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**JOURNAL OF STRIDES IN EDUCATION**  
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## **EDITORIAL**

Dear Reviewers and Esteemed Readers,

Presenting the most recent issue of the Journal of Strides in Education (JSE), a shining example of academic inquiry in the field of education, brings us great joy. Under the direction of the esteemed SNM Training College, Moothakunnam, this biannual journal is happy to present six thought-provoking research articles that explore different aspects of modern education. Six topical and research papers on various issues related to education, humanities, and social sciences are presented in this issue of JSE. The dimensions covered in these articles include augmented reality technology to teach geometry, environmental friendly synthesis of starch-based bioplastics, consumer perception on mobile banking, internet purchasing, the relation between B.Ed. candidates' emotional intelligence and effective classroom management and the effect of self-evaluation strategies on science achievement in secondary school students.

A significant addition to the complex field of education is made by each of these research papers. The authors are commended for their commitment to the advancement of knowledge in various fields, and we are grateful to the SNM Training College, Moothakunnam, for providing an atmosphere that promotes academic inquiry. The Journal of Strides in Education is dedicated to sharing excellent research that educates, provokes thought, and provides inspiration as we negotiate the always changing landscape of education. We cordially encourage our readers to delve deeply into this issue and examine the wide range of viewpoints that together will influence the direction of education.

Sincerely,

Editorial Board

### **ABOUT THE JOURNAL**

JOURNAL OF STRIDES IN EDUCATION (JSE), a biannual, peer-reviewed multidisciplinary journal published by SNM Training College, Moothakunnam highlights research in the broad area of education. Original contributions, as well as review articles in important areas of Education, Humanities, and Social sciences, that contribute to the development of knowledge across the broad field of education, are relevant to this journal. The Journal started in 2022 and is published twice a year. One issue is from May to November, and another issue is from December to April.

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## **Perception of College Students Towards Online Buying**

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### **Abstract**

Online buying is a type of electronic commerce which allows consumers to directly buy goods or services from a seller over the internet using a web browser. Consumers can buy the products by visiting the website or through various online shopping apps available. There is tremendous growth in online buying day by day. The study is to assess the perception of college students towards online buying. The study entitled perception of college students towards online buying was conducted among a sample of 50 students at S N M Training College, Moothakunnam using a questionnaire. Nowadays youngsters are more engaged in the digital world. Online shopping became part of their lifestyle. The study helped to find out the online buying behaviour of students with respect to various factors like convenience, offers, wide range availability..etc. The study also helped to understand the frequency of online buying and satisfaction in online buying. It will also give some suggestions which is very helpful for the online sellers to increase their sales.

### **Introduction**

Nowadays shopping is made easier for customers from the comfort of their own homes or workplace. Shopping is made more easier and convenient for the buyers through internet. Online buying replacing the conventional buying system. In this busy world most of the people are preferring online buying. The convenience and wide variety of products availability at a click

distance is increasing the number of online buyers. Various studies were arriving about online buying. Buying behaviour will differ among people depending on their socio- demographic factors. Online shops has created it's own place in the area of business. The digitalization and technological advancement have also increased the scope for online buying.

### **Need and Significance**

Online shopping is one of the fastest growing business sectors. Online buying is the process whereby consumers directly buy goods or services from a seller in real time, without an intermediary service over the internet. The world is moving towards digitalization. Most of the people are using the internet and go through so many websites a day. Online buying has become one of the unavoidable factors in people. It has many benefits as compared to traditional buying. The usage of mobile phones among students increased during the current situation.so it is more relevant to explore how far the students react to this online buying. Hence an attempt is made to study the Perception of College students towards online buying.

### **Objectives of the Study**

The objectives of the study are ;

- To study the frequency of online buying of students.
- To study factors influencing online buying behaviour of students.
- To identify the range of amounts spent for online buying.
- To study the satisfaction of students in online buying.

### **Methodology**

The study was entitled the perception of college students towards online buying. Both primary and secondary data had been collected. The primary data have been collected from 50 samples through a convenient sampling method from the students of SNM Training College with the help of a questionnaire. The secondary data have been collected from various online journals and websites. For data analysis statistical tool percentage is used. Tables, charts and diagrams were also used for graphical representation.

### **Limitations of the Study**

Following were the major limitation for conducting the study;

- Incorrect answers from the respondents was a problem.
- The study was limited to 50 which may not reflect the perception of others.
- Some of the respondents were not interested in answering the questionnaire.

### **Data Analysis**

The main data collected have been analyzed as by the investigator as follows;

**Table 1**

*Frequency of Buying From Online Shops*

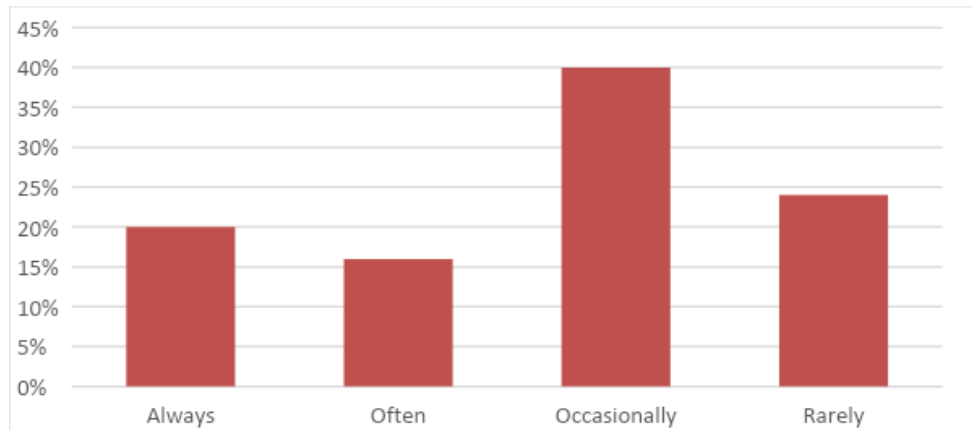
<b>Category</b>	<b>No of Respondents</b>	<b>Percentage</b>
Always	10	20%
Often	8	16%
Occasionally	20	40%
Rarely	12	24%
Total	50	100%

**Source: primary data.**



**Figure 1**

*Frequency of Buying From Online Shops*



**Table 2**

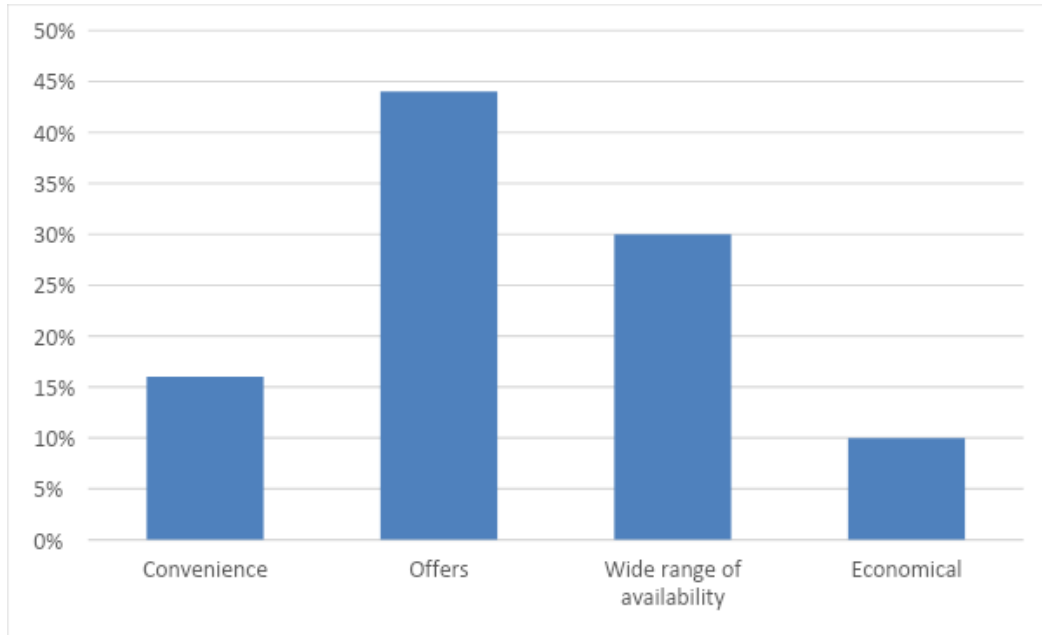
*Factors Influencing Online Buying Behaviour of Students*

Category	No of Respondents	Percentage
Convenience	8	16%
Offers	22	44%
Wide range of availability	15	30%
Economical	5	10%
Total	50	100%

**Source: primary data.**

**Figure 2**

***Factors Influencing Online Buying Behaviour of Students***



**Table 3**

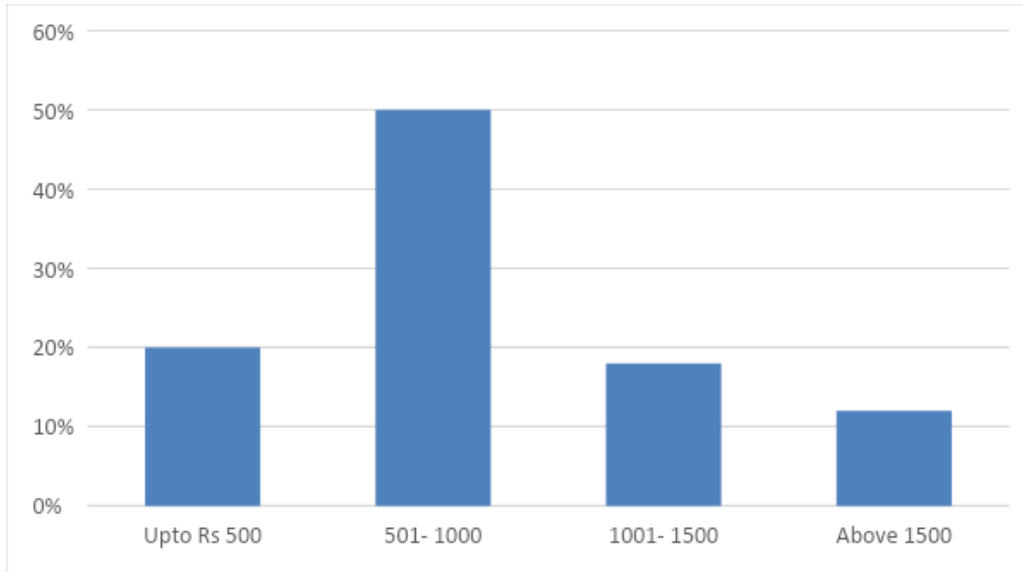
***Amount Spend for Online Buying***

<b>Category</b>	<b>No of Respondents</b>	<b>Percentage</b>
Upto Rs 500	10	20%
501- 1000	25	50%
1001-1500	9	18%
Above Rs 1500	6	12%
<b>Total</b>	<b>50</b>	<b>100%</b>

