Attitude of Secondary School Students towards Mobile-based Learning Applications in Terms of Usability and Effectiveness

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Abstract: *The advancement in information and communication technologies has broadened the scope of mobile technologies. Mobile technology has integrated into the education sector and has taken teaching- learning beyond the classroom walls to anytime anywhere learning through mobile devices. Recently, a number of mobile-based learning applications have come into the market to provide a virtual learning experience to children. The effectiveness and usability of mobile-based learning applications have led to their increasing use in the arena of education. The purpose of the present paper is to find out the attitude of secondary school students toward the usability and effectiveness of mobile-based learning applications. The study also analyzed the opinion of secondary school students in regard to the different attributes of usability and effectiveness of mobile-based learning applications. The sample of the study comprised 300 secondary school students from two schools in the Patna district. The present study revealed that secondary school students show a positive attitude toward the usability and effectiveness of mobile-based learning applications. The study also brought to light that the attitude of secondary school students does not differ due to gender.*

Keywords: *Attitude, Mobile-based Learning Applications, Usability, and Effectiveness.*

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Introduction:

Technology has catalyzed the education system across the globe. It has completely reshaped the entire education system, with digitally empowered classrooms, and has made education available to everyone. Technology has pervaded all spheres of education, bringing with it bundles of perks such as online classrooms, personalized learning applications, gamification, and the use of multimedia resources to study. As a consequence, now education is not limited to classroom learning or traditional learning.

At present, information and communication technology is increasingly being utilized as a teaching and learning tool in educational activities (Matimbwa and Anney, 2016). Recently, the COVID-19 pandemic gave us the opportunity to lay the groundwork for digital learning, one of which is a Mobile-based learning application.

According to Park (2011), mobile learning refers to the use of various wireless devices or

mobile devices for the purpose of learning while on the move. Quinn (2000), in simple words, defines mobile learning as e-learning that is performed through mobile devices. Mobile-based educational applications allow learners to access learning materials across multiple devices, especially on smartphones. Sharples (2000), points out that mobile learning devices permit learners to learn wherever they are located and in their personal setting so that the learning is meaningful.

Due to the presence of mobile learning applications, students have options to learn even when out of the classroom. Even in India, a revolutionary change can be seen in the mobile-based applications to make learning easy and provide the best virtual knowledge. While there are many apps available today, listing down some prominent education apps developed in India that with their unique characteristic, make an impact in the education sector. Popular mobile- based learning educational apps in India are Byju's, Khan Academy, Toppr, Vedantu, myCBSEGuide, LearnNext, Unacademy, Meritnation, Physics Wallah, Top Rankers, etc.

Mobile learning applications facilitate and enhance the learning process. The digital format allows access to education whenever it's necessary. There are several possible reasons for the efficient use of mobile phones in learning, including the device's ability to improve learning due to their intrinsic characteristics, such as portability and ubiquity, the functional communication they provide, and their ease of use.

The effectiveness and usability of mobile-based learning applications have led to their increasing use in the education sector. These advantages have helped in changing the attitude of parents and students toward educational applications. Attitudes of students are also influenced by personal opinions, life experiences, and they are shaped by means of education and acquire a different dimension (Hacieminoglu, 2015, p.36). It is important to stress that with the usability and effectiveness of mobile-based learning environments, students' attitude change toward mobile-based learning applications.

The review of the literature reveals that much research has been conducted on mobile-based learning applications at the national and international levels, but there is a dearth of research at the local level. As no such study has been conducted in the local context, thus in light of all these facts and views, the present study was taken under the formal title**, "Attitude of Secondary School Students towards Mobile-based Learning Applications in Terms of Usability and Effectiveness".**

Research Questions:

The questions that arouse in the mind of the investigators while reviewing the literature in the context of the present scenario were as follows:

- What is the attitude of secondary school students towards mobile-based learning applications?
- What is the attitude of secondary school students toward mobile-based learning applications in terms of their effectiveness?
- What is the attitude of secondary school students toward mobile-learning applications in terms of usability?

Objectives:

The following objectives were proposed for achievement in this study:

1. To find out the attitude of secondary school students towards mobile-based learning applications.
2. To find out the attitude of secondary school students towards mobile-based learning applications in terms of usability.
3. To find out the attitude of secondary schools towards mobile-based learning applications students in terms of effectiveness.

Null Hypotheses:

The following hypotheses were framed for statistical testing:

H01- There is no difference in the attitude of boys and girls of secondary schools toward mobile-based learning applications.

H02- There is no difference in the attitude of boys and girls of secondary schools in terms of the usability of mobile-based learning applications.

H03- There is no difference in the attitude of boys and girls of secondary schools towards

mobile-based learning applications in terms of their effectiveness.

Meaning of the terms used in the Study

The study took into account three important terms-Mobile-based Learning Application, Usability of Mobile-based Learning Applications, and Effectiveness of Mobile-based Learning Applications.

1. **Mobile-based Learning Applications:** Mobile learning is defined as ubiquitous learning that takes place through the use of mobile devices such as smartphones, tablets, or tablet computers. These devices provide opportunities to students to learn anytime and anywhere by connecting to and interacting with content on mobile devices.

2. **Effectiveness of Mobile-based Learning Applications:** Effectiveness is the capability of producing the desired result or the ability to produce the desired output. It is the accuracy and completeness with which users achieve goals. There are several probable reasons for the effective use of mobile phones in learning, including the device's ability to improve learning due to their basic characteristics, such as movability and ubiquity, the functional communication they provide, and their ease of use. The different attributes of the effectiveness of mobile-based learning applications are as follows:

Visual Impact: Visuals attract children more than plain text. The visuals include those sensory objects or images which stimulate and support learning. They make the learning experience more real, more accurate, and more active. The children grasp things more by listening to them or seeing their visual representation than by reading them.

Clarity of Concepts: Mobile-based learning applications primarily use graphics, video, animation effects, and sounds for better clarity of the concepts. The explanation of the concepts through illustrations, graphics, animations, and 3-dimensional depictions of the images helps the student understand the topic.

Better Performance: Mobile technology now comes with a number of features that can be utilized to promote performance through contextual learning.

Self-Pace: The special feature of mobile learning is that it enables the learners to access information independently of time and space through mobile devices and to manage their own learning processes based on their individual differences and needs.

Quick Access to Information: Although there are physical libraries everywhere, smartphones became the main resource for accessing any kind of information with just one click.

Diverse Ways of Learning: The mobile-based learning applications have numerous fun games that indulge the students in a healthy thought process and help them understand things from a different perspective. The use of 3-dimensional videos and images also helps in the explanation of abstract concepts. The teachers take regular tests, organize discussions on different topics and provide regular feedback to the learners.

Feedback: The mobile-based learning applications provide instant feedback to the learners of the tests and games to motivate and encourage them in learning activities. By giving badges and rewards to the students these mobile applications motivate the learners and create a positive attitude toward education.

Drill and Practice: The mobile-based learning applications have the provision for systematic repetition of concepts, examples, and practice problems for drill and practice of the concepts. The regular tests, games, and problems provide opportunities to

learners to practice critical skills and knowledge sets.

Remediation: The mobile-based learning applications provide instant results of quizzes, and tests. The results are tallied and mistakes are addressed so that learners have the opportunity to instantly correct knowledge gaps.

Long-term Retention of Concepts: In order to enable students to grasp a concept better, teachers use technology to transform texts into visuals, graphs, flowcharts, and animated films. It is proven that images help us remember information more effectively than words.

Better Engagement of Students in the Learning Process: The mobile-based learning applications include various strategies like question-and-answer sessions, discussions, video lectures, interactive sessions, writing assignments, hands-on activities, and gaming. All these strategies keep the students involved and engaged in the learning process.

