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Factors affecting the use of modern teaching aids in teaching and learning of Agriculture Science at G.C.E (A/L)

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ABSTRACT

This study aimed to examine the factors affecting the use of modern teaching aids in teaching and learning Agriculture science in G.C.E. (A/L). The research objectives are to identify the teaching aids commonly used in teaching and learning Agriculture science, and examine the factors influencing the use of modern teaching aids in classroom teaching Agriculture sciences. The study adopted a survey and correlation research design. The target population consisted of 325 G.C.E. (A/L) Agriculture science students and 34 teachers of Agriculture science in 32 secondary schools in the Jaffna district of Sri Lanka. A stratified random sample of 228 G.C.E. (A/L) Agriculture science students and purposely selected all teachers as a sample. The questionnaire is used to collect the data from students and the online questionnaire is used to collect the data from teachers. The observation method is also used to collect adequate data. The reliability of the questionnaire was determined by Cronbach's alpha coefficient. To analyze the collected data, correlation coefficients, regression analysis, standard deviation, mean, and percentage were used. The research results showed that the resource availability at the classroom, location of the Agriculture science classroom, administration support, training and seminars for teachers related to digital teaching aids, parent support, and teacher-related factors influence the modern teaching aids integration in the Agriculture science classrooms.

KEYWORDS: *Agriculture Science, Classroom, Modern teaching aids, Teaching-Learning*

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1 INTRODUCTION

Students in this digital era use advanced technology to overcome their daily needs. They expect advanced technology in their classroom learning also. Developed countries use modern teaching aids in their classroom teaching. Developing countries try to change their classroom as technologically advanced. Sri Lanka is no exception. Students learn many things through digital media outside of the classroom. The teacher's role is to facilitate the students to expand their skills and knowledge in and out of the classroom. Teachers also have to use modern teaching aids to educate this era's students.

Teaching aids are tools and equipment used in teaching as a supplement to classroom instruction to increase the interest of students. Traditional teaching aids like chalk and blackboards were used by teachers as standard teaching aid. Elements of nature, actual objects and specimens were presented as teaching aids. Books formed the traditional resource available to both teachers and learners. Technology in those days was not as advanced as it is today – there was no electricity, phones, computers, or internet. Modern teaching aids have well-developed technology. Modern teaching aids became available to teachers and students like computers, television/radio, interactive whiteboard, and multimedia. Modern teaching aids present themselves in different forms. A world of opportunities like teaching aids, games, activities and media have become available to students. They have made teachers' tasks both enjoyable and challenging (Bel & Ordu 2021).

Being an agricultural country, the education system of Sri Lanka gives importance to providing knowledge of Agriculture to the students. Agriculture science is a subject in the secondary school education system. Agriculture science is a blend of many of the pure and applied science for example botany, zoology, chemistry, genetics, entomology, physiology, bacteriology, geography, and economics. Agriculture science is an optional subject in the senior secondary cycle II, which is G. C. E (A/L). A senior secondary cycle II student whatever the stream can select Agriculture science as a subject. Despite the importance of Agriculture, the number of students taking Agriculture science is low (Table 1). But there is a need to technicalize the practical skills and knowledge of Agriculture science students through modern teaching aids. So, modern teaching aids are contributing a lot to the efficient teaching and learning processes, and influence the production of a knowledgeable society.

Table 1: Student population sat for the G.C.E (A/L) examination

Year	Total student population	Agriculture Science student population	
		Amount	Percentage (%)
2017	253330	16260	6.41
2018	267111	18575	6.95
2019			
(New)	187167	11093	5.92
(Old)	94619	7987	8.44
2020			
(New)	277625	19212	6.92
(Old)	24146	3381	14.00
2021	272682	18595	6.81

(Department of examination 2019 & 2021)

1.1 Literature review

The classroom is a dynamic environment, bringing together students from different backgrounds with various abilities and personalities. Being an effective teacher, therefore, requires the implementation of creative and innovative teaching strategies to meet students' individual needs. The teacher must know each character of the students. In addition, the teacher must also prepare designs before conducting the teaching and learning process. The teacher must think of ways to increase students' interest in learning and improve the quality of teaching. With the rapid development of technology, teachers must be able to use these technological developments in the teaching and learning process in the classroom. Modern teaching aids like computers, multimedia projectors, Virtual classrooms, video, augmented reality (AR), robots, and other technology tools are commonly used for classroom teaching.

