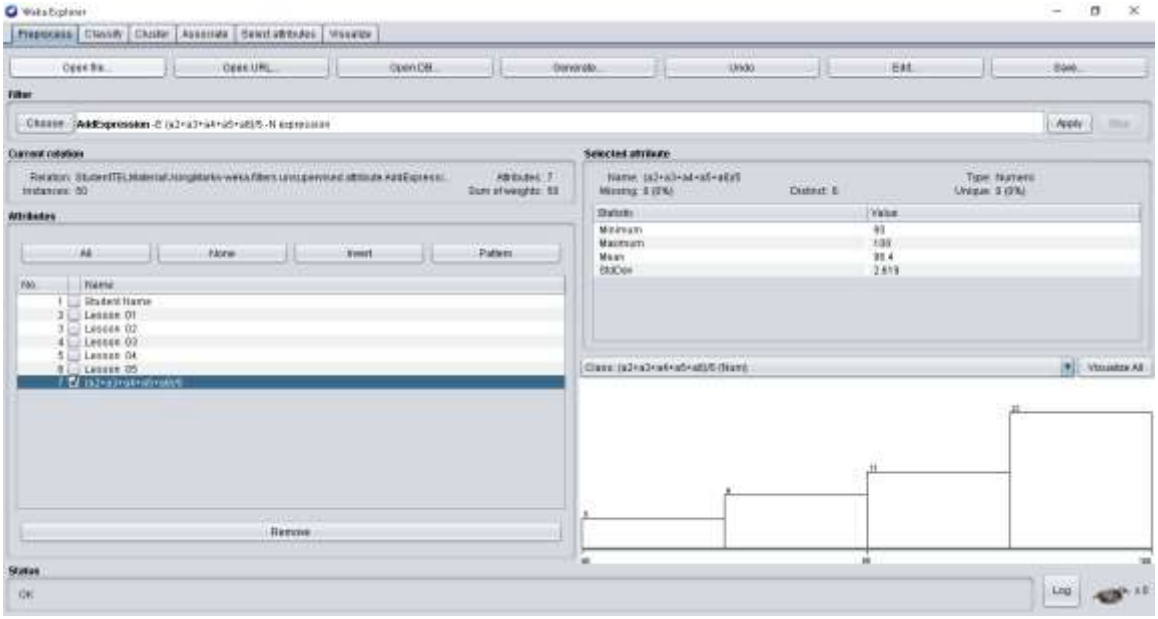


Figure 4.5, Weka Analyse report of Students' marks(using TEL material)

4.3 Qualitative data

The first objective of the study was to use student questionnaires to measure knowledge in detail according to the TPACK concept. Accordingly, the student questionnaire and the knowledge measured by it are given in the table below. (TPACK, which are technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK))

Table 4.1 Objectives measured by the Student questionnaire

	How well you agree with the following points	Objective				Obj. 1
		1	2	3	4	TPACK
1	The instructions provided a good introduction to the lesson (e.g., how to Get started, where to find different course components, how to get it, technical support if needed, etc.).	√				T+P
2	All lessons were well organized	√	√			TPACK
3	of the technology-based lesson were tailored to my needs. (Logical , consistent and efficient)	√	√	√		T+P
4	Educational activities were encouraged to be combined with lessons. (Material / Content)	√	√	√		T+C
5	the educational activity lesson Promoted success. (Objectives)	√		√		TPACK
6	I had ample opportunity to evaluate/provide feedback	√		√		P+C
7	I received adequate support for any technical issues I encountered.	√				T+P
8	During these lessons, I had ample opportunity to examine my learning progress (assessment and recollection) of its objectives, content, and activities	√	√	√		TPACK
9	Received adequate support in case of any problems or pressures			√		
10	I had language problems. (Negative The answer is better)			√		
11	I study I invested enough time and energy to complete		√	√		
12	These lessons will enhance my knowledge and change my training	√			√	P+C
13	the overall quality of these lessons was excellent	√			√	TPACK
14	The instructor's overall learning methodology was excellent with efficiency .	√			√	TPACK

The data obtained from the Parent Questionnaire show the objectives and focus of the study.