3. **Usability of Mobile-based Learning Applications:** Usability is the ease of use and suitability of a system for a specific class of users carrying out specific tasks in a particular environment. Usability is a quality attribute that assesses how useful and easy the product is for the people who interact with it. Usability defines how easily the children can complete certain tasks, how fast their performance is, and how many mistakes they make during the process.
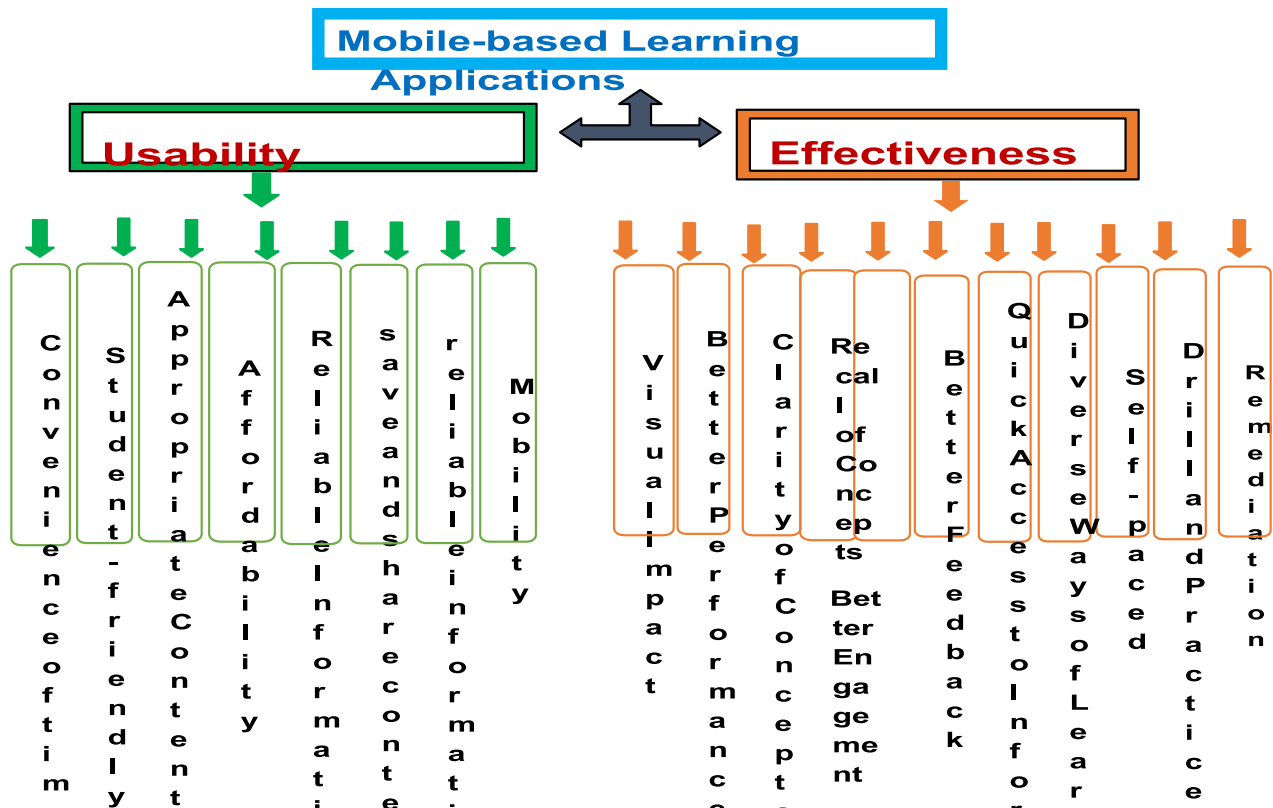

Fig. 1. Showing the different attributes of Mobile-based Learning Applications

The usability dimensions of mobile-based applications have different attributes which are as follows:

● **Student-friendly Features:** The reason for the increasing popularity of mobile learning by young minds is that the

applications are designed in such a way that even very young users can use them easily. The features of mobile learning applications are simplified so that even small children can use them with ease.

- **Appropriate Content Coverage:** The different learning applications follow the course content of these boards so that the learners find the material of each concept explicitly. The content is arranged grade-wise for the convenience of the learners.

- **Convenience of Time:** The best attribute of the usability of mobile learning applications is that the students can clear their queries and get their study materials from anywhere at any time. These apps are always available for students without having any time schedule.

- **Reliable Information:** A lot of content is present online and due to its huge variety, it becomes very easy for children to access it. The content is prepared by subject experts after a lot of research.

- **Save and Share Content:** Among the several notable features of mobile learning, one feature that supports convenience for learners is the instant sharing and transferring of learning content. The learners can share and save some of the contents for later use.

- **Affordability:** There has been a remarkable increase in the use of mobile-based learning applications among the learners after COVID. In response to high demand, many online learning platforms, like Byju's, Vedantu, Unacademy, etc. are providing free access to their students.

- **Mobility:** Mobile technologies are not just a means of communication anymore, but they provide easy access to unlimited information at any time and place in the field of education with the applications developed.

- **Creating interest:** The embedded visual and audio elements in the learning application have proved to be very helpful in promoting engagement, motivation, and learning among students. The games also attract the students and retain their interest in the topic.

Thus, when designing a user interface for mobile phones, especially for educational purposes, the user requirements of these devices should be considered.

Research Method:

Setting of the Study: The study was carried out on secondary school students of two schools of C.B.S.E board-Loyola High School, Kurji, Patna, and B.D. Public School, Buddha Colony, Patna.

Design of the Study: Simple descriptive survey method was employed to study and compare the variables of the study. The descriptive survey method refers to the methods that describe the characteristics of the variables under study. A survey method was undertaken in this study, data was collected and analyzed.

Variable of the Study: This study brought to light and described the relationship between the psychological variable -'Attitude' towards mobile-based learning applications and variables like usability and effectiveness of mobile-based learning applications.

Population and Sample:

A sample of 300 secondary school students was selected by stratified sampling technique. These students were selected from Loyola High School and B. D Public High School. 149 students were selected from Loyola High School and 151 students were selected from B. D Public School.

Sample Selection: An incidental (accidental) sampling technique was adopted to select the sample from the population.

Sample Size: 149 students were selected from Loyola High School and 151 students were selected from B. D Public School.

BREAK UP OF SAMPLE:

Table1. Breakup of the Sample

Sl. No.	Name of the school	Classes	No. of boys and girls	
			Girls	**Boys**

1.	Loyola High School	IX	52	44
		X	17	36
2.	B.D. Public School	IX	29	45
		X	35	42
		Total	133	167

Tool of the Study:

Under the guidance and supervision of their supervisor, the researchers prepared a questionnaire for finding the attitude of secondary school students toward the effectiveness and usability of mobile-based learning applications

Description:

For the collection of relevant data, a questionnaire was constructed and standardized by the supervisors of the study. The questionnaire consisted of two parts, viz., 'Part A' for extracting the personal details about the sample, and 'Part B' was the attitude scale for determining the attitude of secondary school students in terms of usability and effectiveness of mobile-based learning applications. The attitude scale comprised 22 item/statements. The statements were based on the attribute of usability and effectiveness of mobile-based learning applications.

Reliability:

The reliability of the questionnaire was found by the split-half method. The reliability coefficient of the half test was found to be 0.46 and the reliability coefficient of the whole test was found to be 0.66, using the Spearman-Brown Prophecy formula. The reliability coefficients of 0.66 were significant at 0.1 levels which shows that the reliability of the questionnaire was high and the tools were sufficiently reliable.

Validity:

The content validity of the test was established by the constructors with the help of various experts' opinions and suggestions. The items were thoroughly evaluated and criticized by the experts.

Scoring:

Scoring of the questionnaire was based on 5 point scale which possesses the quantitative values for students as-

- For Positive statements: Strongly agree-5, Agree-4, Cannot say-3, Disagree-2, Strongly disagree-1
- For Negative statements: Strongly agree-1, Agree-2, Cannot say-3, Disagree-4, Strongly disagree-5

Based on these scales the total score was converted to z scores and five categories were determined.

Table 2. Classification of Attitude towards Mobile-based Learning Applications in Terms of Usability and Effectiveness

Sl. No.	Description	Range of raw scores	Range of z scores
1.	Very Positive Attitude	97 and above	+1.8 and above
2.	Positive Attitude	84 - 97	+0.6 - +1.8
3.	Indifferent Attitude	71 - 84	-0.6 - +0.6
4.	Negative Attitude	59 - 71	-0.6 - -1.8
5.	Very Negative Attitude	59 and below	-1.8 and below

Administration of the Questionnaire:

The copies of the questionnaire were administered to the students of two different schools of the CBSE board located in Patna.

Difficulties in Data Collection:

The task of data collection was tedious. The investigators had to approach the authorities several times to get the questionnaire duly filled in. However, they were kind enough to spare time for the investigators to conduct the survey in spite of their busy schedules.

Description of Data and Statistical Technique Used:

The data obtained after the administration of the questionnaire was studied to process the data and choose appropriate statistics for analysis.

Statistical Techniques Used:

The following statistical techniques were used for the analysis of the data:

1. The raw scores obtained on the attitude scale by the secondary students were tabulated separately and descriptive statistics comprising measures of central tendency like mean, median, mode, and measures of variability like standard deviation were calculated.

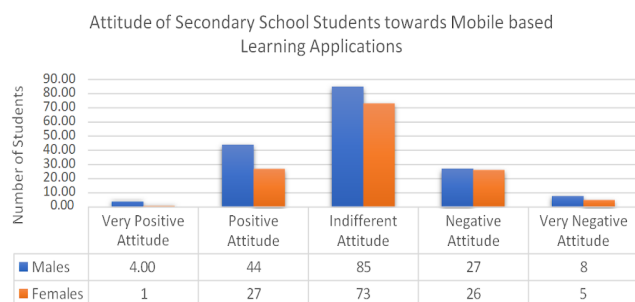Percentages were also found wherever required.

2. T-test (t-ratio) was applied to find out the significant difference between the mean attitudes scores of boys and girls.

3. Statistical Package SPSS 29.0 version and Microsoft Excel were used to analyze the data.

4. Though an incidental sampling technique was used to draw the needed sample, yet parametric statistics like a t-test were selected for analysis.

Analysis and Interpretation:

Analysis Related to the First Objective

The first objective of the study was **to find out the attitude of secondary school students toward mobile-based learning applications.**

For this purpose, a questionnaire was administered to the secondary students. Section B of the questionnaire contained 22 statements/items which were used to find out the attitude of secondary students towards mobile-based learning applications. The sample of 300 students comprised 168 boys and 132 girls. The result obtained on analysing the z score of the responses for determining the attitude of secondary school students toward mobile-based learning applications has been shown in Fig. 1:

Attitude of Secondary School Students towards Mobile based Learning Applications

	Very Positive Attitude	Positive Attitude	Indifferent Attitude	Negative Attitude	Very Negative Attitude
Males	4.00	44	85	27	8
Females	1	27	73	26	5

Fig. 2. Showing the Attitude of Secondary School Students towards Mobile-based Learning Applications

From the graph, it is clear that the maximum percentage 52.7% is of those secondary students who are neutral, which means that they are not able to give their views regarding mobile-based learning applications. 23.7% are those students who show a positive attitude and 17.7%are those who show a negative attitude with this application.