The importance of modern teaching aids in classroom teaching is felt at different levels in the education sector. Researchers try to discover educational technology's impact on the teaching-learning process. Antoine's descriptive study (2000) was to evaluate instructional technology availability and use in secondary agricultural education curricula in North Carolina and Virginia. He found that the Agriculture teachers were largely neutral as to their perceptions regarding instructional technology's future in agriculture education. The benefits of instructional technology were found to be an increase in the availability of educational opportunities, improved informational resources for faculty and students, more effective instructional materials, and more convenient delivery methods for instructors. Further, Antoine (2007) researched technology-enhanced agricultural education learning environments: an assessment of student perceptions. He concluded that web-enhanced instruction be increasingly utilized in agricultural education settings to encourage learning, increase problem-solving skills, and increase technological literacy. In knowledge-based society information communication technologies provide the necessary instruments for educational programs and generate a quality learning and teaching process. Schools and universities need to consider how technology-based instructional programs are mounted to ensure that students use the Internet efficaciously as a learning tool for various authentic learning activities such as conducting research on a given topic or finding relevant information for an assignment (Stefania, 2009). Findings of Shironica and Weerakoon (2020) revealed that despite challenges, such as inadequate ICT facilities, time constraints and limitations in English language competencies, the adoption of Commonwealth Digital Education Leadership Training in Action (C-DELTA) has supported improving digital literacy, enacting changes in thinking and digital behaviour among teachers and students, and enhancing teachers' digital education leadership skills. According to the literature review, the importance of modern teaching aids in classroom teaching is highlighted. However, that should identify the factors that affect the

use of modern teaching aids especially in the Agriculture science classroom.

1.2 Background of the study

Instructional technology application in Agriculture education changed from traditional to modern digital technology throughout the world. But in Sri Lanka adopt technology changes in education slowly. Agriculture science education at the senior secondary level face problem in using technologically advanced teaching aids. Agriculture science is a mixed subject of both applied science and pure science. It is a challenge for the teacher of Agriculture science to teach Agriculture science in a classroom with a diversity of students. Incorporating technology into teaching is a great way to actively engage students, especially as digital media surrounds young people in the 21st century. Interactive whiteboards or mobile devices can be used to display images, and videos, which help students, visualize new academic concepts (Sinnathamby, 2007).Classrooms in Sri Lanka especially in the Jaffna district commonly use traditional teaching methods and traditional teaching aids for teaching Agriculture science. Internet facilities in the classroom, digital teaching aid handling skills of the teacher, and educational technology knowledge of the teacher were identified as problems with using technologically advanced equipment in classroom teaching and learning Agriculture science (Raveendran & Rasanajakam, 2022). Cost, time, and availability of technology were recognized as barriers to technology integration in Agriculture classrooms in Tennessee (Michael et al 2015). Based on the literature review, this problem was identified and studied. This study contributes to the existing literature through its findings.

1.3 The research problem

The Ministry of Education provides many training for the teachers to upgrade their educational technology knowledge at different levels. There is a mismatch between the aim of trainings and day-to-day teaching and learning in the classroom. The question is what are the limitations available in using modern equipments as a teaching aid in the teaching of Agriculture science? It is in the quest to answer the above question that this topic is chosen for research.

1.4 Objectives

The main purpose of the study was to find out the factors affecting the use of modern teaching aids in teaching and learning Agriculture science in line with the following Specific objectives

To identify the equipments commonly used in teaching and learning Agriculture science.

To examine the factors influencing the use of modern teaching aids in the classroom teaching Agriculture science.

2 RESEARCH METHODOLOGY

The study was a descriptive survey design. Data were analyzed using quantitative techniques. Analysis of data for the first objective included

frequencies, means and standard deviations, and analysis of data for the second objective included frequencies, means and standard deviations, and Pearson correlations between the dependent variable and independent variables.

2.1 Conceptual framework

This study mainly identifies the factors affecting the use of modern teaching aids in Agriculture science classroom. Figure 1 shows the conceptual framework of the dependent variables and independent variables.