Table 4.2 Objectives measured by the parent questionnaire

	How well do you agree with the following points	Objective			
		1	2	3	4
1	The child's preparation for lessons is very satisfying.			√	
2	The child did not need any technical assistance	√			
3	During the lessons, the child engaged in other extracurricular activities	√			
4	The child completed the lesson within the relevant period.	√	√	√	
5	was observed that the child was willing to participate in these lessons	√			
6	child happily participated in educational activities			√	
7	the child was able to attend the lesson well with the instructions given That was the observation.			√	
8	The child was stopped halfway through the lesson		√	√	
9	From the observations, you feel that directing the child to such lessons is successful.				√
10	From the statements made by the child about the lesson, you can conclude that such lessons are very successful.				√

In the final stage, respondents were asked by two questionnaires to rank each statement on a seven-Likert scale, anchored between (0) strongly disagreeing and (7) strongly agreeing.

Following are the values obtained from the student's answers to the Questionnaire in analyzing the impact of TEL materials on the TPACK concept on ICT subject performance in providing online education to O / L students. Its minimum value is 5.875 and its maximum value is 7.

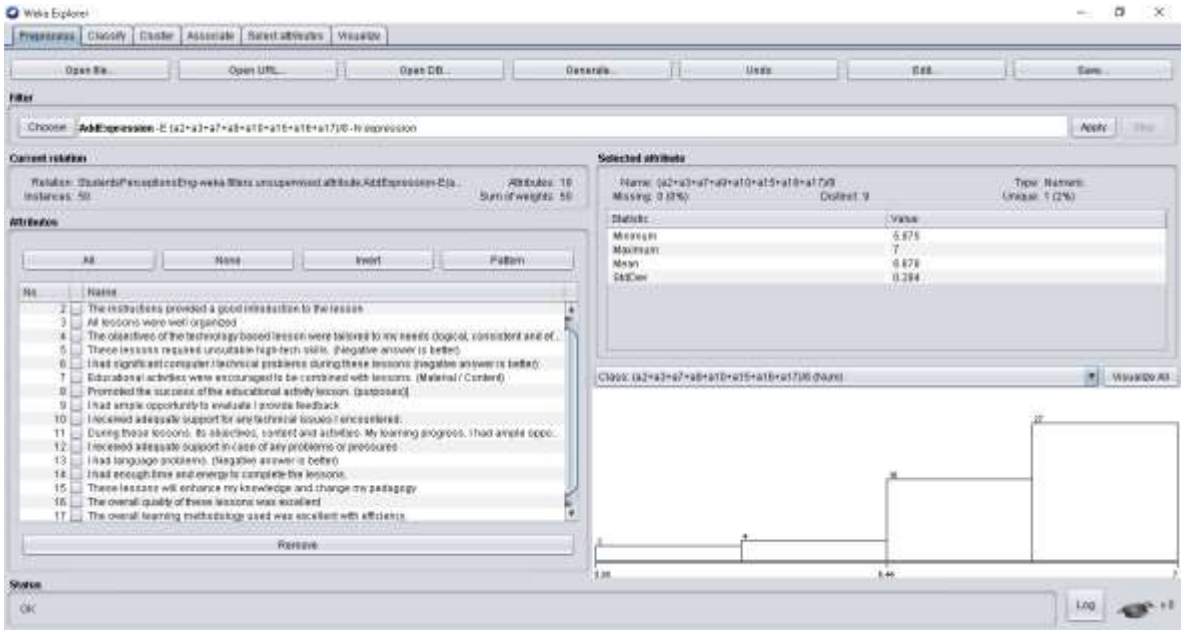


Figure 4.6, Analysed data of Students' Questionnaire for object 01

Students' marks analysis shows the use of TEL material as the most suitable methodology for GCE Ordinary Level ICT subject performance in online education. Further, the data provided by the students based on the questionnaires showed that all the students who used the TEL material strongly agreed with the Likert scale, according to Weka Analytical Reports. (Min 5.4, Max 7, Mean 6.597, StdDev 0.329).

Figure 4.7, Analysed data of Students' Questionnaire for object 02

It is observed that there is a positive correlation in the TPACK concept-based TEL material use exploration into the self-study process of O/L students. Min-5.5, Max-7, Mean-6.593 and StdDev-0.284.