Whereas 4.3%show a highly negative attitude and the minimum percentage of 1.7% of them show a highly positive attitude with this application.

Although maximum secondary students show a neutral attitude towards mobile-based learning applications, still it is clear from the graph that the percentage of secondary students having a positive attitude is more than the students with a negative attitude. Thus in regard to the first objective, we can say that secondary students showed a positive attitude toward mobile-based learning applications. To find out the difference in the attitude of boys and girls in secondary schools toward mobile-based learning applications, a null hypothesis was framed for statistical testing as mentioned below:

H01-There is no difference in the attitude of boys and girls of secondary schools toward mobile- based learning applications.

In order to statistically test the above null hypothesis t-test was performed. The result is as given in Table 2.

Table 3. t-test to observe the difference between attitudes of male and female secondary school students toward mobile-based learning applications:

Specification	N	Mean	Standard Deviation	t-value	df	Signi-ficance
Attitude of Boys	168	77.78	11.832	**0.230**	297.98	0.05
Attitude of Girls	132	77.50	9.229			

Table 3 confirms that there is no significant difference in the attitude of boys and girls in secondary schools toward mobile-based learning applications at 0.05 level. Thus, the null hypothesis stands accepted.

Analysis Related to the Second Objective

The second objective of the study was **to find out the attitude of secondary school students toward mobile-based learning applications in terms of usability.**

For this purpose, Section B of the questionnaire which was administered to secondary school students contained 8 statements/items for finding out the attitude of secondary students towards mobile-based learning applications in terms of usability. The

sample of 300 students comprised 168 boys and 132 girls. The result obtained on analyzing the z score of the responses for determining the attitude of secondary school students toward mobile-based learning applications in terms of usability has been shown in Fig. 3.
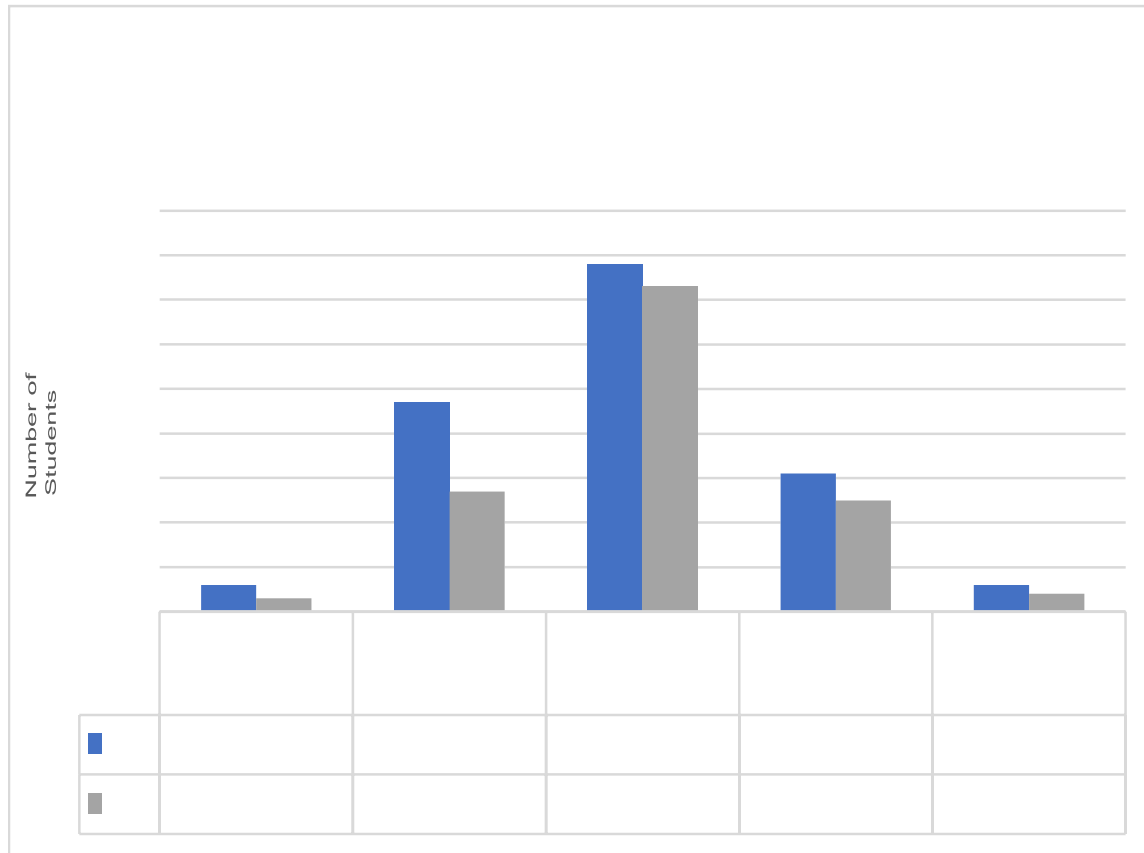
Fig. 3. Showing the Attitude of Secondary School Students towards Mobile-based Learning Applications in Terms of Usability

From the graph, it is visible that the maximum percentage of 50.33% is of those secondary students who are neutral, which means that they are not able to give their views regarding the usability of mobile-based learning applications. 24.67% are those students who show a positive attitude and 18.6% are those who show a negative attitude toward this application. Whereas 3.33% show a highly negative attitude and the minimum percentage of 3% of them show a highly positive attitude with this application.

Although maximum secondary students show a neutral attitude towards mobile-based learning applications, still it is clear from the graph that the percentage of secondary students having a positive attitude is more than the students with a negative attitude. Thus in regard to the second objective, we can say that secondary students showed a positive attitude towards mobile-based learning applications in terms of usability. To find out the difference in the attitude of boys and girls of secondary schools toward mobile-based learning applications in terms of usability, a null hypothesis was framed for statistical testing as mentioned below:

The null hypothesis was framed for statistical testing which is given below:

H02-There is no difference in the attitude of boys and girls of secondary schools in terms of the usability of mobile-based learning applications.

In order to statistically test the above null hypothesis t-test was performed. The results are as given below:

Table 4: t-test to observe the difference between attitudes of male and female secondary school students toward mobile-based learning applications in terms of usability.

Specification	N	Mean	Standard Deviation	t-value	df	Significance

Attitude of Boys	168	27.80	4.352	0.577	284.187	0.05
Attitude of Girls	132	27.52	4.256			

Table 4 confirms that there is no significant difference in the attitude of boys and girls of secondary schools toward mobile-based learning applications in terms of usability at 0.05 level. Thus, the null hypothesis stands accepted.
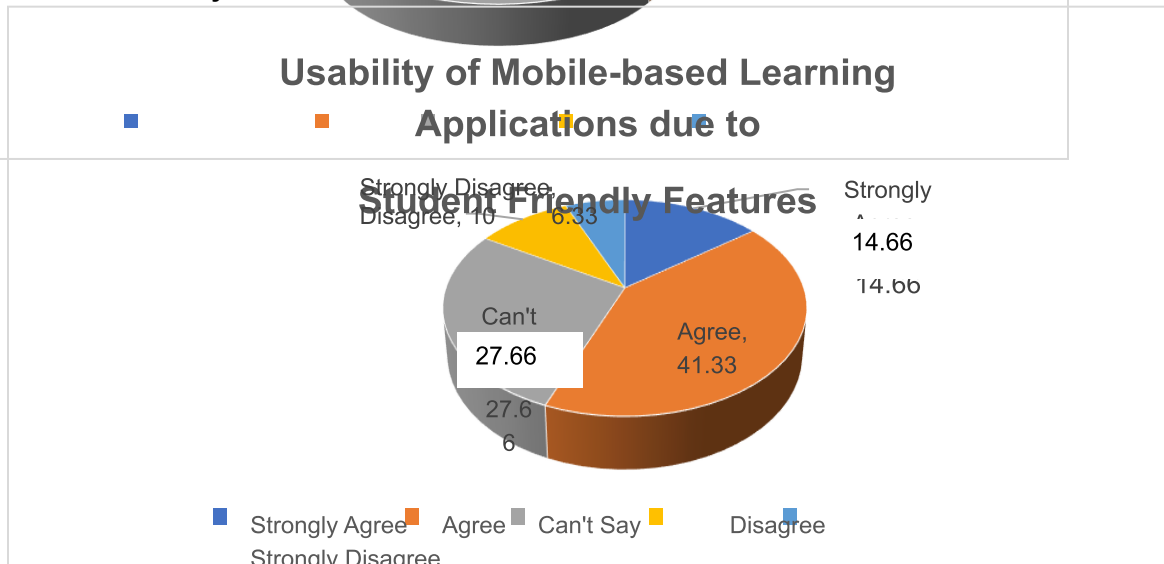
The usability of mobile-based learning applications has many dimensions. Analysis was also done on the views of secondary school students on the usability attribute of mobile-based learning applications.

1. Convenience of Time

Fig. 4. Percentage of Secondary School Students Who Agree that the Usability of Mobile-based Learning Applications is due to Convenience of Time

It is evident from the above fig. 33.33% of secondary school stu... anything about the use of mobil... applications in context to the con...