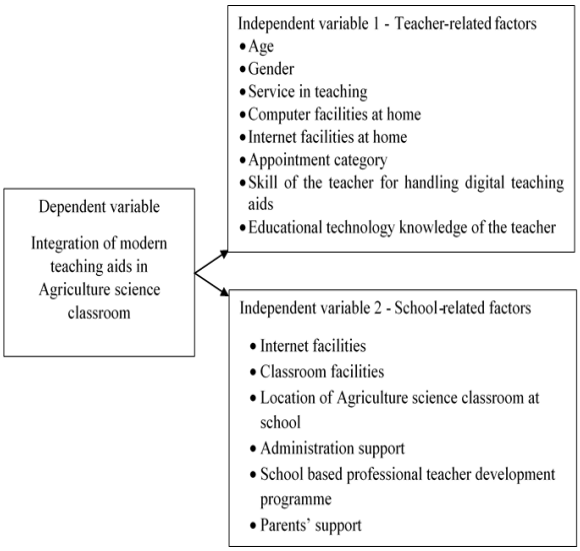

Figure 1: Conceptual map of the study

2.2 Population and sampling

The target population consisted of 325 G. C. E (A/L) students who studied Agriculture science and 34 teachers of Agriculture science in 1AB (31 schools) and 1C (1 school) schools in the Jaffna district of Sri Lanka. Based on Krejcie and Morgan's formula for a 5% margin of error, a stratified random sample of 228 students was required for a population of the above size and purposely selected all teachers as a sample.

2.3 Data collection methods

The questionnaire is the main instrument used to collect the data from students and the online Questionnaire is used to collect the data from teachers. The observation method is also used to collect adequate data and confirm data accuracy through data triangulation. Students' questionnaires consist of three sub-sections. Each section's reliability statistics were got separately. Results of the reliability statistics of internal consistency for the questions in each subsection shows that the items have a strong correlation (Cronbach's Alpha value > 0.7). Cronbach's Alpha value for online questionnaire questions is 0.713. This value also shows the questions in the online questionnaire have a strong correlation. Therefore, the instruments were accepted as reliable for the study.

3 RESULTS AND DISCUSSION

3.1 Equipment commonly used in teaching and learning Agriculture science

91.2% of the teachers (31) use computers or laptops to prepare the lesson of Agriculture science. 8.8% of the teachers do not have their own computers to prepare the teaching materials. They used school computers if they needed. Teachers used their own internet asses. Only 8.8% of the teachers were able to used school internet facilities for lesson preparation. Table 2 shows the teaching aid use by the teacher for classroom teaching. 26 teachers (76.5% of the teachers) used writing boards in day-to-day teaching. Available of smart board

for G. C. E (A/L) Agriculture science classroom in Jaffna district is 3.

Table 2: Equipment used in classroom teaching

		Frequency	**Percent (%)**
Valid	Smart board	3	8.8
	Writing board	26	76.5
	Other equipments	5	14.7
	Total	34	100.0

Table 3 shows that 50.9% of the students (116) learning Agriculture science through textbooks. 39.9% of the students (91) used YouTube channels for self-learning. These students used mobile phones, laptops, desktop computers, and tabs to watch the YouTube channel. 2.6% of the students (6) used television to learn Agriculture science. The results show that students and teachers commonly use traditional teaching aids in learning and teaching Agriculture science even though they prefer to use modern teaching aids in the classroom. There are certain factors affecting modern teaching aids integration in Agriculture science classrooms.

Table 3: Self- learning tools of students

	Self- learning tools	Frequency	Percent (%)
Valid	YouTube	91	39.9
	TV	6	2.6
	Radio	2	0.9
	Books	116	50.9
	others	13	5.7
	Total	228	100.0

3.2 Factors influencing the use of modern teaching aids in classroom teaching Agriculture science

A negative Pearson correlation (-0.396*) between the age of the teacher and modern equipment used in the classroom, and is 0.021 level of significance at $\alpha = 0.05$. Junior teachers prefer to use modern teaching aids in classroom teaching of Agriculture science. Service in teaching is increase with the age of the teachers. Due to that reason, service in teaching also has a negative correlation (-0.356*) with modern teaching aids used by the teacher. School-based professional teacher development training and seminars attended by the teacher are negatively correlated (-0.680) with the age of the teacher, and it is a 0.000 level of significance at $\alpha = 0.01$. Senior teachers did not get the proper training to use modern teaching aids. There is no any correlation between the gender and civil status of the teacher and the modern teaching aid used by the teacher.