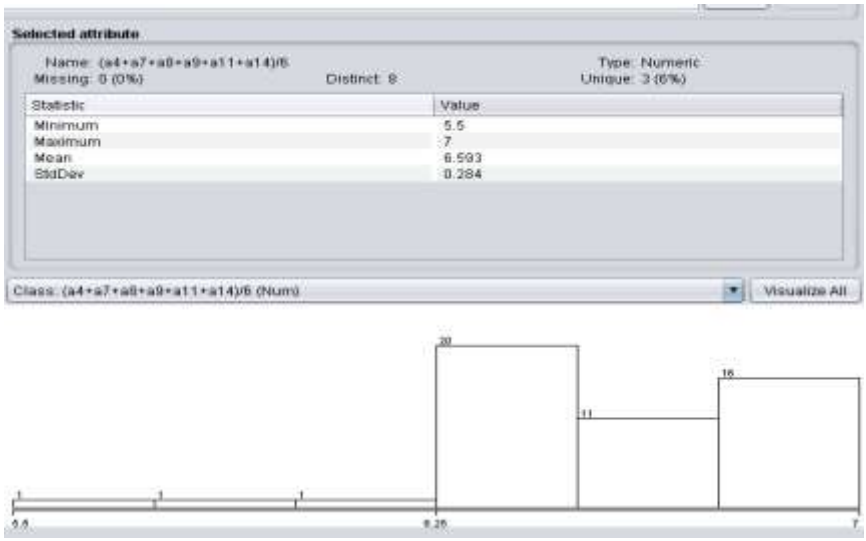


Figure 4.8, Analysed data of Students' Questionnaire for object 03(Positive answer)

Analyzing the negative answers received when asked about the idea that language problems arise in student self-study demonstrated that the students did not agree with that opinion (Figure 9). Min-5.5, Max-7, Mean-6.593 and StdDev-0.284.

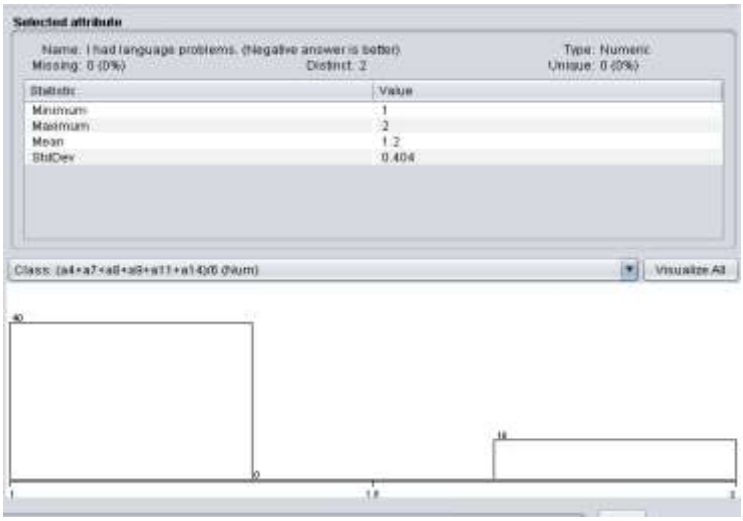


Figure 4.9, Analysed data of Students' Questionnaire for object 03(Negative answer)

A positive answer was also given in testing students' cognition of the use of TEL material in the teaching-learning process. (Min. 6, Max. 7, Mean, 6.713, StdDev.0.301)