25.33% of them agree with this statement. 20% of students disagree with the statement. 10.66% students strongly agree and also strongly ... e with the statement.

2. Student-friendly Features

Usability of Mobile-based Learning Applications due to Student Friendly Features

Strongly Disagree, Disagree, 10   6.33

Strongly 14.66
14.66

Can't 27.66

Agree, 41.33

27.66

Strongly Agree   Agree   Can't Say   Disagree
Strongly Disagree

Fig. 5. Percentage of Secondary School Students Who Agree that Usability of Mobile- based Learning Applications is due to Students – friendly features

The above pie chart shows 41.33% of secondary school students agree that usability is due to student friendly features. 27.66% of them

can't say anything about student-friendly features. 14.66% of them strongly agree with the statement. 10% of them disagree and 6.33% of them strongly disagree with the statement.

3. Appropriate Content Coverage

Fig. 6. Percentage of Secondary School Students Who Agree that the Usability of Mobile-based Learning Applications is due to appropriate content coverage

From the above figure, it is evident that 43% of secondary school students agree that usability is due to appropriate content coverage. 29% of them strongly agree with this fact. 12% of them can't say anything about content coverage. 9% of them disagree and 7% of them strongly disagree with this fact.
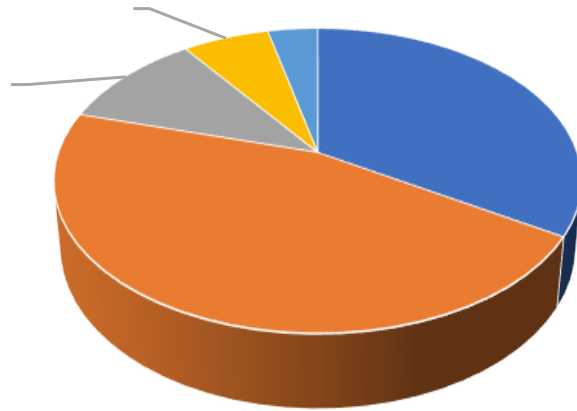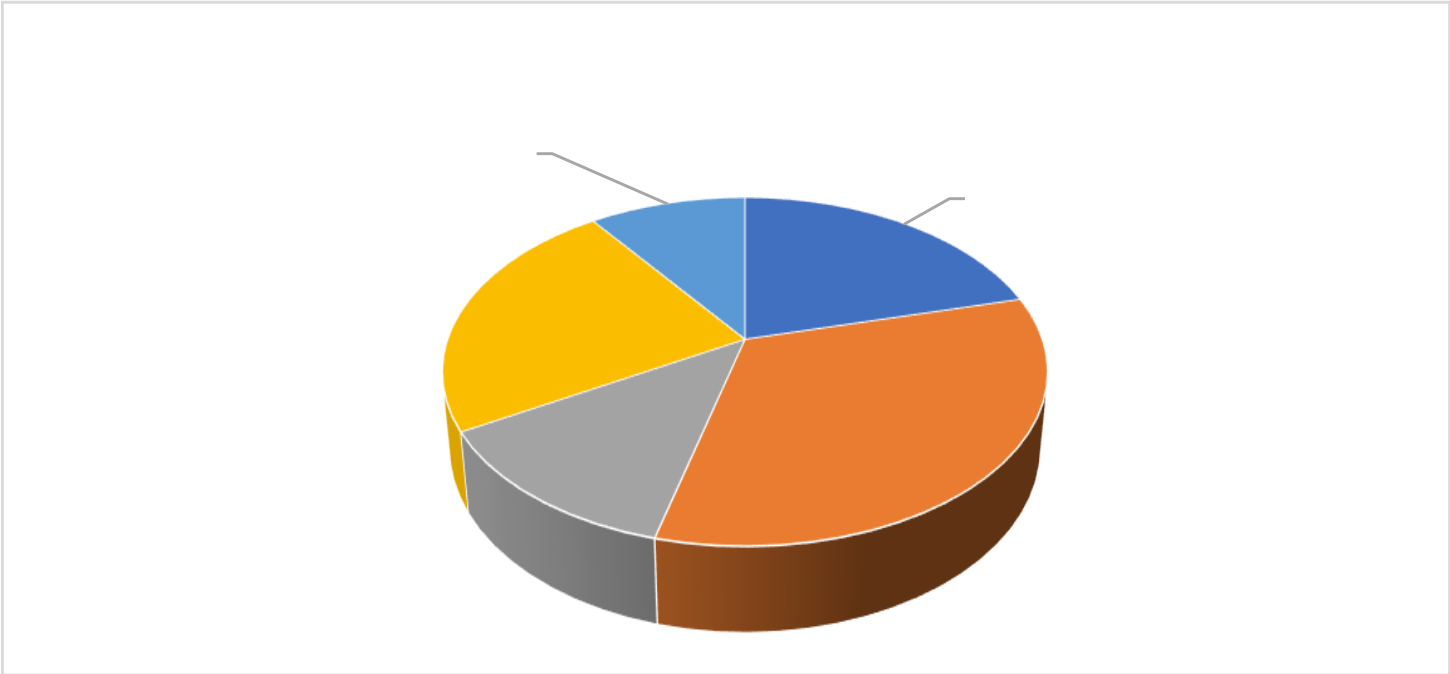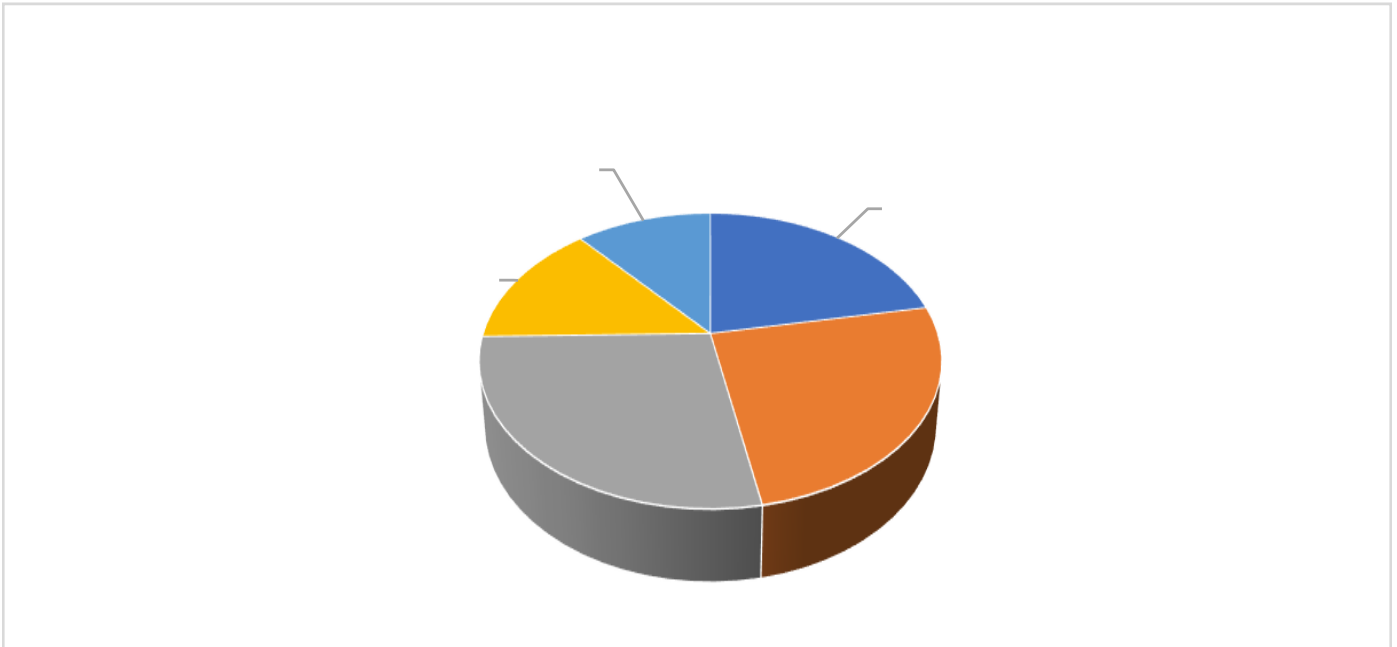
4. Reliable information
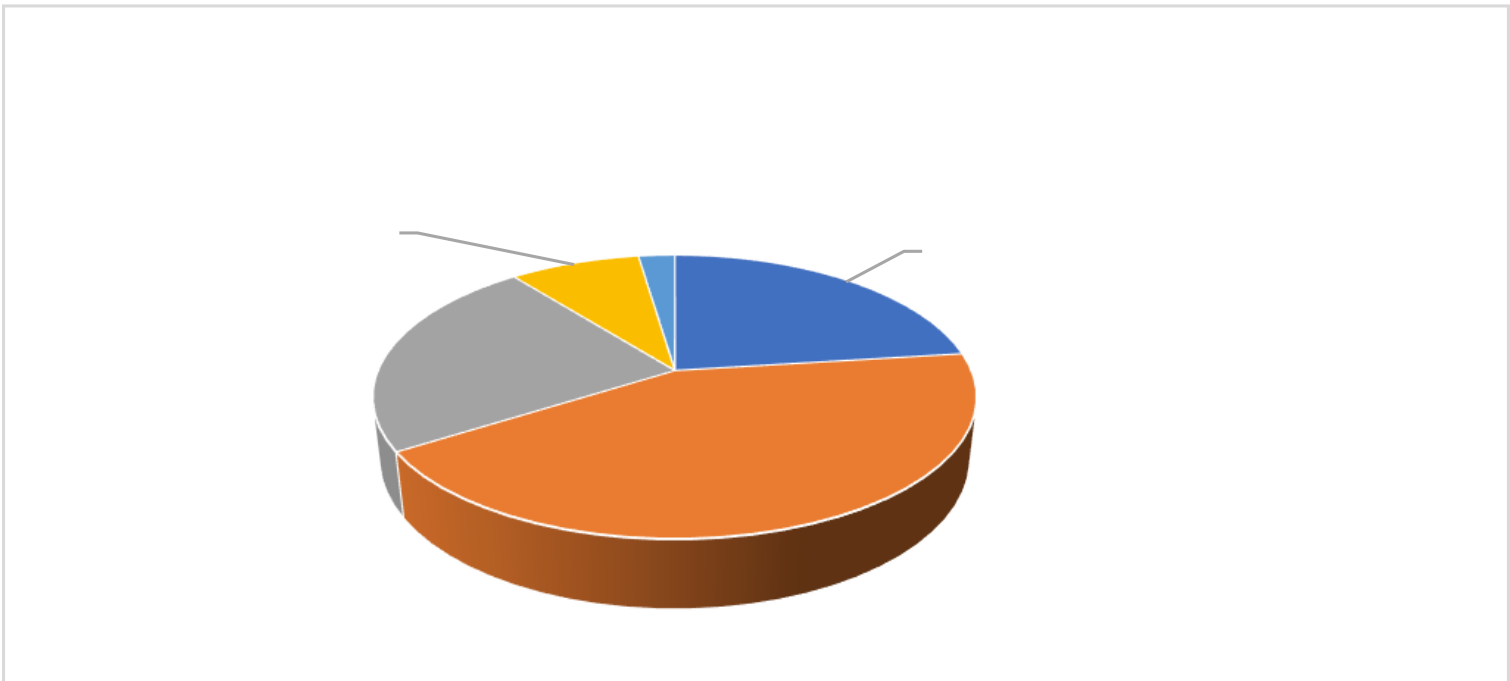
Fig. 7. Percentage of Secondary School Students Who Agree that the Usability of Mobile-based Learning Applications is due to Reliable information