**Source: primary data.**

**Figure 3**

*Amount Spend for Online Buying*



**Table 4**

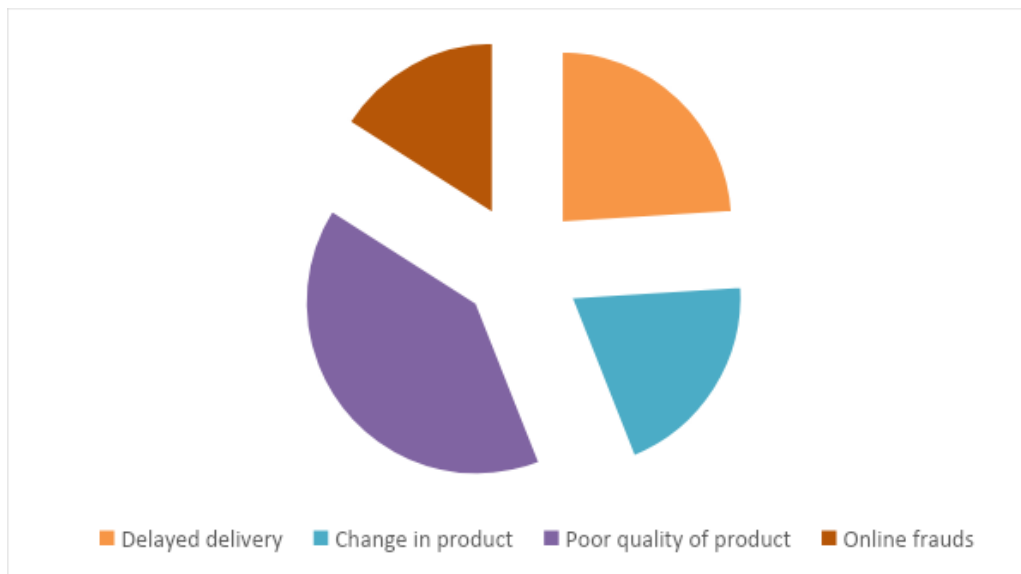
*Difficulty Faced in Online Buying*

Category	No of Respondents	Percentage
Delayed delivery	12	24%
Change in product	10	20%
Poor quality of product	20	40%
Online Frauds	8	16%
Total	50	100%

**Source : primary data.**

**Figure 4**

*Difficulty Faced in Online Buying*



**Table 5**

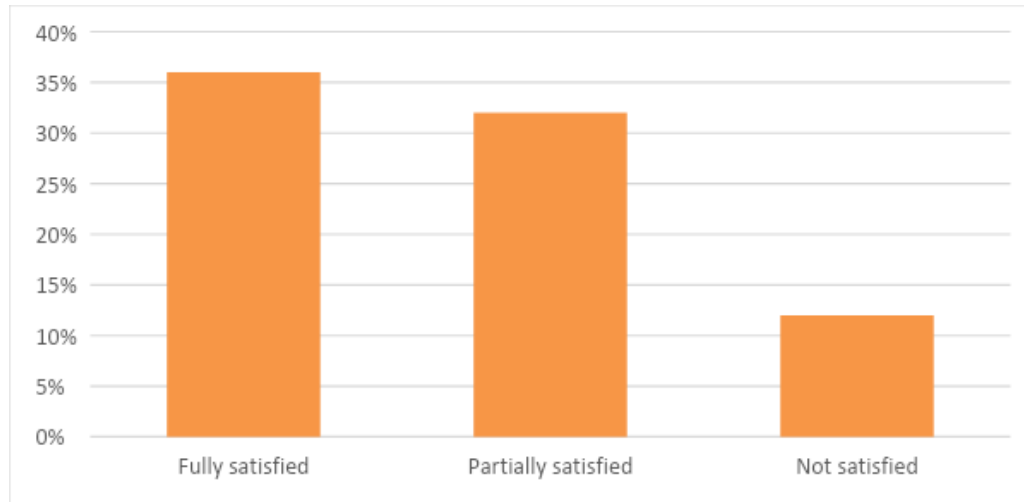
*Satisfaction of Students in Online Buying*

Category	No of Respondents	Percentage
Fully satisfied	18	36%
Partially satisfied	26	32%
Not satisfied	6	12%
Total	50	100%

Source: primary data.

**Figure 5**

***Satisfaction of Students in Online Buying***



**Findings of The Study**

On the basis of the objectives of the study the collected data have been analysed and interpreted to evolve the following findings;

- Majority of the respondents , 40 % , are buying online occasionally.
- Among the various factors influencing online buying, 44% of the respondents are influenced by offers.
- Wide range availability of products are also influencing the buying behaviour of students.
- When it comes to the amount spent for online buying 50 % of the respondents are spending Rs 501 - Rs 1000 range.
- Poor quality of product is the main difficulty faced by 40 % of the respondents in online buying.
- 36% of the respondents are fully satisfied with online buying.

- The overall online buying perception and experience of the students are Very good.

### **Suggestions**

Based on the analysis and findings of the study following are the suggestions for online sellers.

- Online sellers must identify the issues faced by online buyers in their online purchase decision making process.
- Online shopping sites must make sure that they are delivering good quality products.
- Many offers can be included in online buying to attract the buyers.
- Offering economically viable good quality products will increase sales.

### **Conclusion**

Online buying is a new experience in the initial times of its introduction but now it is a part of daily life. Online buying has a great impact on the youth. The study conducted revealed a positive attitude and behaviour towards online buying. The increased usage of internet and online shopping among college students has created new prospects and opportunities for online traders. The study also arrived at some valuable findings which lead to the suggestions for the betterment of online selling.

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**Consumer Awareness Towards Usage of Mobile Banking with Special Reference to  
Malappuram City**

Vivek C. P., and Syam Prasad A. V.  
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**Abstract**

In the Globalized world, banks serve various innovative functions like ATMs, internet banking, Tele-banking and mobile banking through electronic channels. This paper proposes an attempt to study consumer awareness and perception towards usage of mobile banking. The survey was conducted among the bank customers using a structured questionnaire at Malappuram city. Mobile banking means banking transactions using mobile devices such as smartphones, tablets etc. In the digital world it is becoming an inevitable factor in society. Nowadays the majority of transactions take place through electronic devices. One of the cheaper electronic devices that can be used for banking transactions is mobile devices. So we should have awareness towards usage of mobile banking. The study shows that consumers are aware about mobile banking service provided by banks. Majority of the consumers are entered into the mobile banking services because of easy to use, flexibility to do transactions irrespective of time.

*Keywords:* digital world, mobile banking, transactions

**Introduction**

Banks are the most important financial institution in the world. Emergence of advanced technologies make tremendous change in the banking sector. All the physical or traditional banking services are replaced with technologies. Mobile banking is one of the innovative services provided by the banks. Mobile banking simply means financial or



banking transactions take place through mobile devices. Mobile banking helps the customers to do banking transactions as well as financial transactions from anywhere at any time.

Nowadays all banks are providing mobile banking services. For smooth functioning of banking transactions banks have developed their own apps. The mobile banking application facilitates seamless transactions between bank accounts, offering numerous benefits to users such as balance inquiries, fund transfers, bill payments, SMS alerts, and more. As a result, customers increasingly prefer mobile banking for its convenience and versatile features. Mobile Banking helps customers to access banking services anywhere. Now people use various mobile apps to save time and money. It is not only used by the individual himself for his personal uses but also used by their business transactions.

### **Objectives**

- To evaluate the level of customer awareness regarding mobile banking.
- To determine the extent of consumer awareness regarding mobile banking services.
- To ascertain the acceptance level of mobile banking among banking customers.

### **Methodology**

Information was collected from both primary and secondary sources. The primary data collection involved the use of a structured questionnaire, while secondary data was obtained from a variety of books, journals, and websites. Sample sizes were determined using both quantitative and qualitative approaches. The research was carried out in the city of Malappuram, with a total sample size of 50 respondents.

### **Theoretical framework**

Mobile banking is an innovative service provided by banks for banking transactions

through a mobile device such as mobile devices like mobile phones, tablets etc. Traditionally mobile banking services were offered over SMS only.

In recent times, mobile banking is predominantly carried out through SMS or the mobile web. It involves accessing banking and financial services using mobile telecommunication devices.

*Mobile Banking Services:* Banks offering the following services to their customers:

Mobile banking services provided by banks include:

- Inquiry of Account Balance and Statement Inquiries for Accounts,
- Checking Cheque Status
- Requests for Cheque Books
- Transferring Funds between Accounts
- Receiving Credit/Debit Alerts
- Minimum Balance Notifications
- Alerts for Bill Payments
- Bill Payments
- Viewing Recent Transaction History
- Requesting Information such as Interest Rates/Exchange Rates.

*Technologies employed in Mobile Banking include:* Mobile Banking is operational through mobile applications developed on one of the following four channels: Standalone Mobile Application Clients, IVR (Interactive Voice Response), SMS (Short Messaging Service)

WAP (Wireless Access Protocol)

### **Advantages of Mobile Banking**

- Mobile banking holds an edge over internet banking.

- Mobile banking is characterized by user-friendliness, cost-effectiveness, and time-saving
- Banking through mobile devices reduces the risk of fraud.
- Utilizing mobile banking benefits banks by reducing telecommunication costs and being more economical.
- Mobile banking enables banks to engage with their clients.
- Banks can utilize mobile banking to promote and sell their products and services, such as ATM cards and loans, to customers.
- Various banking services, including checking account balances, receiving credit/debit alerts, facilitating fund transfers, providing bill payment alerts, and offering transaction history, are available through mobile banking.