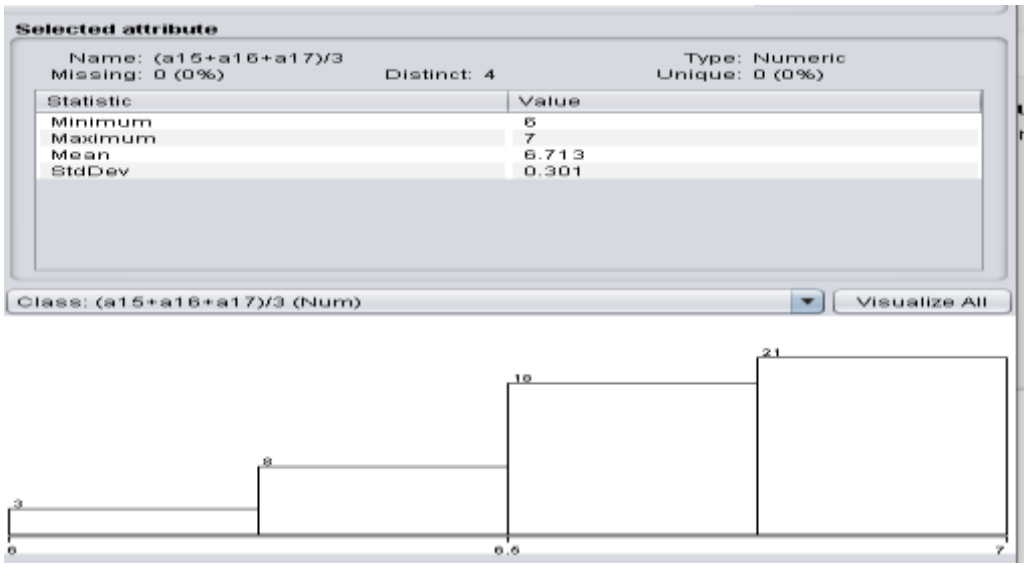


Figure 4.10, Analysed data of Students' Questionnaire for object 04

Similarly, the data obtained from the parent questionnaire based on the 4 objectives were analyzed as follows.

In the analysis of parent opinions based on student observations on the impact of TEL material designed according to the TPACK concept on ICT subject performance in providing online education to O/L students, Min. 4.5, Max. 5.75, Mean, 5.276, StdDev.0.332 shows a positive trend.

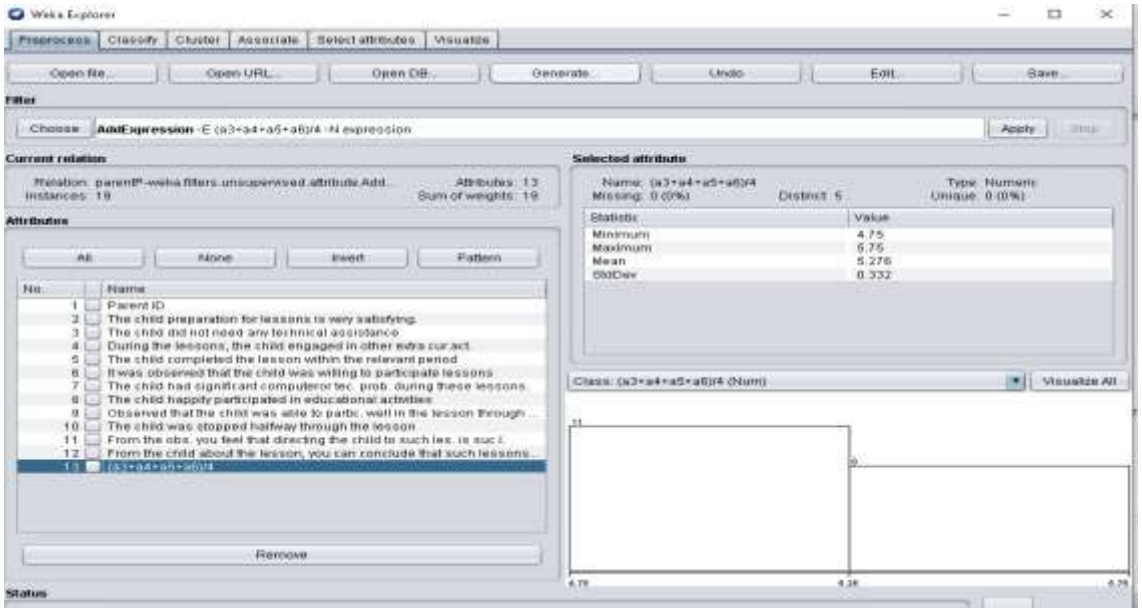


Figure 4.11, Analysed data of Parents' Questionnaire for object 01

Parents have approved the selection of the TEL material as the most suitable method for ICT subject performance in O/L students 'online education (Min. 4.5, Max. 5.75, Mean 5.276, StdDev.0.332). Analytical results also show that the use of TEL material based on the TPACK concept has a positive effect on the self-study process of O/L students (Min. 5, Max. 5.75, Mean, 5.33, StdDev.0.214). The parents indicated that the child did not stop lesson 02 (Min. 1, Max. 2, Mean, 1.263, StdDev.0.452). Parental observation resulted in O/L students minimizing technical problems with the TEL material (Min. 6, Max. 7, Mean 6.5, StdDev.0.289). Similarly in testing the parental cognition of TEL material used in the teaching-learning process Min. 6, Max. 7, Mean, 6.737, StdDev.0.306 shows a positive trend.