It is evident from the above figure that 43% of secondary school students agree that usability is due to reliable information. 23% of them strongly agree and also can't say anything about the information provided by this statement. 8% of them disagree while 2% of them strongly disagree with the statement.

5. Save and Share Content

Fig. 8. Percentage of Secondary School Students Who Agree that the Usability of Mobile-based

Learning Applications is due to Save and Sharing Content.

The above pie chart shows 46% of secondary school students agree that usability is due to sharing and saving of content. 34% of them strongly disagree. 11% of them can't say anything about this fact. 6% of them disagree and 3% of them strongly disagree with this fact.

6.   Affordability
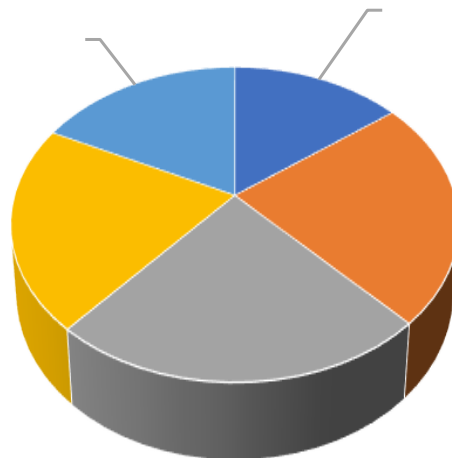
Fig. 9. Percentage of Secondary School Students Who Agree that the Usability of Mobile-based Learning Applications is due to Affordability

From the above figure, it is evident that 23% of secondary school students agree and also can't say anything about the affordability of mobile-based learning applications. 21% of them disagree with the statement. 18% of them strongly disagree while 15% of them strongly agree with the statement.

7. Mobility

Fig. 10. Percentage of Secondary School Students Who Agree that Usability of Mobile-based Learning Applications is due to Mobility

The above pie chart shows 33% of secondary school students agree that usability of mobile-based learning applications is due to mobility. 23% of them disagree. 21% of them strongly agree with the fact. 13% of them can't say anything about mobility while 10% of them strongly disagree with the fact.

8. Creating interest

Fig. 11. Percentage of Secondary School Students Who Agree that the Usability of Mobile-based Learning Applications is due to Creating Interest

It is evident from the above figure that 28% of secondary school students can't say anything related to creating interest among them. 25% of them agree with the statement. 22% of them strongly agree with the statement. 14% of them disagree while 11% of them strongly disagree with

the statement.

Analysis related to the third Objective

The third objective of the study was **to find out the attitude of secondary school students toward mobile-based learning applications in terms of effectiveness.**

For this purpose, a questionnaire was administered to the secondary students. Section B of the questionnaire contained 11 statements/items which were used to find out the attitude of secondary students toward the effectiveness of mobile-based learning applications. The sample of 300 students comprised 168 boys and 132 girls. The result obtained on analyzing the z score of the responses for determining the attitude of secondary school students towards mobile- based learning applications has been shown in Fig. 12.
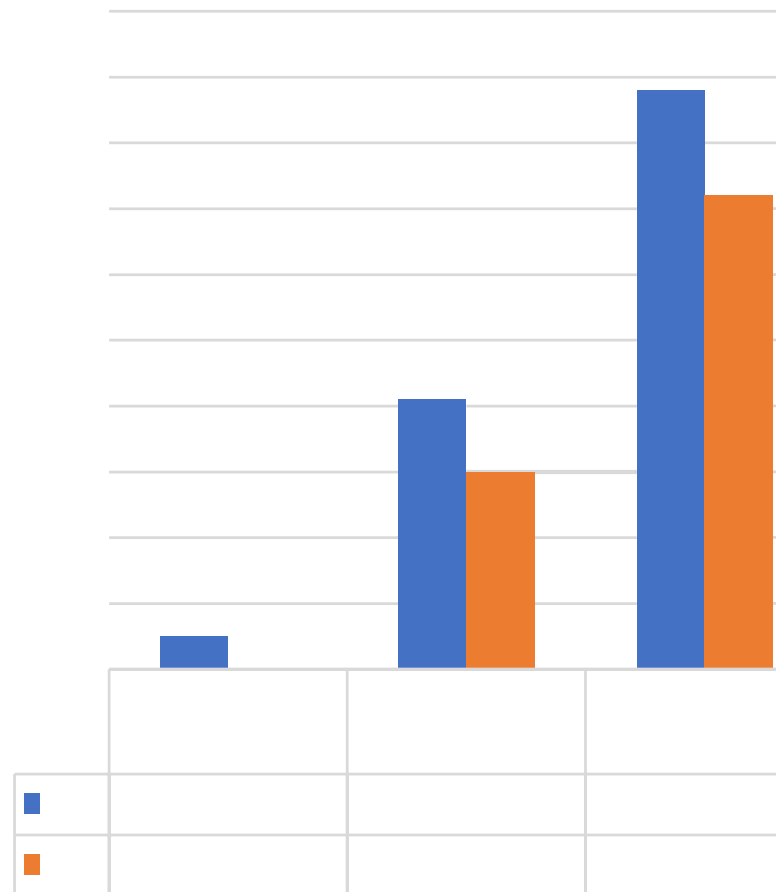
Fig. 12. Attitude of Secondary School Students towards Effectiveness of Mobile-based Learning Applications

It can be inferred from the graph, that the maximum percentage 53.33% is of those secondary students who are neutral, which means that they are not able to give their views regarding the effectiveness of mobile-based learning applications. 23.67% are those students who show a positive attitude and 17.33% are those who show a negative attitude with this application. Whereas 4% show a highly negative attitude and the minimum percentage of 1.67% of them show a highly positive attitude with this application.

It is clear from the graph that, although maximum secondary students show a neutral attitude towards mobile-based learning applications, still the percentage of secondary

students having positive attitudes is more than the students with a negative attitude. Thus, in regard to the third objective, we can say that secondary students showed a positive attitude toward the effectiveness of mobile-based learning applications. To find out the difference in the attitude of boys and girls of secondary schools toward mobile-based learning applications in terms of effectiveness, a null hypothesis was framed for statistical testing as mentioned below:

The null hypothesis was framed for statistical testing which is given below:

H03-There is no difference in the attitude of boys and girls of secondary schools towards mobile-based learning applications in terms of their effectiveness.

In order to statistically test the above null hypothesis t-test was performed. The results are as given below:

Table 5. t-test to observe the difference between attitudes of male and female secondary school students toward mobile-based learning applications in terms of effectiveness

Specification	N	Mean	Standard Deviation	t-value	df	Significance
Attitude of Boys	168	41.58	7.084	**0.643**	294.812	0.05
Attitude of Girls	132	41.09	6.170			

Table 5 confirms that there is no significant difference in the attitude of boys and girls of secondary schools toward mobile-based learning applications in terms of effectiveness at 0.05 level. Thus, the null hypothesis stands accepted.