Table 4: Using Modern equipment

		Modern equipment used in self-learning	Modern equipment used in Practical	Modern equipment used in assignments
N	Valid	228	228	228
	Missing	0	0	0
Mean		2.80	2.57	2.81
Std. Deviation		1.526	0.643	0.424

(Low – 1, Moderate – 2, High – 3)

Table 4 shows the mean value of the modern equipment used in practicals and assignments

by the students. According to this mean value, most of them can use modern equipment.

The location of the Agriculture science classroom shows a positive Pearson correlation (0.412) with the facilities of the classroom with technologically advanced teaching aids and significant at α=0.05 with 0.016 level. Proper classroom facilities for Agriculture science teaching-learning also show a positive Pearson correlation with administration support in using modern educational technology (0.355) significant at α=0.05 and educational technology knowledge of the teacher (0.441) significant at α=0.01. It reveals that, if the administration of schools provides proper facilities to the teachers, the usage of modern teaching aids in the classroom will increase. Teacher knowledge of educational technology induces the administration to provide their support to the teacher in using technologically advanced equipment in classroom teaching.

The skill of teachers in handling technologically advanced teaching aid varies with age, gender, years of service in teaching, appointment subject, and appointment category. The data in Table 5 gives an idea about the level of skill of teachers in handling technologically advanced teaching aid among teacher respondents. According to the mean value, male teacher respondents (mean = 2.29) have higher skills than female respondents (mean = 2.11) in handling technologically advanced teaching aid in classroom teaching. But almost the mean value is approximately 2. Below 30 years of aged respondents have a mean value of 3. The skill teachers using technologically advanced teaching aids mean value decreases with the increasing age.

Table 5: Age and gender Vs Skill of teacher to use modern teaching aids

Age	Gender	N	Mean ± SD
Below 30 years	Male	2	3.00±0.000
	Total	2	3.00±0.000
31 – 40 years	Male	5	2.00±0.707
	Female	22	2.18±0.501
	Total	27	2.15±0.534
41 – 50 years	Female	4	1.75±0.500
	Total	4	1.75±0.500
More than 51 years	Female	1	2.00±0.100
	Total	1	2.00±0.100
Total	Male	7	2.29±0.756
	Female	27	2.11±0.506
	Total	34	2.15±0.558

(1 – Low, 2 – Moderate, 3 – High)

The age of the teacher respondents shows a negative Pearson correlation (-0.363) with the skill of teachers using technologically advanced teaching aids and a level of significant 0.035 at α = 0.05. The result reveals that younger-aged teachers have more skills to use modern teaching aids than senior teachers.

Table 6 shows the mean value of skill of teachers using technologically advanced teaching aids higher in teacher respondents who have below 10 years of service in teaching. This result proves already existing result that younger age teachers have a higher mean value than others. Even though the mean value expresses they have a moderate level of skill in handling modern teaching aids. Teachers who have got an appointment for teaching Agriculture science subject (2.24) show a

higher mean value of skill of teacher using technologically advanced teaching aids than the teacher who teaching Agriculture science with other subject appointments (2.06).Based on the appointment category, graduate teachers have a higher mean value (2.16) of skill of teacher using technologically advanced teaching aids than the diploma holders (2.00) or other category teachers (2.06). However, the mean value indicates none of the teacher respondents has sound skills in handling modern teaching aids in classroom teaching.

Table 6: Service in teaching, appointment subject, and appointment category Vs Skill of teacher using technologically advanced teaching aids

Variable	Category	N	Mean ± SD
Service in teaching	Below 10 years	28	
	11 – 20 years	5	2.00 ± 0.000
	21 – 30 years	1	2.00 ± 0.000
	Total	34	2.15 ± 0.558
Appointment subject	Agriculture science	17	2.24 ± 0.562
	Other subjects	17	2.06 ± 0.556
	Total	34	2.15 ± 0.558
Appointment category	Diploma holders	1	2.00 ± 0.000
	Graduate	32	2.16 ± 0.574
	Others	1	2.00 ± 0.000
	Total	34	2.15 ± 0.558

(1 – Low, 2 – Moderate, 3 – High)

The skill of teacher using technologically advanced teaching aids shows a 0.768 positive Pearson correlation with the educational technology knowledge of teachers and is significant at $\alpha = 0.01$ (sig. level 0.000). Senior teachers do have not enough knowledge about educational technology. Service in teaching aids shows a negative Pearson correlation (-0.412) with educational technology knowledge of teachers and a level of significant 0.016 at $\alpha = 0.05$. Educational technology knowledge of teachers and teaching aid used by teachers in classroom teaching show a positive Pearson correlation (0.510) and a level of significant 0.002 at $\alpha = 0.01$. Not only does educational technology knowledge of teachers influence the teaching aid used by teachers in classroom teaching and learning but some other factors also influence the teaching aid used by teachers. Factor analysis has been made on all of the expected independent variables to explain the degree of influence on the dependent variable.