### **Data analysis**

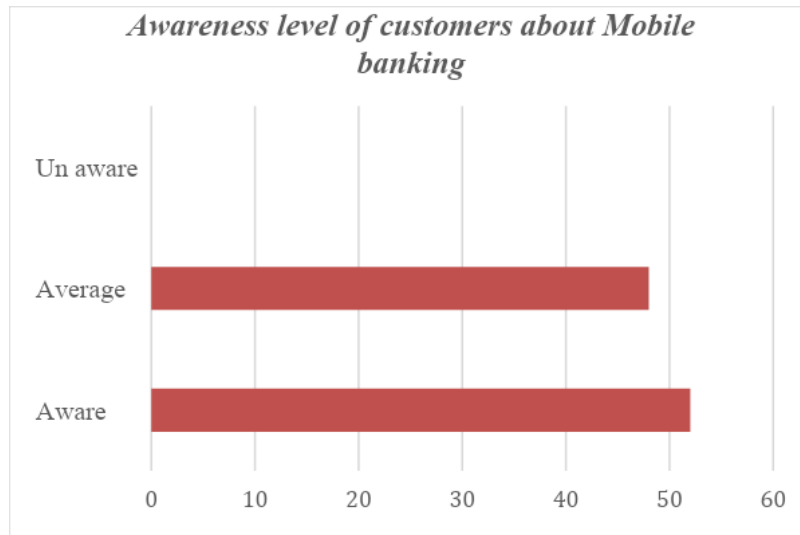
The data collected were tabulated and graphically analyzed. The details are as follows.

**Table 1**

<i>Awareness level of customers about Mobile banking.</i>		
Option	No of Respondents	Percentage
Aware	29	52
Average	21	48
Un aware	0	0
Total	50	100

**Figure 1**

*Awareness level of customers about mobile banking.*



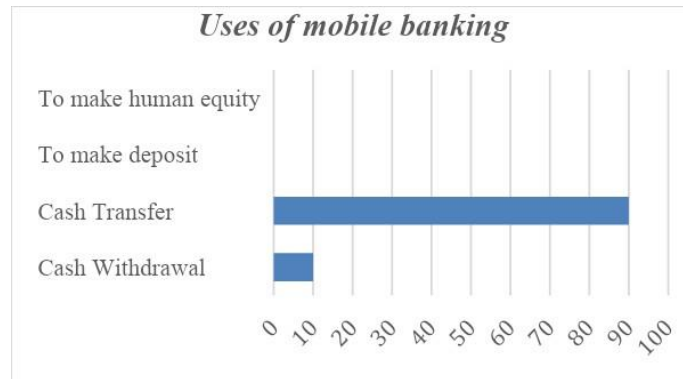
**Table 2**

*Uses of mobile banking.*

Option	No of Respondents	Percentage
Cash withdrawal	5	10
Cash transfer	45	90
To make deposit	0	0
To make human equity	0	0
Total	50	100

**Figure 2**

*Uses of mobile banking*



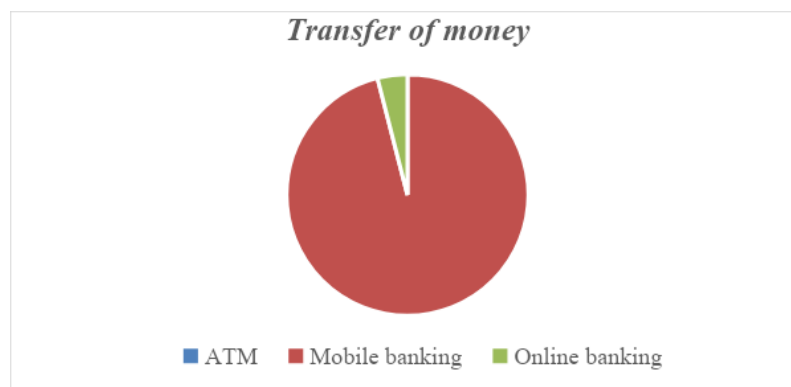
**Table 3**

*Transfer of money*

Option	No of Respondents	Percentage
Automatic teller machine	0	0
Mobile banking	48	96
Online banking	2	4
<b>Total</b>	<b>50</b>	<b>100</b>

**Figure 3**

*Transfer of money*



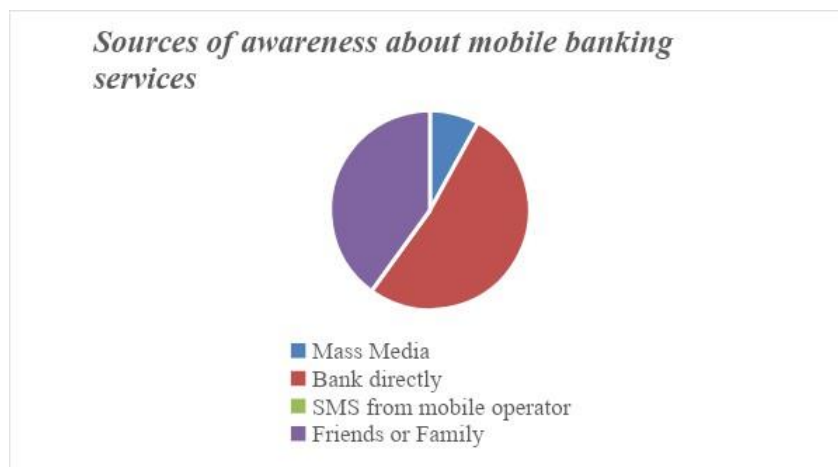
**Table 4**

*Sources of awareness about mobile banking services*

Option	No of Respondents	Percentage
Mass media	4	8
Bank directly	26	52
SMS from mobile operator	0	0
Friends or family	20	40
Total	50	100

**Figure 4**

*Sources of awareness about mobile banking services*



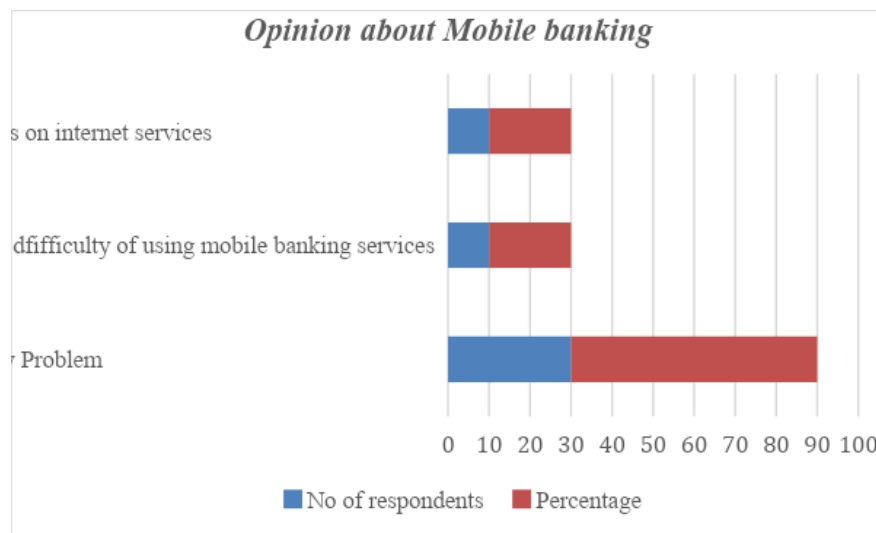
**Table 5**

*Opinion about Mobile banking.*

Option	No of Respondents	Percentage
Security problem	30	60
Over all difficulty of using mobile banking services	10	20
Depends on internet services	10	20
Total	50	100

**Figure 5**

*Opinion about Mobile banking*



**Findings**

- Majority of banking customers are highly aware about mobile banking now.
- Majority of customers typically transfer money in mobile banking.
- 8% of customers hear about the mobile money services from the mass media, 52% of

customers hear from the bank directly and 10% of customers hear from friends or family.

- Most of the mobile banking customers believe that using mobile banking is safe.
- The security problem is the main disadvantage of mobile banking.

### **Conclusion**

This study centered on examining customers' attitudes toward mobile banking services. The analysis revealed that a majority of customers responded positively, expressing that mobile banking is easy to understand and use. They appreciated the faster services, ease of fund transfer, and simplicity in making balance inquiries through mobile banking. However, the study also identified that customers faced security concerns. Therefore, the study suggests that banks should prioritize ensuring security and create awareness among customers regarding technical aspects. By addressing these concerns, it is anticipated that more customers will embrace mobile banking services in Malappuram city.

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## **Emotional Intelligence as a Predictor of Classroom Management Success in B.Ed. Trainees**

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### **Abstract**

Emotional intelligence integration into classroom management techniques fosters a helpful and encouraging learning environment. Emotionally intelligent teachers are better able to manage the demands of the classroom, form enduring bonds with their pupils, and foster an environment that promotes both teaching and learning. In this study, the researchers attempted to investigate the relationship between the B.Ed. trainees' emotional intelligence and classroom management abilities throughout their teaching practice. The research examined the association between B. Ed. students' emotional intelligence and classroom management during practice teaching for both the entire sample and subject-specific subsamples. The results reveal that there is a difference in the mean values of Emotional Intelligence and Classroom Management of different subject students but all come under the average level of Emotional Intelligence and Classroom Management. The study reveals that there is a relationship between Emotional Intelligence and Classroom Management of B.Ed. students during teaching practice but it is not significantly correlated. The results of the study suggested that in order to produce teacher candidates with high levels of emotional intelligence and classroom management, additional value-enriching programs, seminars, camps, counseling, group activities, etc., are required.

*Key Words:* Emotional intelligence, Classroom Management, B.Ed. Trainees

## **Introduction**

Education is a lifelong and universal process. The basic function of education is to stimulate learning, develop personality, amplify thinking, provide a path of self-expression, open the door towards self-actualization and liberate the human being. Education is a fundamental aspect in determining a nation's progress, and teachers play a crucial role in shaping and guiding students in the right direction. The basic role of any teacher is to create a very interesting classroom for students. If a teacher efficiently manages his/her classroom, it will be a great success in his/her career. Keeping classrooms tidy and distraction-free is the duty of teachers in order to support learning for all students. An emotionally stable, knowledgeable educator can be quite successful in this field of work. Mayer & Salovey (1997) considered emotions as useful sources of information that help one to make sense of and navigate the social environment.