The effectiveness of mobile-based learning applications has many dimensions. Analysis was also done on the views of secondary school students on the effective dimension of mobile-based learning applications.
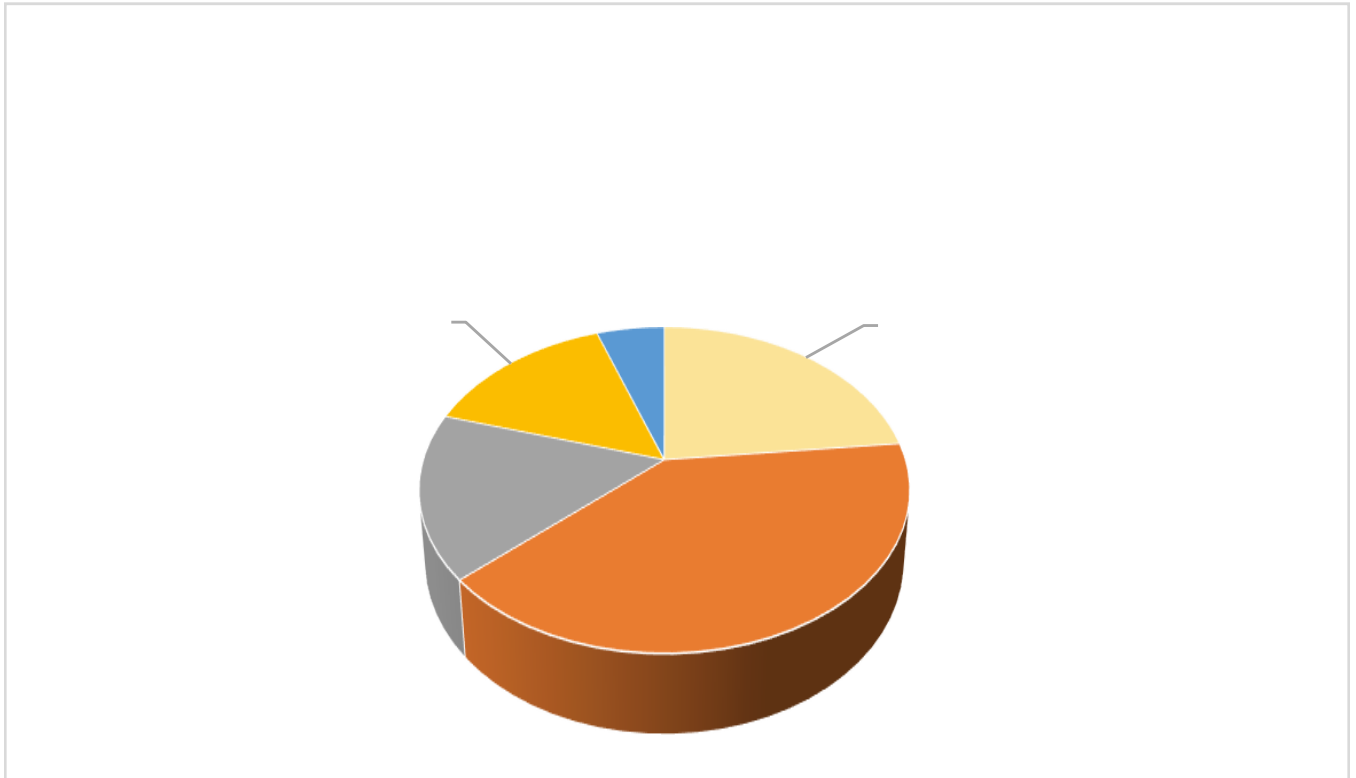
1. **Visual Impact**
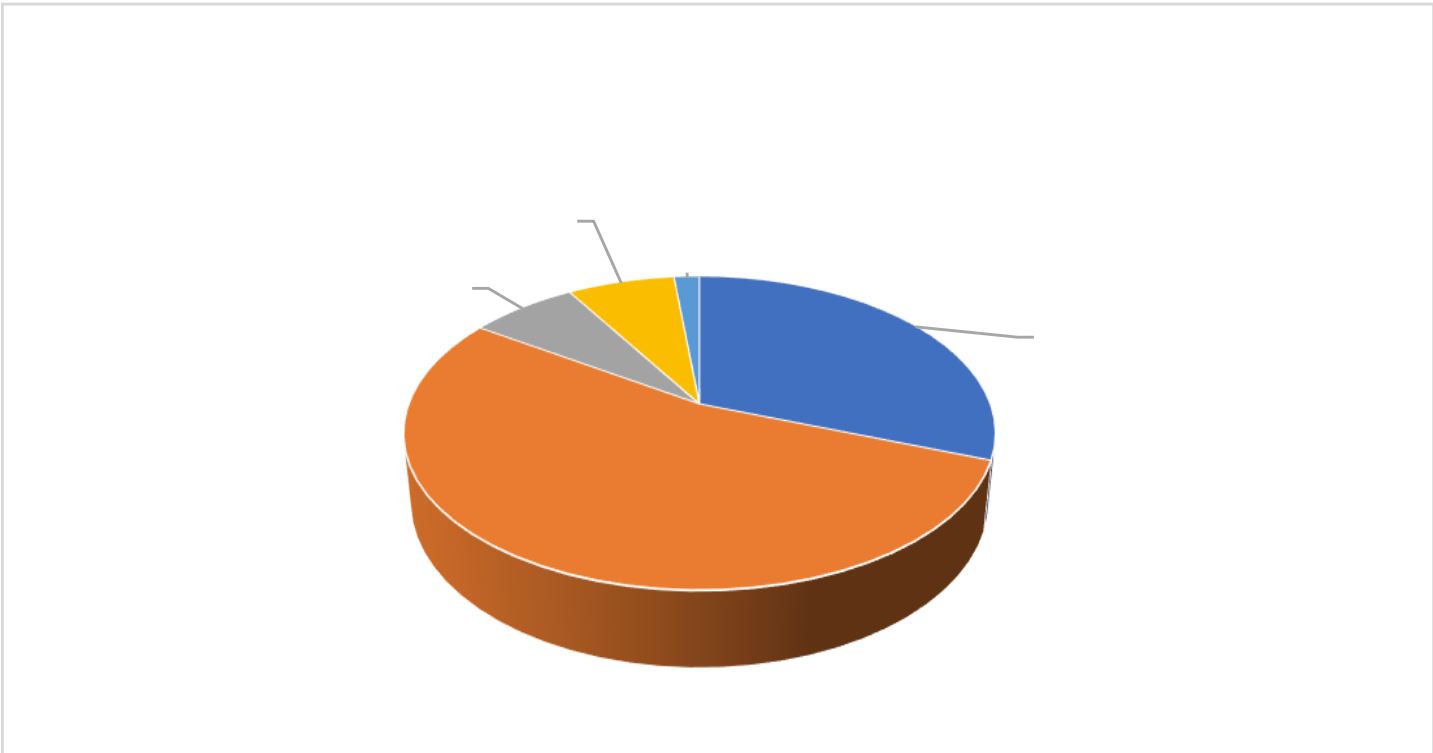
Fig. 13. Percentage of Secondary School Students Who Agree that Effectiveness of Mobile-based Learning Applications is due to Visual Impact

The above pie chart shows 54% of the secondary school students agree that effectiveness is due to visual impact. 31% of them strongly agree with the fact. 7% of them disagree and also can't say anything about visual impact. 1% of them strongly disagree with the fact.
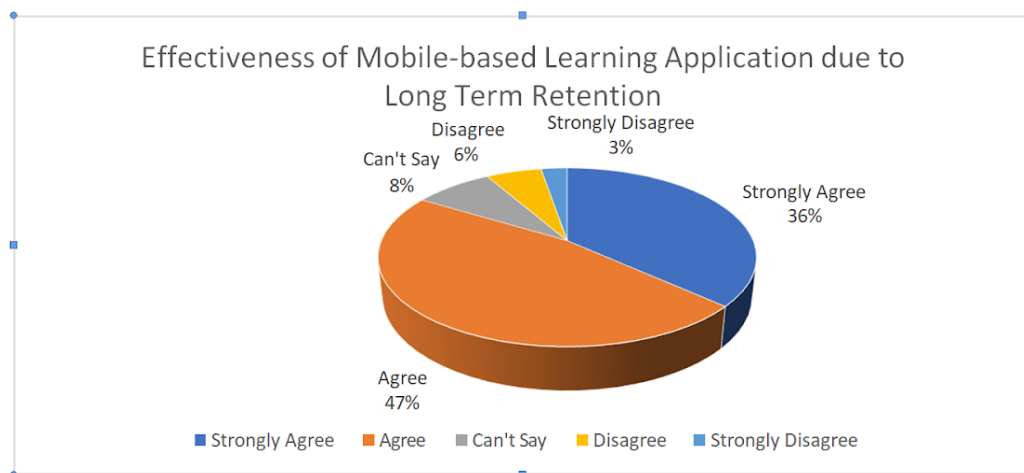
2. Remediation Facility

Fig. 14. Percentage of Secondary School Students Who Agree that Effectiveness of Mobile-based Learning Applications is due to Remediation Facility.

It is evident from the above figure that 40% of secondary school students agree that effectiveness of mobile-based learning applications is due to remediation. 23% of them strongly agree with the statement. 16% of them can't say anything related to remediation facilities. 15% of them disagree while 5% of them strongly disagree with the statement.