Thirteen questions related to teacher demographic data and school facilities were factor analyzed using principal components analysis with varimax rotation. Table 7 shows Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.555, above the commonly recommended value of 0.50, which means the sample size is sufficient. Bartlett's Test of Sphericity was significant ($\chi 2$ (78) = 173.197, $p<0.001$), which means that enough correlation for factor analysis.

Table 7: KMO and Bartlett's Test for the factors influences on equipment used in classroom teaching

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.555
Bartlett's Test of Sphericity	Approx. Chi-Square	173.197
	df	78
	Sig.	0.000

In this case, there are thirteen factors in total. Table 8 shows that percent of Variance tells how much of the variance in the dataset can be explained by each other. Here are the factors arranged in descending order of the variance. The first five factors account for a relatively large proportion of the variance compared to the latter factors. Using both the scree plot and eigenvalues > 1 to determine the underlying components, the analysis yielded five factors explaining a total of 74.668% of the variance in the data. The Scree plot curve helps to extract the factors from the all factors.

Figure 2 shows the scree plot graph. In this case the graph appears to tail of after 7 factors and there is also another drop after 11 factors. Factor 5 has an Eigenvalue near to 1. So, only five factors have been retained. Rotated component matrix tells how each variable loads onto each of five factors after rotation and to what extent.

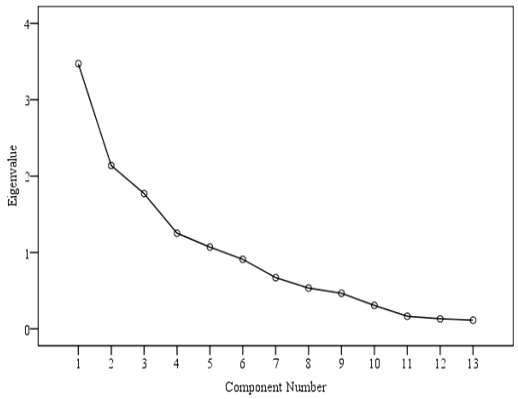

Figure 2: Scree plot for the factors influences on equipment used in classroom teaching

Retained factors included in the multiple regression analysis. The multiple regression analysis result clearly shows the strength of each factor that influences the equipment used in classroom teaching-learning of Agriculture science.

R can be considered to be one measure of the quality of the prediction of the dependent variable on independent variables such as place of Agriculture science classroom, educational technology skill of the teacher, internet facilities of the school, parents' support, Gender, facilities of the classroom, modern teaching aids operating skill. Table 9 shows R-value of 0.739, indicating a good level of prediction. R square value of 0.546 indicates independent variables explain 54.6% of the variability of the dependent variable, equipment used in classroom teaching. And 45.4% (100%-54.6%) of the variation is caused by factors other than the predictors included in this model. Minimum variation between R square and adjusted R square is good for model fit to data. In this case, can't vouch for a good model fit but it is not a low level of model fit.

Table 8: Total variance explained for the factors influences on teaching aids use in classroom

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.473	26.717	26.717	3.473	26.717	26.717	2.431	18.703	18.703
2	2.139	16.457	43.175	2.139	16.457	43.175	2.050	15.766	34.469
3	1.771	13.626	56.801	1.771	13.626	56.801	1.807	13.897	48.366
4	1.252	9.631	66.432	1.252	9.631	66.432	1.772	13.628	61.994
5	1.071	8.237	74.668	1.071	8.237	74.668	1.648	12.675	74.668
6	0.910	6.999	81.667						
7	0.670	5.156	86.823						
8	0.533	4.102	90.925						
9	0.466	3.582	94.507						
10	0.306	2.355	96.862						
11	0.164	1.264	98.126						
12	0.131	1.008	99.133						
13	0.113	0.867	100.000						

Extraction Method: Principal Component Analysis.