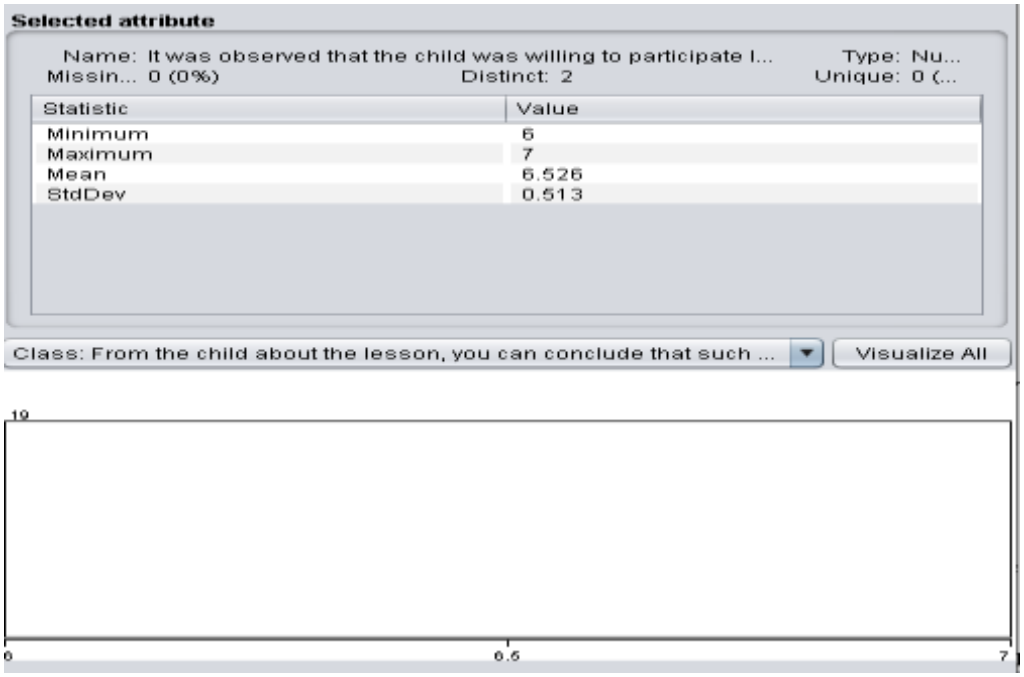


Figure 4.12, Analysed data of Parents' Questionnaire for object 02(Positive Answer)