3. Long-term Retention of Concepts

Fig. 15. Percentage of Secondary School Students Who Agree that the Effectiveness of Mobile-based Learning Applications is due to Long-term Retention of Concepts

From the above figure, it is evident that 47% of secondary school students agree that mobile-based learning applications help in long-term retention of facts. 36% of them strongly agree with the fact. 8% of them can't say anything about long-term retention of concepts. 6% of them disagree and 3% of them strongly disagree with the fact.
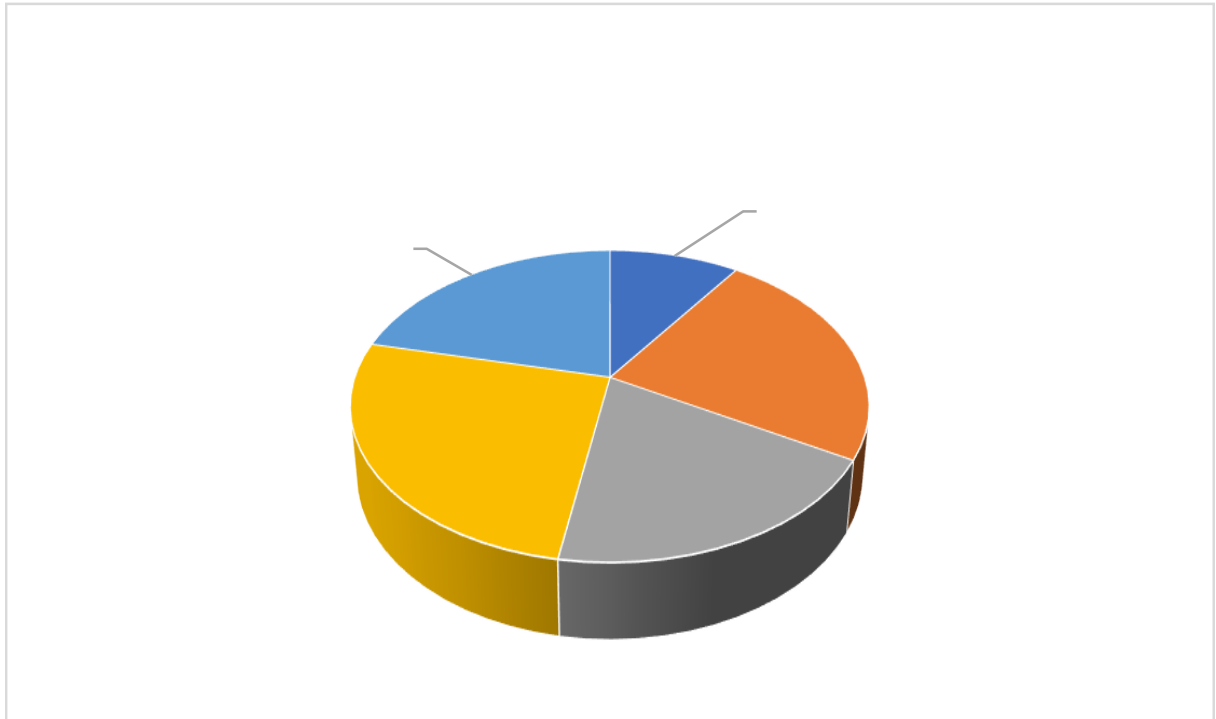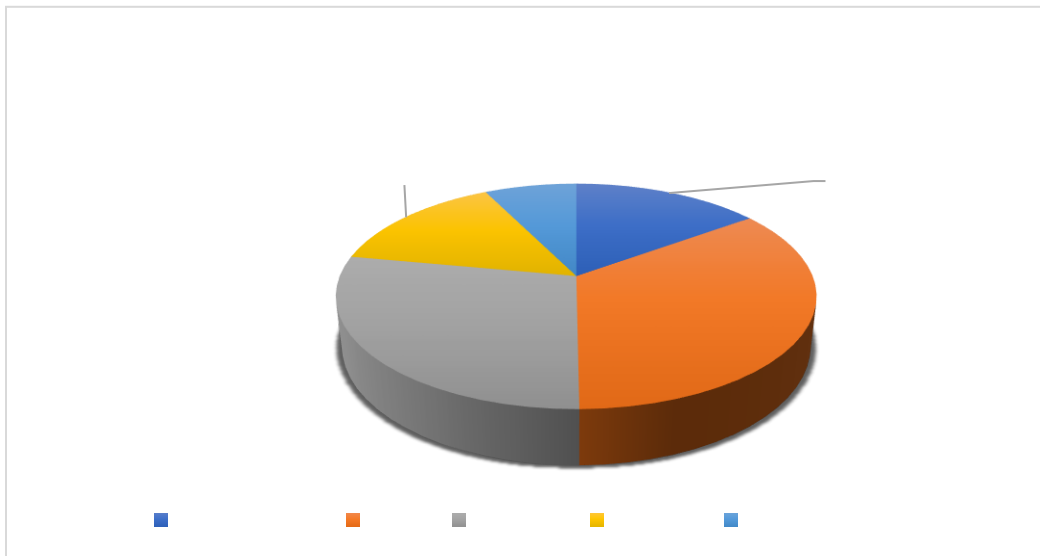
4. Better engagement of students in the learning process
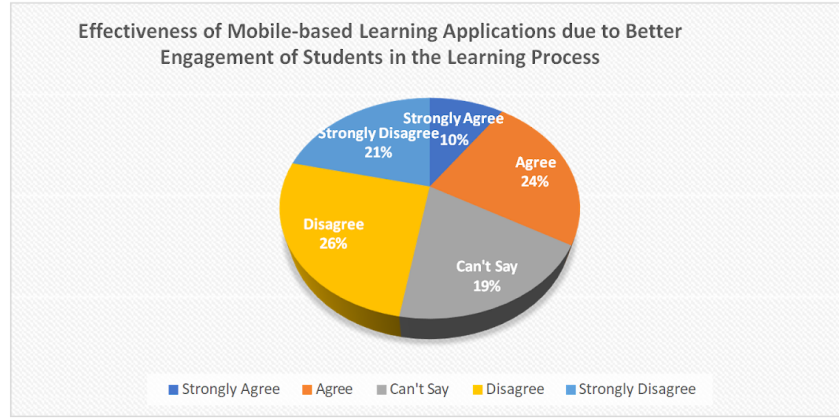
Fig. 16. Percentage of Secondary School Students Who Agree that Effectiveness of Mobile-based Learning Applications is due to Better engagement of students in the learning process

The above pie chart shows 26% of the secondary school students disagree that mobile-based learning applications leads to better engagement of students. 24% of them agree with the statement. 21% of them strongly disagree with the statement. 19% of them can't say and 10% of them strongly agree with the statement.

5. Better Performance

Fig. 17. Percentage of Secondary School Students Who Agree that the Effectiveness of Mobile-based Learning Applications is due to Better Performance

It is evident from the above figure that 26% of secondary school students disagree that mobile-based learning applications lead to better performance. 24% of them agree with the fact. 21% of them strongly disagree with the fact. 19% of them can't say anything about their performance and 10% of them strongly agree with the fact.
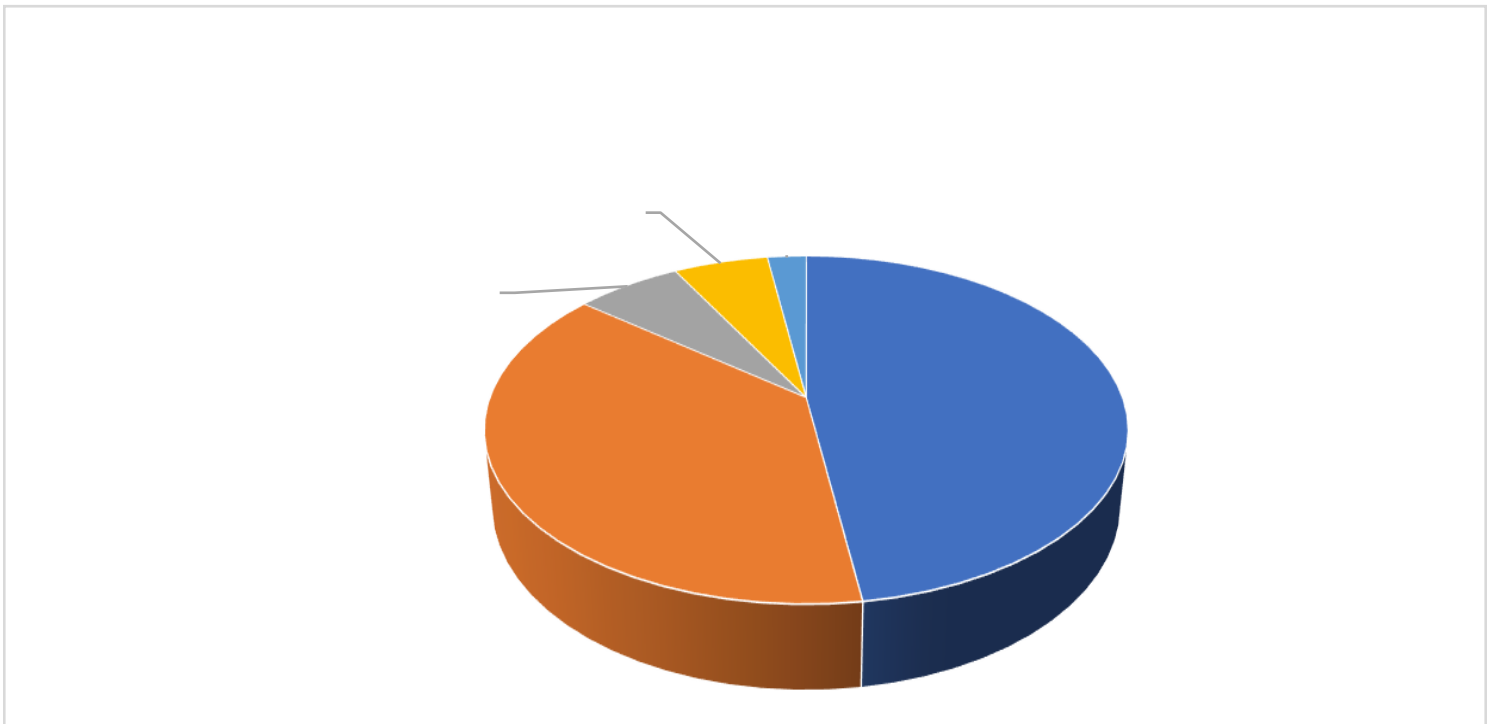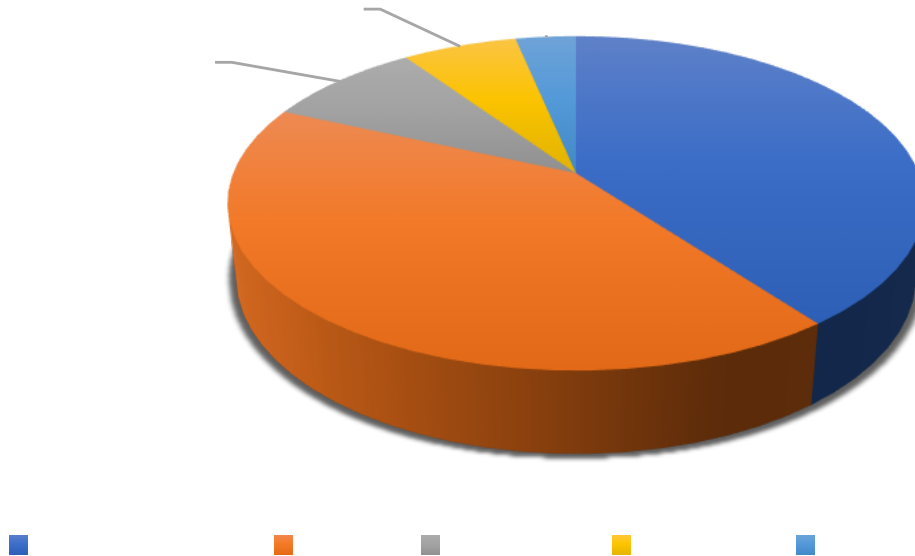
6. Feedback