Teachers view classroom management as a challenging aspect of their work. Classroom management is a fundamental problem that confronts both experienced and beginning teachers. According to Taylor (2009) classroom management is one of the greatest concerns of teachers and administrators when addressing the safety and well-being of students. Classroom management ranks at or near the top for beginning teachers as a general concern. Excellent teaching is concerned with fostering effective student learning within the framework that excellent management has established. Classroom management is concerned with providing an atmosphere in which learning can occur. Teachers who have more capacity to deal with emotion demonstrate a greater management of discipline in the classroom (Valente et al., 2018). Success in an activity like teaching is directly dependent on successful classroom management. Throughout their practice teaching phase, aspiring teachers are constantly working to improve their

classroom management abilities. Additionally, it is seen that the student instructors' constant fear and emotional instability stem from this classroom management assignment. Therefore, the researchers thought it was crucial to examine the emotional intelligence and classroom management abilities of B.Ed. students and determine how these two factors relate to one another.

### **Objective**

1. To investigate the emotional intelligence of B.Ed. students.
2. To research the B.Ed. students' proficiency in classroom management.
3. To find out subject-wise differences in Emotional Intelligence among the B.Ed. students.
4. To find out subject-wise differences in Classroom Management among the B.Ed. students.
5. To study the relationship between Emotional Intelligence and the Classroom Management of B.Ed. students for the total sample and subject-wise subsamples.

### **Hypothesis**

1. The level of Emotional Intelligence is high among B.Ed. students.
2. The level of Classroom Management during teaching practice is average among the B.Ed. students.
3. There will be no significant difference of Emotional Intelligence among B.Ed. students.
4. There will be no significant difference of Classroom Management among the B.Ed. students.

5. There is an important relationship between Emotional Intelligence and classroom management during teaching practice among B.Ed. students for the total sample and subject-wise subsamples.

## **Methodology**

### **Participants of the Study**

A representative sample of total 382 students, in which 86 were from Natural Science, 83 of Physical Science and 78 were Malayalam optional subject students. 82 students were English subject students, 81 Commerce, 86 Mathematics and 80 were Social Science subject students. These graduate level teacher training students belong to different locales and gender and this ensures real representation of the population.

### **Instruments Used for the Study**

For the study, two types of tools were used. The Emotional Intelligence scale(2007) was developed and standardized by Anukool Hyde, Sanjayot Pethe and Upinder Dhar and the Classroom management inventory was prepared and standardized by the researchers Nayana Narayanan and Bisini P S (2023). The Emotional intelligence scale consists of 34 items: there are five possible answers for each item: strongly disagree, disagree, neutral, agree, and strongly agree. The test was developed on ten factors of emotional intelligence; self-awareness, empathy, self-motivation, emotional stability, managing relations, integrity, self-development, value orientation, commitment and altruistic behavior from the Goleman model (Goleman, 2001). The scale established reliability and validity - 0.88 and 0.93 respectively. The Classroom management inventory consists of 47 items:there are five possible answers for each item:

strongly disagree, disagree, uncertain, agree, and strongly agree. The inventory was developed on different dimensions of classroom management; physical arrangements, behavior management, instructional strategies, evaluation management, advance planning before the planning of teaching practice, time management and reinforcement.

### **Procedure**

After the collection of data, the level of Emotional Intelligence and Classroom Management among the total sample was found out using percentage analysis. The relationship between the variables among B.Ed. students were found by using Spearman's rho coefficient of correlation.

### **Analysis and Interpretation**

The mean and standard deviation of the two variables, classroom management and emotional intelligence, were determined for the purpose of data analysis and interpretation.

### **Emotional Intelligence for Total Sample and Subject-Wise Subsamples**

The overall score was determined, divided by its maximum score, and the percentage of Emotional Intelligence of B.Ed. students were calculated across the entire sample and subject-wise subsample. The mean score of emotional intelligence for the total sample is 138.69, and the standard deviation is 13.79. Based on the subject specialization, the calculated mean of emotional intelligence for Malayalam student teachers is 141.04; for English student teachers it is 134.368; for Natural Science student teachers it is 138.484; for Physical Science student teachers it is 139.360; for Social Science student teachers it is 142.571; for Mathematical student teachers it is 136.961 and for Commerce student teachers it is 140.75. The standard deviation of Malayalam, English, Natural science, Physical science, Social science, Mathematics

and, Commerce student teachers are 13.846, 13.021, 13.373, 12.437, 13.273, 16.28 and, 12.821 respectively.

**Figure 1**  
*Mean Comparison of Emotional Intelligence for Total and Subject-wise among B.Ed. Students*

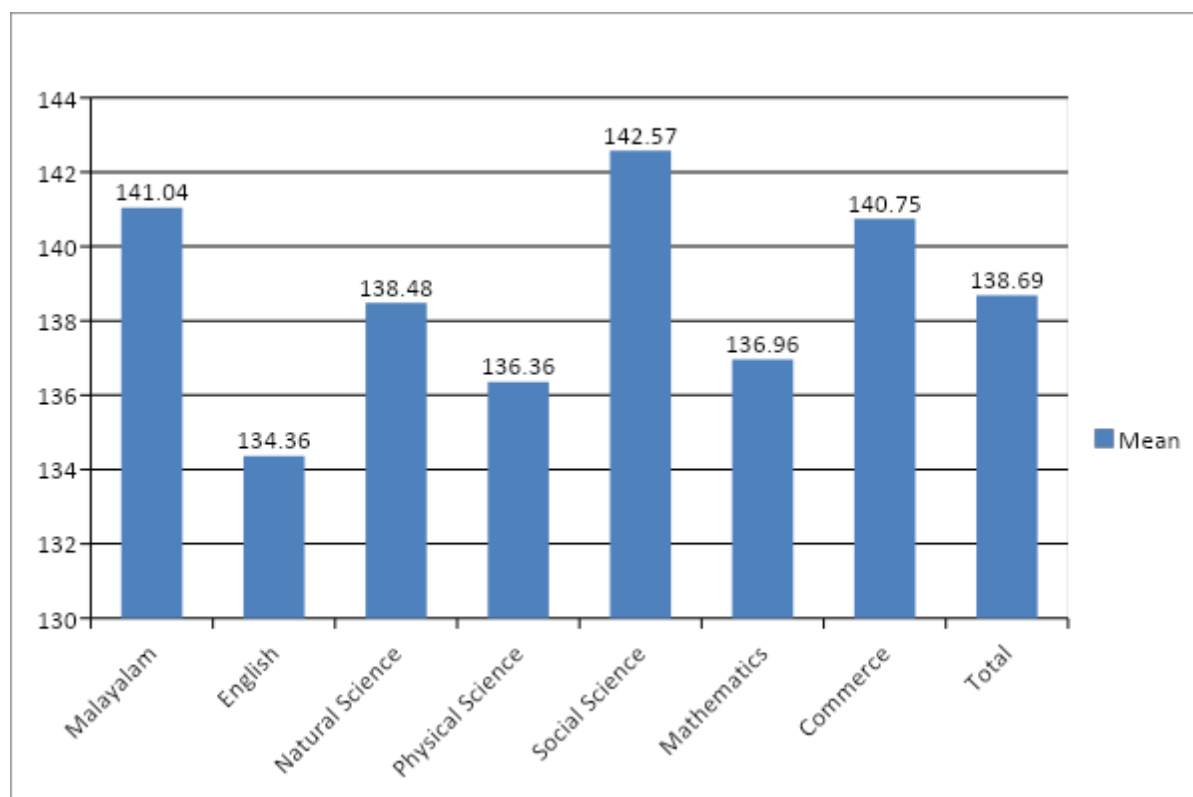


Figure 1 shows that students in Social Science performed better than students in other disciplines, whereas English students had the lowest Emotional Intelligence of all the subjects. Students pursuing a Bachelor of Education degree would rank in the following subjects: Social Science, Malayalam, Commerce, Natural Science, Mathematics, Physical Science, and English, in decreasing order of emotional intelligence.

## Level of Emotional Intelligence

**Figure 2**

*Percentage of B.Ed. Students with Various Levels of Emotional Intelligence*

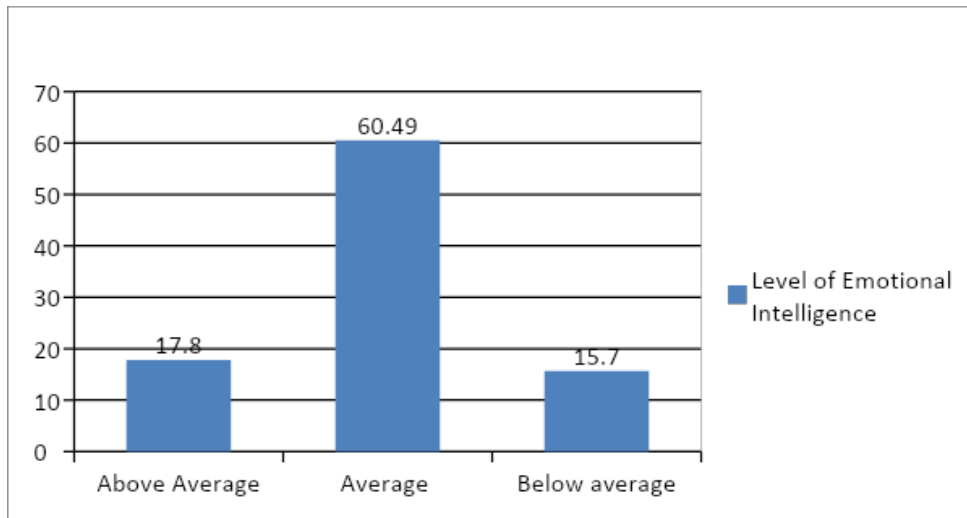


Figure 2 reveals that 17.8% have above-average Emotional Intelligence, 60.49% average and 15.7% below-average Emotional Intelligence. That means most of the B.Ed. students possess average and above average levels of Emotional Intelligence.

## Managing the Classroom for the Whole Sample and Subject-Specific Subsamples

The total score was computed, divided by the maximum score, and the percentage of classroom management proficiency among B.Ed. students throughout the entire sample and subject-wise determined. The mean score of classroom management for the total sample is 84.32, and the standard deviation is 12.23. Based on the subject specialization, the calculated mean of classroom management for Malayalam student teachers is 78.84; for English student teachers, it is 84.947; for Natural Science student teachers, it is 87.424; for Physical Science student teachers, it is 86.960; for Social Science student teachers, it is 84.178; for Mathematical student



teachers, it is 84.461; and for Commerce student teachers, it is 81. The standard deviations of Malayalam, English, Natural science, Physical science, Social science, Mathematics and Commerce student teachers are 9.474, 12.077, 13.103, 12.218, 14.088, 11.196 and 9.85 respectively.