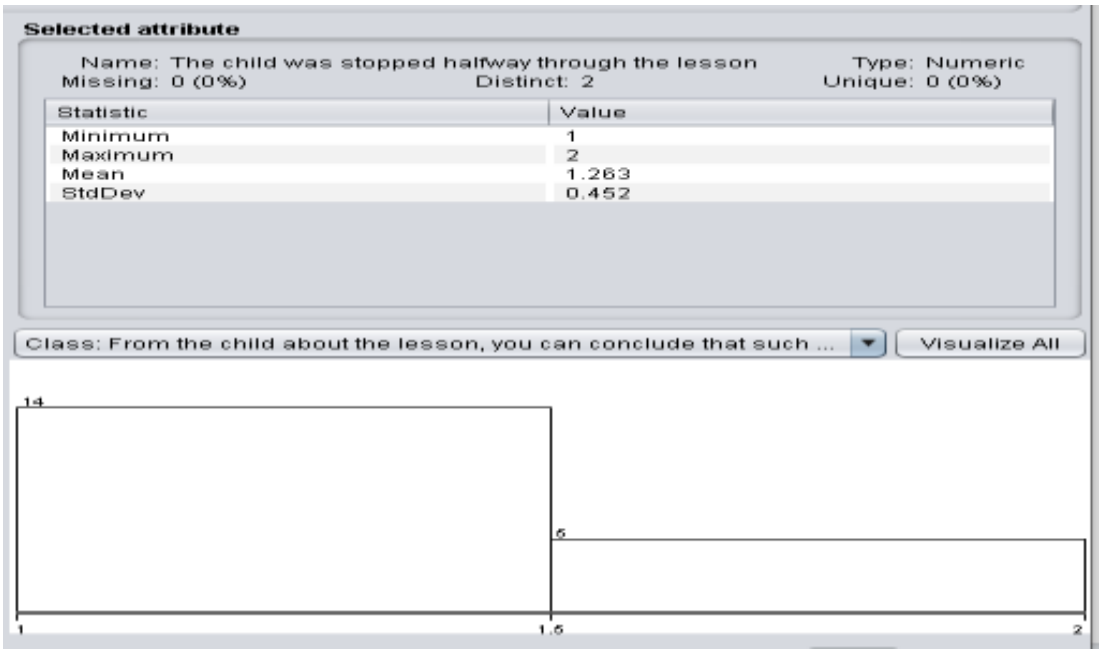


Figure 4.13, Analysed data of Parents' Questionnaire for object 02(Negative answer)