Fig. 18. Percentage of Secondary School Students Who Agree that the Effectiveness of Mobile-based Learning Applications is due to Feedback.

From the above figure, it is evident that 34.67% of secondary school students agree that effectiveness of mobile-based learning applications is due to feedback facility. 28% of them can't say anything about the feedback that is provided by mobile-based learning applications. 15.33% of them strongly agree with the statement. 15% of them disagree and 7% of them strongly disagree with the statement.

7. Quick access to information

Fig. 19. Percentage of Secondary School Students Who Agree that the Effectiveness of Mobile-based Learning Applications is due to Quick access to information.

As shown in the above pie chart, 48% of secondary school students strongly agree that effectiveness of mobile learning is due to quick access to information. 38% of them agree with the fact. 6% of them can't say anything about quick access to information and also disagree with the fact. 2% of them strongly disagree with the fact.
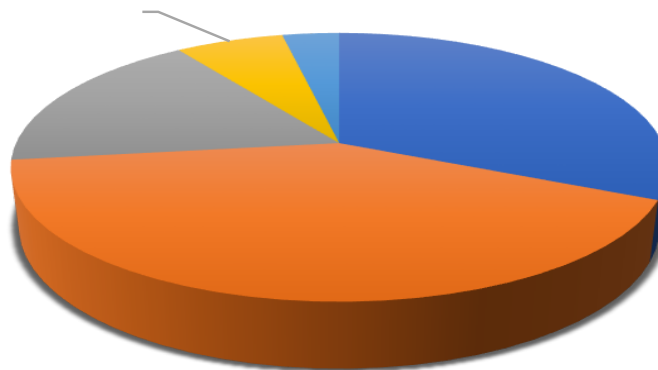
8. Diverse ways of learning

Fig. 20. Percentage of Secondary School Students Who Agree that the Effectiveness of Mobile-based Learning Applications is due to Diverse ways of learning.

The above pie chart shows 42% of secondary school students agree to the statement that students can learn through diverse means in mobile. 40% of them strongly agree with the statement. 9% of them can't say anything about the diverse ways of learning. 6% of them disagree and 3% of them strongly disagree with the statement.
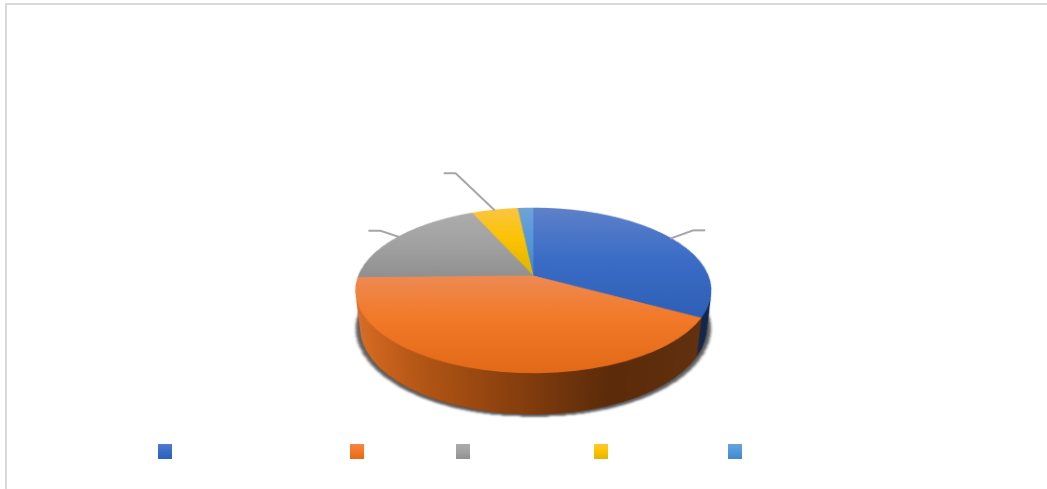
9. Self-pace

Fig. 21. Percentage of Secondary School Students Who Agree that the Effectiveness of Mobile-based Learning Applications is due to Self- pace

It is evident from the above figure that 32% of secondary school students strongly agree with the fact that effectiveness is due to self pace learning. 42% of them agree with the fact. 17% of them can't say anything about learning at their own pace. 6% of them disagree and 3% of them strongly disagree with the fact.

10. Drill and Practice

Fig. 22. Percentage of Secondary School Students Who Agree that the Effectiveness of Mobile-based Learning Applications is due to Drill and Practice

As shown in the above pie chart 41% of secondary school students agree that effectiveness of mobile-based learning applications is due to drill and practice. 33% of them strongly agree with the statement. 19% of them can't say anything about the practice sets available in mobile-based learning applications. 5% of them disagree and 2% of them strongly disagree with the statement.

11. Clarity of Concepts

Fig. 23. Percentage of Secondary School Students Who Agree that the Effectiveness of Mobile-based Learning Applications is due to Clarity of Concepts.

From the above figure, it is evident that 41% of secondary school students agree w... 33% of them strongly agree with ... them can't say anything abou... concepts on mobile-based learni... 5% of them disagree and 2% of t... disagree with the fact.
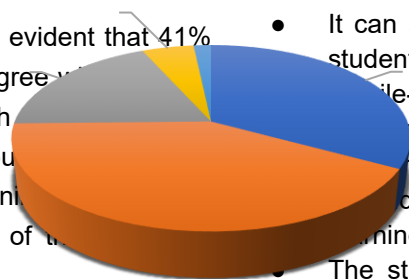
- It can also be concluded that the secondary students have positive attitude towards ...ile- based learning applications in terms ...ability. But there is no significant ...nce in the attitude of boys and girls of ...dary schools toward mobile-based ...ning applications in terms of usability.
- The study also leads to the conclusion that the attitude of secondary students is positive toward the effectiveness of mobile-based learning applications. On the basis of the study, it we can conclude that there is no significant difference in the attitude of boys and girls of secondary schools toward mobile-based learning applications in terms of effectiveness.

Conclusion:

- On the basis of the study, it can be concluded that the attitude of secondary students towards mobile-based learning applications is positive. It can also be concluded that the attitude of boys and girls of secondary schools does not differ toward mobile-based learning applications.

Implications of the Study

- The present study reveals that secondary schools show a positive attitude towards

mobile- based learning applications. Keeping this in mind the school administration should try to include a blended mode of teaching for better teaching-learning results.

- The present study reveals that the mobile based-learning is popular among students. Thus, the Government needs to establish clear strategic planning to establish a network to connect different districts, blocks, wards universities, and schools to establish a network for technology-based learning.

Limitations of the Study

Due to the paucity of time and money, the present study was delimited as:

1. This study has not included parents' behavior assessment because it was not possible to contact the parents of all students.
2. Due to the limitation of time students of Loyola Public School and B.D. Public School only were taken although there are some more schools.
3. Students of only secondary level were taken for their opinion keeping in mind that they would provide relevant information.

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