**Figure 3**

*Mean Comparison of Classroom Management for Total and Subject-wise among B.Ed. Students*

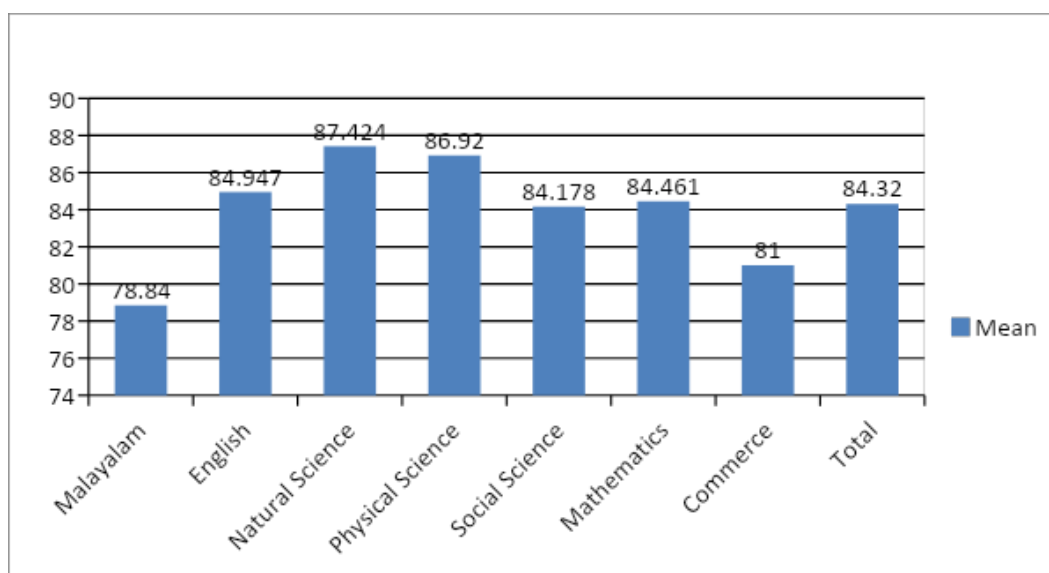


Figure 3 shows that while Malayalam students had the least amount of classroom management proficiency of all the disciplines, Natural Science students performed better than the others. Students pursuing a Bachelor of Education degree fall into the following categories if we rank

them according to decreasing levels of emotional intelligence: natural science, physical science, English, mathematics, social science, commerce, and Malayalam.

### **Level of Classroom Management**

**Figure 4**

*Percentage of B.Ed. Students with Various Level of Classroom Management*

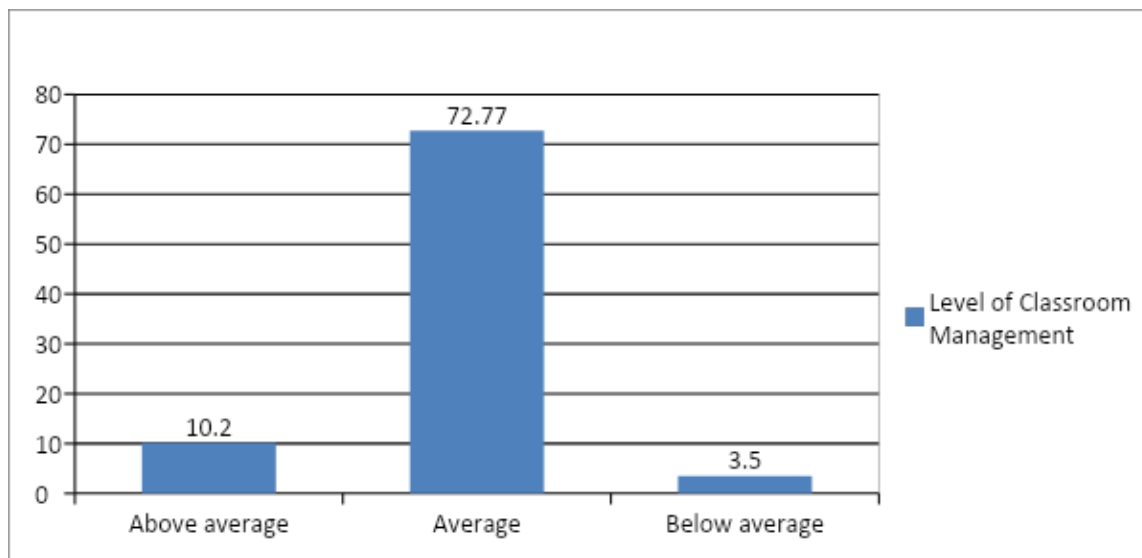


Figure 4 reveals that 10.2% have above-average Classroom Management, 72.77% average and 3.5% below-average Classroom Management. That means most of the B.Ed. students possess average and above-average levels of Classroom Management.

**Table 1**

***Relationship between Classroom Management and Emotional Intelligence for the entire sample and each subject's subsample***

Sl.No	Samples	Number of Samples	Coefficient of Correlation
1	Malayalam	50	0.229
2	English	76	0.153
3	Natural Science	66	0.38
4	Physical Science	50	0.052
5	Social Science	56	0.29
6	Mathematics	52	0.186
7	Commerce	32	0.138
8	Total	382	0.101

## **Result and Discussion**

Through this study, the researchers attempted to investigate the emotional intelligence and classroom management levels of B. Ed. students during their teaching practice, as well as the differences in these variables between subjects. Additionally, this attempt investigates the association between B. Ed. students' emotional intelligence and classroom management during teaching practice for both the entire sample and subject-specific subsamples. Rejecting hypothesis one and accepting hypothesis two, the study found that B. Ed. students' emotional intelligence and classroom management levels were average throughout teaching practice.

Among the sub-sample based on the subject, it was found that Social Science students had high and English students had lower levels of Emotional Intelligence than the other subject students. It was also found that Natural science students have high and Malayalam students have Classroom management as compared to other subject students. The results reveal that there is a difference in the mean values of Emotional Intelligence and Classroom Management proficiency of different subject students but all come under the average level of Emotional Intelligence and Classroom Management. The study reveals that there is a relationship between Emotional Intelligence and Classroom Management of B.Ed. students during teaching practice but it is not significantly correlated and the last hypothesis is rejected.

### **Conclusion**

The goal of the current study was to ascertain the association between these two factors by examining the classroom management and emotional intelligence of B.Ed. students throughout their teaching practice. The study's conclusions showed that the majority of B.Ed. students exhibit mediocre levels of classroom management and emotional intelligence. Even though B.Ed. students exhibit average emotional intelligence and classroom management, they may be inspired to reach a high level of these competencies through intensive training provided throughout the program. They may also use these competencies in their teaching and learning processes and in their future careers as teachers. Reducing the variety of activities included in the curriculum is not necessary. The results of the study suggested that in order to produce teacher candidates with high levels of emotional intelligence and classroom management, additional value-enriching programs, seminars, camps, counseling, group activities, etc., are required.

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## **Eco Friendly Synthesis and Characterisation of Starch Based Bioplastics**

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### **Abstract**

Bioplastics are made from vegetable oil, corn starch, straw, sawdust, sawdust, recycled food waste, etc. They are plastic materials made from renewable energy sources such as, Some bioplastics are obtained by direct processing from natural biopolymers, including polysaccharides and proteins. This article is discussing about the preparation of bioplastics using potato starch, corn starch, Corn/agar and potato/Corn in different combinations to produce four types of bioplastics and comparing the solubility, heat resistance and biodegradability of bio- plastics to realize its characteristics to allow them to compete with the conventional plastics. The future of bioplastics shows great potential.

*Key words:* Heat resistance, Solubility, Degradability.

### **Introduction**

Our society has entered the age of plastics. Although it is a recent invention, it is able to influence modern life. The growing concern about the pollution caused by dumping of plastic wastes led to the search for relatively environment friendly materials to substitute these conventional petroleum based plastics. Recently biodegradable plastics have been developed from natural polymers. Current research is focusing on how to use Natures' polymers to make plastics. Bio-plastics are biodegradable or bio-based plastics completely or partially derived from renewable biomass sources like corn and potato starch, banana peel, milk, paper waste, food waste, cheese etc. Bio-plastic is usually derived from sugar derivatives including starch, cellulose and lactic acid.

### **Need of the study**

Bio-plastic can be sensibly developed as a solution to the massive plastic invasion on our planet. Not all bio-plastics are biodegradable but they degrade more readily than the common petroleum based plastics. Bio-plastic is commonly transformed into plates, cutlery, bottles, bags, textiles and packaging materials. It can also be used in the medical field as the implant during surgeries which will dissolve within the body thereby a second surgery for the removal of implants can be avoided. Bio-plastic is used in agriculture mainly for the preparation of mulch sheets.

Demand for plastic is insatiable. Everything from shopping bags, fast food packaging, switch boards, plastic containers etc. are made of plastics. Usually these plastic wastes end up in oceans or in landfills thereby causing pollution and significant amounts of greenhouse gasses are produced from them. Common fossil fuel based plastics are non- biodegradable and exotic materials. This can be effectively replaced by renewable, bio- degradable, eco-friendly bio- plastics.

### **Literature Review**

The first known bioplastic was polyhydroxybutane, discovered by French scientist Maurice Lemoligue in 1926 while working on *Bacillus megaterium*. Antonio (2009) studied “innovation and industrial trends in bio-plastics”. It briefly explains how these developments occur and identifies the latest trends in technology and business. Jame Colwill and El Wright of the Society of Plastics Engineers Plastics Environment Section studied "Opportunities to store biopolymers through closed-loop recycling" in 2010. They assessed the weakness in existing research, related to recycling of biopolymers. A research paper based on “The golden bridge for nature: the new biology applied to bioplastics' ' was published by Johana

Ricones<sup>2</sup>. The research focused on the possibility of modifying organisms in order to create new biosynthetic routes for the production of monomers that would fit the production of high quality polymers from renewable feedstock. Starch attracts public attention as a replacement of fossil fuel in polymer industries because it is renewable, biodegradable and non-toxic. Mariya Yuliana<sup>3</sup> and her coworkers researched on defatted cashew nut shell starch and possibilities of deriving a plastic from it. Olivier Talon<sup>4</sup> attempts to answer the question “Are bioplastics ‘green’ plastics? by life cycle assessment (LCA) methods, also examining limitations of these methods, and then by putting an additional reference framework established on the basis of the 12 principles of green chemistry. In the interests of clarity, it should be noted the term ‘bio-plastics’ is to be understood in terms of nature rather than properties.