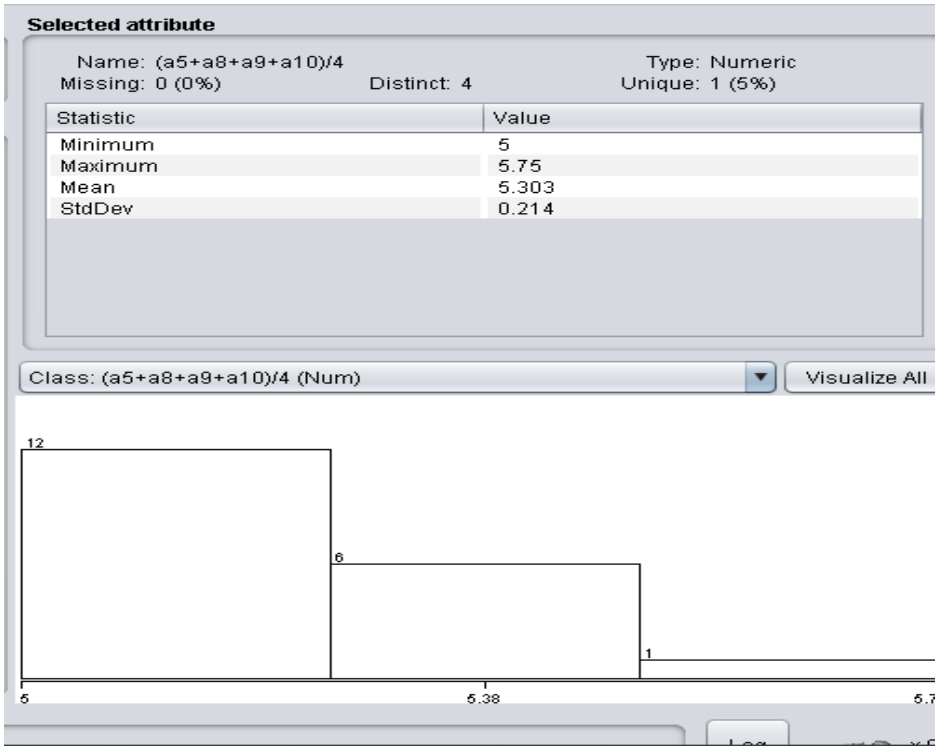


Figure 4.14, Analysed data of Parents' Questionnaire for object 03

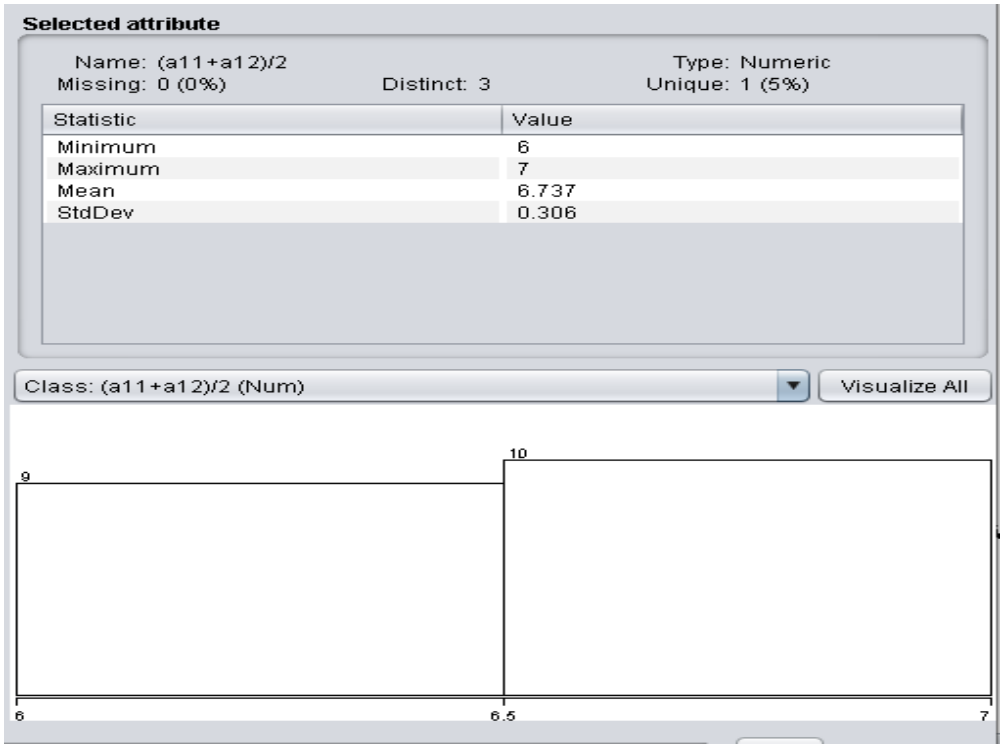


Figure 4.15, Analysed data of Parents' Questionnaire for object 04

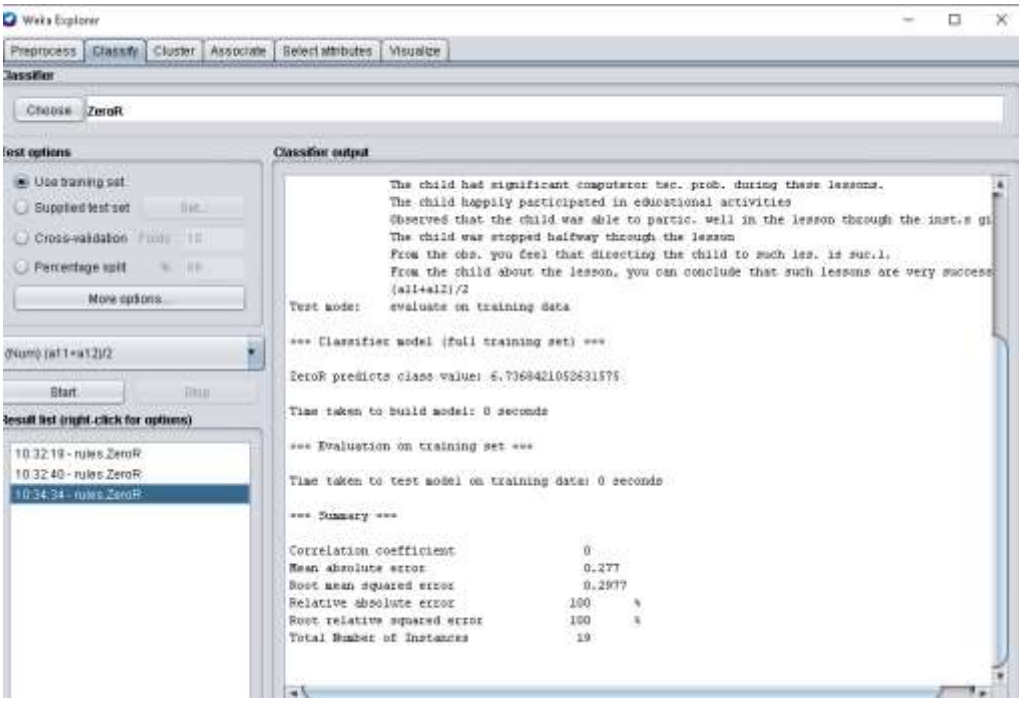


Figure 4.16, Classifier output of Parents' Questionnaire for object 04

4.4 Summary

This chapter presented a complete analysis of the data analysis of the study. In this case, it is emphasized that using our learning techniques provides an efficient and accurate solution to the learning-teaching process. The next chapter provides a discussion of the findings presented here.

Chapter 05

Discussion

5.1. Introduction

This chapter presents a review of the data analysis obtained in the study. Here, the results of the study conducted according to the objectives were investigated.