Table 9: Regression test output for equipment used in classroom – Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.739	0.546	0.423	0.737

The F-ratio in the ANOVA shows the overall model is a good fit for the data because table 10 shows that independent variables such as place of Agriculture science classroom, Educational technology skill of the teacher, internet facilities of school, parents support, Gender, facilities of the classroom, modern teaching aids operating skill statistically significantly predict the dependent variable equipment used in classroom teaching, $F(7, 26) = 4.462$, $p(0.002) < 0.01$.

Table 10: Regression test output for equipments used in classroom – ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.949	7	2.421	4.462	0.002
	Residual	14.110	26	0.543		
	Total	31.059	33			

Table 11 shows the t-value and corresponding p-value in the "t" and "Sig." columns respectively. Independent variables Internet facilities of school p (0.011) < 0.05 and parents support p (0.029) < 0.05 are significant but other independent variables show a greater p-value than 0.05. So, the other independent variables are not significant with the dependent variable equipment used in classroom teaching.

According to the above results classroom facilities for teaching and learning Agriculture science are very low level in secondary schools in the Jaffna district. Most of the schools did not have a proper classroom for teaching Agriculture science. Due to that, the administration couldn't allocate technologically advanced teaching aids for teaching Agriculture science in schools. But parents give their support to using modern

teaching aids in Agriculture science teaching. School-based professional teacher development training does not properly prepare the teachers who need skills for handling modern teaching aids by the administration. The availability of internet facilities at school for classroom use is a limited resource in Jaffna district schools. These school-related factors affect the integration of modern teaching aids in Agriculture science classrooms.

Modern teaching aid usage in classroom teaching is influenced by teachers of Agriculture science. Male teachers have more interest in using technologically advanced teaching aids than female teachers. The operating skill of technologically advanced teaching aid is higher in male teachers than the female teachers. Junior teachers have higher knowledge and skill in using technologically advanced teaching aid than senior teachers. The appointment subject of the teacher also influences the teaching aids used by teachers in classroom teaching or the practical. Agriculture science appointment teachers used available modern teaching aids to teach Agriculture science more than the other teachers who teach Agriculture science with other subject appointments. Graduate teachers prefer to use modern teaching aids in classroom teaching and practical Agriculture science than teachers who teach Agriculture science without a degree. Because educational technology knowledge and application skills of the teacher high in degree holders than others.

Table 11: Regression test output for equipments used in classroom – Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	-1.427	1.286		-1.110	0.277
Gender	-0.062	0.358	-0.026	-0.173	0.864
Educational technology skill of the teacher	-0.026	0.119	-0.032	-0.219	0.829
Modern teaching aids operating skill	0.571	0.359	0.298	1.592	0.123
facilities of the classroom	-0.064	0.225	-0.047	-0.286	0.777
Internet facilities of school	0.490	0.180	0.427	2.725	0.011
Parents support	0.573	0.248	0.347	2.310	0.029
Location of Agriculture science classroom	-0.070	0.113	-0.094	-0.617	0.543

4 CONCLUSION & RECOMMENDATIONS

The finding of the study reveals that in the digital era teachers and students prefer to use technologically advanced aids for teaching and learning. According to the literature review, modern teaching aids improve the understanding of students in subjects. But, 76.5% of schools in the Jaffna district use traditional writing boards to teach Agriculture science. School-related factors like limited resources for teaching Agriculture science, limited support provided by the school administration to the Agriculture science subject, training and seminars arranged by the school and parents' support influence the

integration of modern teaching aids in Agriculture science classrooms further, teacher-related factors also influence on the use of modern teaching aids in classroom teaching. Senior teachers do not have an interest in using modern teaching aids, Agriculture science graduate teachers use more modern teaching aids than others, the skill of handling modern teaching aids and educational technology knowledge of the teacher show a positive relationship with the use of modern teaching aids in classroom teaching and learning of Agriculture science. Recommendations made highlighted that the usage of modern teaching aids in the classroom would enhance the student's learning. The department of zonal education and teachers' center should provide proper training to the teachers, especially senior teachers to increase their skills in handling modern teaching aids in the classroom and provide knowledge about the importance of educational technology in classroom teaching. Further, these organizations should use special software to confirm that teachers use advanced technology in their classroom teaching to reduce the mismatch between the aim of training and day-to-day teaching learning in the Agriculture science classroom. The administration of schools and parents should provide their support to increase the Agriculture science classroom facilities as technologically advanced.

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