LCA of bio- plastics is capable of providing us with interesting data in terms of evaluation of their environmental impact, there are certain limitations, the list of which could still be added to. Pragya Shailendra<sup>5</sup> Rathore studied about “bio-prospects of the PHB”. Polyhydroxybutyrate is a bioplastic produced by a variety of microbial species in carbon rich and nutrient poor environments. Cheaper materials for mass production of PHB were researched and planned to reduce the production costs.

### **Objectives of the study**

Through this work I have tried to prepare bio-plastics using potato starch, corn starch, Corn/agar and potato/Corn in different combinations to produce four types of bioplastics and compared the solubility, heat resistance and biodegradability of bioplastics to realize its characteristics to allow them to compete with the conventional plastics. The future of bioplastics shows great potential.



## **Methodology**

For making bioplastic from corn starch, First add 2 tablespoons of cornstarch into a beaker. Then add 3-4 tablespoons of water. Mix them well. Add 1 tablespoon of glycerine and 1 tablespoon of vinegar. Stir the mixture well. Now heat the mixture and stir continuously until a sticky precipitate is formed. Spread the product on a flat surface and let it dry. Keep it for a few days and carefully detach it from the surface without tearing.

Repeat the same procedure for the preparation of other plastics. Skip adding vinegar for making (corn + agar) bio-plastic. Water plays an important role in bioplastic production. First, it acts as a solvent that dissolves the starch. The latter helps keep the starch separate when heated, and the vinegar releases acetate ions and hydrogen ions into the solution. Large cellulose molecules, such as starch, have long chains. By adding a small amount of vinegar, we can break some of the polymer chains and make the plastic less brittle. Glycerin acts as a plastic desiccant and lubricates plastics.

In order to know whether the plastics that we have made can be used as an alternative to replace the normal plastic, we conducted a few experiments.

- 1. Heat resistance test**
- 2. Solubility test**
- 3. Degradability test**

The results for the flexibility and transparency of the plastic can be obtained by visual observation.

## **Analysis and interpretation of data**

1. Heat Resistance

The prepared bio plastic pieces were added into the water heated to 80<sup>0</sup> C. All

prepared bio- plastics curls and becomes soft. On continuous stirring, it breaks down into small particles and dissolves. Among the four bioplastics prepared agar based one dissolved easily. Studies revealed that corn based bioplastic is more heat resistant when compared to other there bioplastics

## 2. Solubility

To test solubility, pieces of bio-plastics were kept in a beaker filled with water for about 7 days. The plastics become soft and when stirred with a glass rod is dissolved in water. Bio-plastics made from potatoes were comparatively more soluble than others.

## 3. Biodegradability

After one week, all the soil buried bio-plastics are in the same condition. It shows no difference in size, but there is a change in colour intensity i.e. paleness from its original colour. After 4 weeks, a few pieces of corn + agar bio-plastics left but the corn made plastic has completely decomposed. The bioplastic made from potato decomposed partially and its size decreased with numerous pores. The potato+corn based bioplastic decomposed after a period of one month.

### **Findings of the study**

- Potato + Corn based bioplastic is least soluble in water whereas potato alone based bioplastic is highly soluble in water.
- Among the four bioplastics, corn based is the most heat resistant.
- Biodegradability studies indicate that all the bioplastics have a nearly one month shelf life.
- Bio-plastic made from corn has got superior properties compared to other three bioplastics.

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**Teaching 2D and 3D geometry with the aid of augmented reality technologies**

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**Abstract**

The visualization of content in secondary educational institutions is one of the key factors in the excellent assimilation of educational material and its continued usage in the learning process. Visualizations require the academic subjects that are the most challenging to comprehend and, for the most part, lack widespread practical application at the beginning of the study, which are primarily mathematical items. To better visualize teaching geometry; this study examined mobile tools that can be utilized for this purpose. The method of teaching geometry in secondary school middle classes is the subject of the study. The use of augmented reality tools to teach geometry to children in grades 7-9 is the focus of the project. The analysis and justification of the selection of mobile augmented reality for the study of mathematics were research methodologies employed in the study. Geogebra, ArloonGeometry, and Geometry AR were two augmented reality technologies that were revealed via analyses. Teachers can use these tools to visualize lesson material and create challenging scenarios in order to help pupils learn geometry and succeed academically. Due to the utilization of augmented reality, the geometry lectures specifically provide the right setting for a fruitful emotional exchange between the student and the teacher. Additionally, it helped to lessen negative attitudes towards geometry lectures such as fear and anxiety. The emotional aspect of learning fosters interest in mathematics, realizes creative potential, and creates the circumstances for diverse approaches to solving geometric problems. It also encourages improved recollection of the instructional material.

*Keywords:* Geometry, Augmented Reality Tools, Arloon Geometry, Geogebra, Geometry – Augmented Reality.

### **Introduction**

The younger generation must be able to quickly adapt to all situations, gain knowledge under all circumstances, and be able to put their newly acquired knowledge into practice due to the fast-changing information and communication technology and the present pace of life.

All of the Ministry of Education's most recent developments are focused on ensuring that graduates of educational institutions have a certain set of skills and the ability to independently pick up the knowledge they need to solve particular difficulties.

In order to remain competitive in the domestic and international labor markets, a graduate of a modern secondary or higher education institution must fulfill certain standards. They must gain knowledge and build a range of competencies during their education.

But the current status of secondary and higher education systems falls well short of state needs and demands for change.

### **Literature review**

A review of scientific research has revealed that one method for improving the state of the educational system is the competent and methodical integration of mobile information and communication tools and technologies into the learning process as well as the alteration of the learning model, which entails the switch from conventional to novel forms and methods of instruction.

The innovations of traditional psychology and pedagogical research provide the foundation for the revolutionary force that is the informatization of education. The construction and successful integration of information and communication technologies in educational practice necessitates the establishment of special tasks.

The incorporation of mobile ICT into classroom instruction will lead to higher education standards. By giving them greater freedom and choice over the time and place of study, it also contributes to the improvement of educational chances for people with disabilities. Training materials are sent to their mobile devices according to their requirements. This meets the needs of lifelong learning and training while improving the learning process's adaptability.(Serhiy O. Semerikov,2019)

Scientists believe that integrating cutting-edge mobile technology like augmented reality into the educational system is one approach to increasing the quality of mathematics teaching, particularly in geometry.

It cites Construct 3D as a stunning example of the application of augmented reality in the study of geometry as a tool for creating three-dimensional geometric structures. Personal interactive panels and stereoscopic primary displays are used in this application. Multiple individuals can work together in the same area using Construct3D to create various geometric models that are similar to the actual world.( Dyulicheva, 2020)

Students have the chance to make connections between things in their environment and geometric shapes to ascertain their properties by using the AR Math application. This fosters the development of not only spatial thinking but also the capacity to make logical connections. Such education involves manipulating virtual items in augmented reality.

Machine learning algorithms, such as the k-mean algorithm for choosing clusters of objects based on colour or shape, are used in the implementation of AR Math projects. Real mathematics is studied more effectively because of the presence of a virtual assistant who involves pupils in an augmented reality setting by telling them "Stories" about fascinating historical figures and challenging problems.

The GeoGebra AR program is yet another intriguing tool that helps kids comprehend the world of geometry. According to the article's writers, this application will be helpful for future maths teachers as well as students who want to improve their spatial thinking. GeoGebra 3D Calculator with AR can be used systematically to help students improve their research abilities, increase their socialization opportunities through ICT learning, and guarantee the development of universal STEM competencies. It goes without saying that every STEM teacher's main objective should be to inspire and involve their pupils in research projects.

The purpose of this essay is to assess a few mobile ICTs that can be employed in the secondary education system to make studying mathematics easier.

### **Objectives of the study**

To study the teaching of two-dimensional and three-dimensional geometry with the aid of augmented reality tools.

### **Knowledge of cloud computing applications and services in the fields of science and education**

It is recommended that seventh-grade geometry students be introduced to the Spanish-language Arloon Geometry program (<http://www.arloon.com/>), since this will facilitate



their understanding of the geometry learning process. The creators advise using this program to familiarize yourself with geometric forms and bodies beginning at the age of ten (fig. 1).

**Figure 1**

*The ArloonGeometry application window.*



With the following basic prerequisites for your mobile device: iOS 8.0 or above, or Android 4.0.3 or higher, you may get this program from Google Play. This software is entirely independent, not connected to any textbooks, and is available for free, albeit it does have a nominal \$2.99 pricing.

This program's features include the ability for students to study geometry in both space and on a plane. Volumetric forms have a planar sweep, and students can convert flat shape combinations they've made themselves into space; Utilizing the program will enable students to locate and identify polyhedrons and other geometric bodies in their surroundings; independently complete the tasks in the "guess," "right / wrong," and "calculation" sections and assess how much material they have learned. When working with spatial bodies, one can learn how to calculate the volume or area of the side surface of the body. Additionally, the program can

choose the "perform exercises" mode and study formulas or calculations that apply to one or more of a spatial polyhedron's side faces.

One of the program's shortcomings is that it costs money and is only supported in Spanish and English at the moment.

Students that are exposed to this program in geometry lessons will be able to distinguish between 2D and 3D geometry in addition to developing their spatial vision skills. But first, understand the geometry task's foundations to determine geometry's applied orientation. There are programs for chemistry, biology, arithmetic, anatomy, and astronomy in addition to augmented reality geometry software. ( Modlo et al, 2019)

It is advised to use a mobile augmented reality tool such as Geometry—Augmented Reality when studying geometric forms. (figure 2).