5.2. Discussion

First, the main questions of this study were whether a computerized approach could be used to enhance the learning experience of O/L students in ICT education and what methodology would be used for that. Current studies are exploring the possibility of using TPACK, a knowledge-based framework, for a more effective learning approach. Users seem to like the user-friendly interface provided by computers and the Internet. Positive answers indicate that the child completed the lesson within the relevant period. It features a sleek and simple eLearning interface.

In the TEL (Technology Enhanced Learning) material, which integrated all knowledge according to the TPACK concept, the evaluation scores of the students who participated in the lessons were compared with those of the control group. However, in the analysis of the scores obtained by these two groups in the range of 0-100, all the students scored very low before the lesson. Based on the analysis of the scores obtained at the end of the online learning process based on the TEL material and Zoom technology, the test group was able to achieve a higher score than the control group's score. Thus, the analysis of the numerical data by Weka software shows that the lessons conducted with the TEL material were more successful.

According to the questions posed by the student-directed questionnaire, the instruction provided a good introduction to the lesson, the student received adequate support for any technical problems encountered, the technology-based lesson objectives were relevant to the student's needs, and the educational activities were encouraged to engage with the lesson. Pedagogical knowledge was also able to be measuredω Pedagogical content knowledge was measured by students having adequate opportunity to evaluate/provide feedback and acknowledging that students develop their knowledge and change their practice. Technological content knowledge can be measured by

demonstrating that educational activities promote lesson success. All lessons are good, indicating that the child had sufficient opportunity to check (assess and recall) the student's learning progress on its objectives, content, and activities during these lessons, indicating that the overall quality of the lessons is excellent, and indicating that the instructor's overall learning methodology is excellent and effective. This analysis also allowed for the measurement of TPACK by recognizing that it was organized. From the analysis of the data obtained through the student and parent questionnaire, it was observed that the TEL material has a high impact on the TPACK concept on the ICT subject performance in providing online education to O/L students and that it is the most suitable method for the ICT subject performance in online education.

Similarly, Table 4.1 and Table 4.2 Identify the most suitable methodology for ICT subject performance in O / L students' online education, Exploring the impact of the use of TEL material based on the TPACK concept in the O / L students' self-study process සහ Examine students and parent' perceptions of the use of TEL material in the teaching-learning process to measure whether they are moving towards the objectives. Finally, students' and parents' perceptions of the use of TEL materials in the teaching-learning process showed a positive trend.

5.4. Summary

The analysis shows that the performance has reached the highest level by using the TEL material on the concept of TPACK through the student score analysis. In the end, all the stakeholders express their strong support for this learning methodology from the ideas of the student and parents.

Chapter 6

Conclusion and Recommendation

6.1. Introduction

This chapter provides an overview of our research and examines how the results of the study have been achieved according to the objectives.

6.2. Culmination

There we can consider the alignment of TEPACK concept in distance learning and use the implementation of online learning to have a positive effect on ICT subject performance in providing online education to general education students.. It can be concluded that this has the potential to create an opportunity for the Internet to contribute to the learning and teaching process. Based on the TPACK concept, the TEL module provides a valuable opportunity for the student to develop an active self-learning process by planning to learn. The study shows that it can be concluded that TEL material on the TPACK concept is the most suitable methodology for ICT subject performance in students' online education. The use of TEL material based on the TPACK concept has a significant impact on students' self-study process. The results of the study show that the perceptions of students and parents about the use of TEL material in the teaching-learning process are positive and that they are willing to participate in it. Thus, the time has come to implement this concept, which is being used successfully in the world, in Sri Lankan education as well.

6.3. Limitations of research

In the face of the current pandemic, problems arose in obtaining information and Contact stakeholders and all information will be collected online.

The student scores of the two groups of students selected for the sample are compared, assuming that the environmental and social levels of all students are the same under the current situation. The analysis is also performed assuming that the conditions are similar.

Although the sample selected is small, the conclusions drawn from it should be justified for the whole country.

6.4. Recommendations

Since the study only included students who had no technological issues, it should be verified if all students can use the TEL material built on the TPACK concept. Future research may also examine if this concept may be applied to other topics in the same way that it was for information and communication technology.

6.5. Summary

This chapter concluded with the conclusion of the research work, limitations, and extended future work.

Chapter 7

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