**Figure 2**

***A R Window of Geometry***



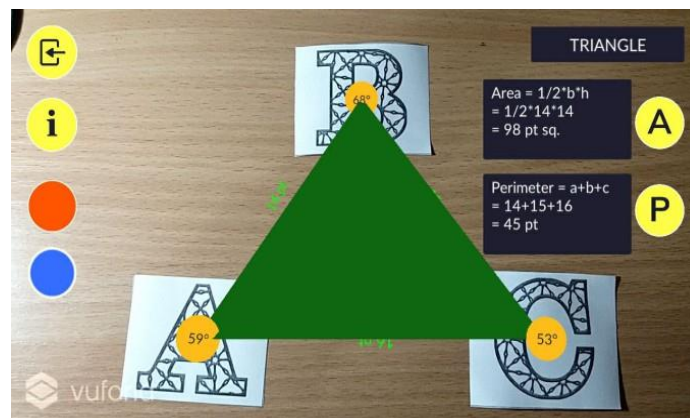
You may get this software for free from Google Play if your Android version is 4.0 or higher. Since its first release in 2017, this app has not gained significant traction. You also need

to download and print the labeled letters for this program in order to work with geometric forms. In order to create polygons, the four letters A, B, C, and D can be repeated.

With the use of this program and a mobile device, students can build segments and calculate their length using standard units, build triangles and calculate their perimeter and surface, and build quadrangles and calculate their perimeter and surface.

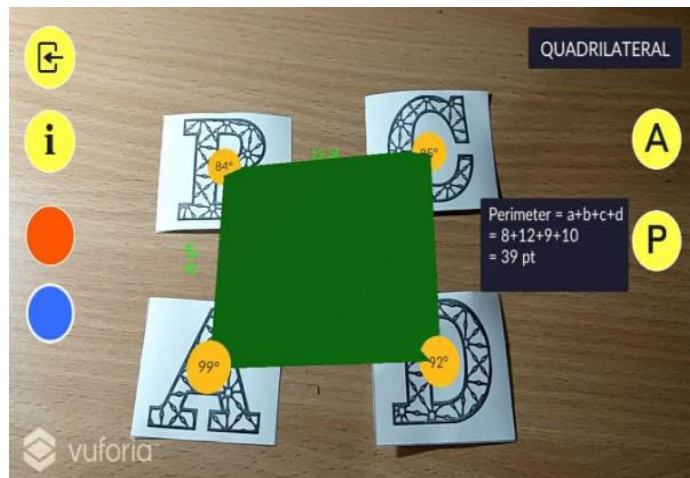
**Figure 3**

***Triangle construction***



**Figure 4**

***Quadrilateral construction***



The ability to self-visualize quadrilaterals and to separate their characteristics becomes increasingly more crucial when the educational system shifts to a blended learning approach. As a result, augmented reality tools have become essential in this kind of educational system.

After looking into a number of augmented reality tools and technologies, it was discovered that school curricula, particularly for geometry classes, are not well-established or customized. On the other hand, a variety of platforms have been created to let teachers create their own augmented reality programs or to offer students this option.

**Figure 5**  
*Geogebra logo*



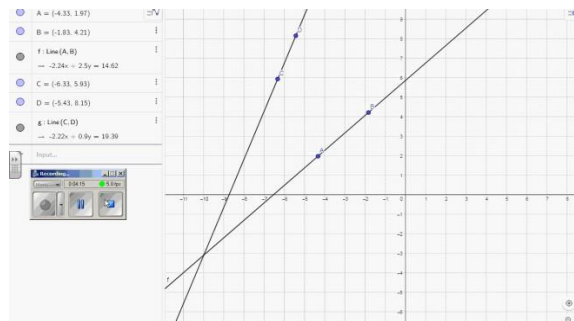
An open-source dynamic mathematics program called GeoGebra may be used to learn mathematics in elementary school, secondary school, and even higher education. (Akkaya et al, 2011)

The development of spatial imagination, practical knowledge, and logical reasoning are the three basic aims of teaching geometry, and these may be accomplished by teachers using

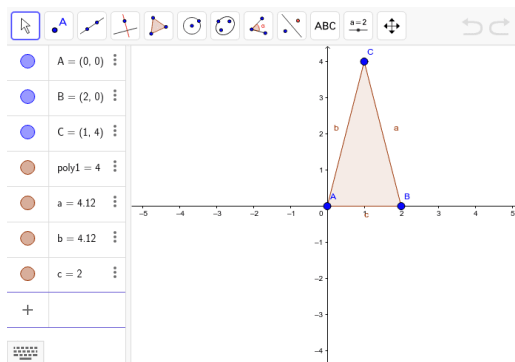
GeoGebra to build interactive materials. GeoGebra may be accessed over mobile Internet in both standalone and online modes.

The different features offered by Geogebra software indicate that it might be an excellent tool for rapidly, precisely, and effectively visualizing abstract geometric objects for its users.

**Figure 6**  
*Plotting lines in Geogebra*

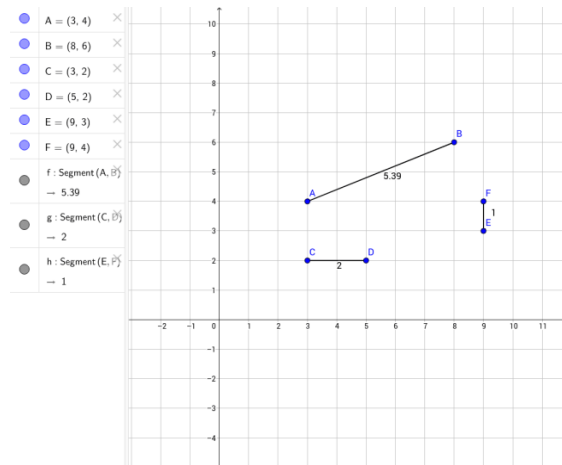


**Figure 7**  
*Creating polygons*



**Figure 8**

***Finding length of line segments***



Look at some of the platforms that make it possible to create applications in an AR format, which are freely available or subject to specific licensing requirements :( Stolyarova & Shulzhenko, 2019)

- **HP Reveal**, which was Aurasma until 2018 and is available for download from Google Play, is a platform for building augmented reality applications. The process of creating instructional resources on this platform is highly engaging and allows users to showcase their creative talents to both teachers and pupils.
- **AR Toolkit** is a collection of resources for developing AR apps and design solutions. For developers, this platform is the most widely used. (<http://artoolkit.hitl.washington.edu/> )
- **Metaverse** is a platform that lets you make engaging educational exercises without requiring a lot of programming knowledge (<https://studio.gometa.io/landing>).
- For all programmers, **EVToolbox** (<https://nitforyou.com/ev-toolbox/> ) is an easy-to-use constructor. Augmented reality can be made independently by the instructor or student.

EV Toolbox Designer allows users to personalize the visualization of mathematical abstractions and textbook content. It also displays produced objects, such as three-dimensional geometric surfaces and forms, on a smartphone screen. The drawings made by the kids on the aircraft are simultaneously turned into interactive three-dimensional objects.

- The platform **Vuforia** (<https://developer.vuforia.com/>) lets you build augmented reality (AR) apps for iOS and Android smartphones. With the use of virtual controllers, the user may rotate and zoom the item in addition to creating and analyzing flat pictures, rudimentary three-dimensional objects, and geometric forms.

Virtual Object Interaction visualizes an action that would almost certainly not be capable of being carried out on paper. It can therefore be concluded that a teacher in his field must not only use the created enhanced reality, but also create educational products which will enable him to develop his creative potential.

These are regarded as effective teaching and learning resources because they:

- improve the way mathematics is taught;
- support conceptual growth;
- improve geometric visualization;
- provide the groundwork for analysis and deductive reasoning;
- Foster creative thinking.

### **Conclusion**

An investigation of a few augmented reality technologies that might be used to teach geometry in classrooms leads to the following conclusions:

- 1) A teacher's main responsibility is to set up the educational process so that pupils may realize who they are and develop their creativity in an engaging way;
- 2) The instructor in the learning process serves as the inspiration for creating a personalized learning route. He exhibits his capacity to use an array of information and communication technologies and tools for personal growth and advancement;
- 3) A teacher's personal impact on a student's emotional state is also significant. The truth is that a student's disposition towards a teacher is an indicator of how they feel about the subject. When a student's emotional connection with the instructor plays a significant role in providing motivation, learning outcomes improve, students' cognitive abilities grow, creativity is recognized more fully, and so on;
- 4) The way that geometry is studied has a significant impact on students' emotional needs. It is advised that every geometry class begin with a teaching approach that empowers students to learn and relate what they have learned to their everyday lives on an emotional level;
- 5) The application of augmented reality in geometry instruction creates just the right kind of atmosphere for positive interactions between students and instructors. Students first learn that there are particular ways in which they may utilize their mobile device to structure, extend, and enhance their educational experience.

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<https://nitforyou.com/ev-toolbox/>

<https://studio.gometa.io/landing>

**Effectiveness of Self Assessment Practices on Achievement in Science of  
Secondary School Students**

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**Abstract**

The present study investigates the impact of integrating science teaching with self-assessment practices on the academic achievement of secondary school students. Self-assessment is a potent tool for personal growth, and among various methods, this study focuses on two practices: self-assessment Rubric and Diary. This experimental study involved a total sample of 80 students, with 40 in both the Experimental and Control groups. Appropriate tools and statistical techniques were employed for analysis. The findings revealed that the Experimental group exhibited improved achievement in Science compared to the Control group. Specifically, the use of self-assessment Rubric and Diary after each chapter enabled students to assess their own progress. This innovative approach holds promise for the future, as it aligns with the evolving nature of education. Schools of the future will not only be designed for learning but also for cultivating critical thinking skills. In conclusion, the integration of science teaching with self-assessment practices, such as the Rubric and Diary, encourages students to adopt the right thinking patterns and enhances the overall learning experience

*Key Words:* Self- Assessment Practices, Achievement, Secondary School Students

## **Introduction**

Education serves as a potent and compelling instrument for the progress of any nation. The quality of learning is defined through assessment, and any enhancements in education hinge ultimately on the quality and improvement in assessment. Similar to how physicians cannot effectively practice without good assessment, teachers require skills related to effective assessment (Nenty, 2005). Classroom assessment practices serve as a crucial link between the curriculum, instructional mechanisms, and students' learning outcomes—an essential element in the teaching-learning process. Self-assessment practices empower students to engage with learning content, develop thinking patterns, and enhance their confidence in acquired skills. According to Andrade and Valtcheva (2009), self-assessment is a process in which students collect information about their own performance, compare it to explicitly stated criteria, goals, or standards, and make revisions accordingly. Assessments identify students' weaknesses and strengths, allowing teachers to provide targeted academic support.

Assessment plays a pivotal role in education, determining students' performance. Self-assessment involves students monitoring and evaluating the quality of their learning, identifying strategies for improvement. Brown and Harris (2013) define self-assessment as a "descriptive and evaluative act carried out by the student concerning his or her own work and academic abilities." If students can assess their progress, it may serve as a motivating factor for further learning. A qualitative study explored the role of reflective diaries as a form of formative assessment in promoting self-regulated learning (Alabidi et al., 2022), elucidating the impact of reflective diaries on increasing student motivation. Building upon these findings, a new study was conducted to employ diverse self-assessment practices to

enhance students' achievements. This study facilitates the monitoring of students' academic improvement through the implementation of self-assessment rubrics and diaries. In the current study, self-assessment practices, such as Self-assessment Rubric and Diary, were employed to monitor changes in the achievement of secondary school students in science.

### **Objectives**

1. To find out the effectiveness of Self-assessment practices on Achievement in science of students at secondary level

### **Hypotheses**

1. There is no significant difference in the Achievement in science in experimental and control group students at secondary level

### **Methodology**

The present study investigated the Effectiveness of self-assessment practices : Self-assessment Rubric and Diary on achievement in science of secondary school students. The design employed for conducting the present study is pre-test quasi experimental design. For the purpose of present study, the Pre-test Post-test Non – equivalent Groups Design (specified by Best and Khan,2007) were adopted. The experimental method is one of the best methods to conduct the research.

Experimental research was applied in a classroom setting where the investigator has some degree of control over the variables involved and conditions under which the variables are observed. For that the investigator selected a control group and an experimental group, where the experimental group is taught a concept and allowed students to assess themselves with the help of self-assessment practices such as Rubrics and Diary. An achievement test was conducted to evaluate the difference in achievement

of students in both groups.

### **Sample**

Considering the nature of the study, a random sampling technique was used for the selection of schools in Ernakulam district. For the study, a sample of 40 students are taken as control group and another set of 40 students were taken as experimental group from two different classes in the same level in secondary schools

### **Tools used for the study**

The following tools were used in the present investigation:

1. Self-assessment rubric
2. Self-assessment Diary format
3. A standardized Achievement test in science for standard VIII was prepared by the researcher
4. Lesson transcripts Based on Science teaching with self-assessment rubric
5. Lesson transcript based on prevailing method of science teaching

### **Statistical Techniques employed for the study**

The statistical techniques used include ANOVA, ANCOVA and adjusted means.

### **Analysis and Discussion**

#### **Comparison of the score of Achievement of students in Experimental and Control Groups using ANOVA**

To determine the effectiveness of Self- Assessment Practices on the achievement in Science over the prevailing method, analysis of covariance (ANCOVA) was conducted to analyze pre-test and post-test scores of experimental and control groups. As a preliminary analysis, the scores were subjected to analysis of variance (ANOVA). The data and results of ANOVA are presented in table 1

**Table 1**  
**Summary of ANOVA of Pre-test and Post-test Scores of achievement in science of**  
**Experimental and Control Group students**

Source of variation	df	SSx	SSy	MSx	MSy	F-ratios
Between groups	1	8.015	1080.136	8.015	1080.136	$F_x = 6.505$
Within groups	78	78.848	232.484	1.232	3.632	$F_y = 297.347$
Total	79	86.863	1312.621			

The critical value of F (df = 1/78) is 4.00 at .05 level and 7.08 at .01 level. The calculated value of  $F_x$  is 6.505. The calculated value is greater than the critical value (4.00) at .05 level of significance. From this we can understand that there is significant difference between the pre-test scores of the experimental and control group. The value obtained for  $F_y$  is 297.347. It is higher than the table value (7.08) at .01 level. Thus, it can be stated that there is significant difference between the post-test scores of the experimental and control group.

The summary obtained for ANCOVA of pretest and post-test scores of experimental and control group students are given below in table 2

**Table 2**

**Summary of ANCOVA of Pre-test and Post-test Scores of achievement in science of  
Experimental and Control Group students**

Source of variation	df	SSx	SSy	SSxy	SSy-x	MSy-x	SD yx
Between	1	8.015	1080.136	93.045	937.709	937.709	
Within	77	78.848	232.484	20.181	227.319	3.608	1.899
Total	78	86.863	1312.621	113.227	1165.029		

$$F_{yx} = \frac{MS_{x(\text{between})}}{MS_{(\text{within})}} = 259.88$$

From table, for  $df = 1/77$ , critical value of F at .01 level = 7.08. The calculated value of  $F_{yx}$  is 259.88. It is higher than the critical value (7.08) and is significant at 0.01 level. From the  $F_{yx}$  ratio we can understand that there is significant difference in the pre-test and post-test scores of both groups. The adjusted means of post-test scores (Y means) were computed, their difference between the adjusted Y means was tested for finding the significance. The details are given in table 3

**Table 3**

*Data and Test result of the Significance of Difference between Adjusted Means of Post test Scores*

Groups	N	M <sub>x</sub>	M <sub>y</sub>	M <sub>y-x</sub> (Adjusted)	SE <sub>D</sub>	t
Control	40	7.43	13.05	13.786		
Experimental	40	8.80	15.75	15.78	0.424	18.628

The critical value of t is 2.66 at .01 level of significance. The calculated t value is 18.628. Since it exceeds the critical value, it is significant at 0.01 level. The significant difference in adjusted Y means shows that the experimental and control groups differ significantly in the achievement in post-test. Thus, the adjusted mean of the experimental group (15.78) is greater than the adjusted means of control group (13.05). By the use of self-assessment practices, students came to be capable of understanding their mistakes. They started thinking about their role in learning. By the regular practice of self-assessment Rubric after each class and writing a Diary as their reflection about the class according to the given criteria, students developed their thinking skills. This helped in developing the metacognition of students and their interest in science. Thus we can arise at the conclusion that Self- Assessment

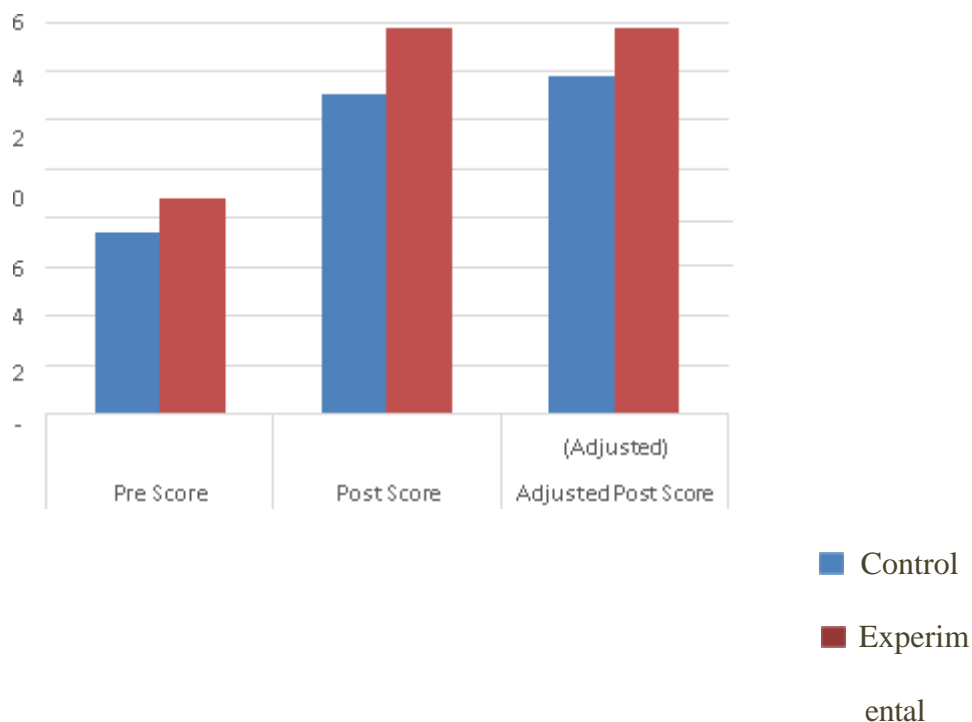
Practices are more effective than the prevailing method in enhancing the achievement in Science of students in secondary level. From the above findings it can be



stated that the teaching learning process along with the Self-Assessment Practices are more effective than the prevailing method for increasing the achievement in Science among students in secondary level.

**Figure 1**

***Graphical representation showing the effectiveness of Self-Assessment Practices on Achievement in Science of secondary school students***



The figure above illustrates that the pre-test mean scores of the experimental and control groups are comparable. However, the adjusted mean score of the experimental group surpasses that of the control group, indicating that the experimental group achieved higher scores in science. Consequently, it can be concluded that teaching science blended with self-assessment practices is effective in enhancing the achievement in science for secondary-level students .

The graph provides evidence that students exposed to self-assessment practices exhibited significant improvement in science achievement compared to the control group,

which followed the conventional transactional method. This improvement may be attributed to the efficacy of selected self-assessment practices, such as self-assessment rubric and diary, which contributed to strengthening learning and establishing a holistic conceptual framework. This framework serves as an intellectual initiation for students to take control of their own learning

### **Educational implications**

From the study, it was found that teaching science with Self-Assessment practices is more effective over the prevailing method for better achievement in science by the students at secondary level. The study highlights the effectiveness of self-assessment practices as a crucial step in enhancing achievement in science, suggesting its potential application in other subjects such as Social Science, Arts, Mathematics, and English. Student engagement in self-assessment not only improves their learning but also enhances metacognition .

Furthermore, the study indicates that self-assessment practices offer students opportunities for reflection on learning and performance, enabling them to monitor their progress and providing motivation for academic success. Rubric-referenced self-assessment positively influenced students' learning strategies and attitudes in this study. Additionally, the impact of reflective diaries on students' cognition, metacognition, and increased motivation is evident. Consequently, students in the experimental group achieved higher marks than their counterparts in the control group, underscoring the effectiveness of self-assessment practices compared to the prevailing method .

Hence, teachers should encourage the use of Self- Assessment practices while teaching the subject. Teachers shall design their teaching learning endeavor blending Self-Assessment practices. This method of science teaching blended with Self-Assessment

practices should be incorporated in the curriculum of pre-service teachers training programme. In-service teacher training should be provided at secondary level based on this method of teaching. The implications of the study are not confined only to the students. The teacher and the educational system also benefit from the study.

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