The Maple 15 Learning Software effect on the conceptual realization, and developing the Afghanistan students’ knowledge through curves: A case study in Samangan

Abdul Basir Deljuy*


Corresponding author: Abdul Basir Deljuy Emaill: basir.deljuy@gmail.com Contact number: 0093728008080


Abstract- The objective of this research is to evaluate the Maple 15 Software effect on the meaningful realization of the female tenth class students of Afghanistan through curves drawing as a method of applying technology in learning. Amongst the 8 tenth classes of the female students of Ajani Malika High School, the two classes were selected as experimental and control groups. In the experimental group, 31 students and the control group 32 students were attended. At the beginning of the learning period, a pre-test related to the curves drawing of the tenth class mathematic was taken. The experimental group was taught by applying the Maple Software and the control group with the traditional method. At the end of the learning period, a post-test was taken from both groups. The results of (MANOVA) showed that at a significant level (P<0.05), the numbers of the experimental group were better than the control one. Also, the findings of this study show that learning the algebraic and trigonometric curves drawing by using Maple Software can be effective on the mathematic operation and components’ meaningful realization of the tenth class students.

Keywords: Curves drawing, electronic learning, meaningful perception, software

I. INTRODUCTION

The math perception is usually effective to reach occupational successes and routine life management. Therefore, mathematics is seen as the main major at the primary, intermediate, and upper periods of learning training [1]. From the viewpoint of Jourjya Polya (1999), thinking is the most important object of math learning, he also recommends the teachers arise the capability of their students’ thinking level. So, the responsibilities of today’s teachers are more complex and heavy than the past ones. It is not possible to direct the society and its individuals toward a complex and developed evolution via the traditional approaches [2]. Today’s science and technology are rapidly improving and being seen at all parts of our life. The rapid and wonderful spreading of new technicalities has changed most of our life’s attributes. For instance, the changes in the ways of social, economic, and business communications. The schools with ancient systems cannot prepare the individuals to enter the same communities. The methods of learning in Afghanistan schools have to be responsive to the needs when the pupils encounter the outbound societies and environments.

Applying a suitable learning software as a tool for problem-solving provides an experimental environment, and allows the students to involve the subject. By evaluation of the different researches in mathematical learning, it seems that through applying the interactive dynamic software a good visualization from the drawing of the curves can be stated, and the conceptual percept in which is said the facts perceptions, concepts and mathematic thoughts to increase. The computer softwares not only do the arithmetic calculations, and symbolic handy products but also can exhibit the results of these calculations in an incarnate way that allow the talented brains to apply the incarnate and visual exhibited results for seeing the conceptual communications [3].

Relevant to the comprehensive using, new and various usages of technology in mathematics learning [4] explained the role of technology as a supporter in developing the skills and mathematic concepts, helper of mathematic questions, mathematic training arguments, and for mathematic relations. The other researchers such as (Allison & Grassl, 2005) applied the combination of traditional learning and group activities for the students of the control group. (Meagher, 2005) evaluated the Computer Algebra System (CAS) on students’ mathematic learning. In (2008) Perinar introduced the visualizing, argument, excavation, problem-solving, new producing, and the new questions designing as advantages of technology compilation with mathematic learning.

Regarding the role of technology in mathematic teaching, Peers (2001) conducted researches on the (CAS) and expressed his results related to the characteristics of this system and the paved learning environment: “the findings were concise and without calculative mistakes. The students had attention to unexpected results and patents. The students had more partnership during learning. The results of the calculations and geometrical features drawing were rapidly producible. Applying the various and unexpected strategies was much by the students. They were involved in more complex problems than those in which they were able to do by hand. Consequently, the students were getting...
more plenary ideas related to mathematic issues”. Also, Peers says that in recent years, the (CAS) has improved technically and accessibly. Recently, the technology has been becoming more universal, and the world has been witnessing the traditional fadings [5].

Generally, the results of this research show that except for how the (CAS) is applied, the acquisitive individuals who use (CAS), the mathematic operation and their achievements are increased significantly. Based on the past researches results, CAS suggests a new method for learning teaching duration and provides a better opportunity to help the conceptual knowledge promotion.

Also, according to the principles and rules of the National Council of Teachers of Mathematics (NCTM, 2000), technology increases the learning of mathematics, supports effective teaching, and influences the mathematics which is taught. The students can learn mathematic with a deeper realization through applying a suitable mathematic software. By remarking the importance of the curves drawing learning, its conceptual perception in mathematics, and the potential of technology in mathematic learning, it seems the technology applying in conceptual learning of the curves drawing is not overlooked. Although a few types of research relevant to these problems have been done in Afghanistan, the necessity of conducting such researches is completely felt in the country.

This research evaluates the effect of the Maple 15 algebraic computer software that is a kind of dynamic and interactive software on conceptual realization and extending of Afghanistan students’ knowledge via the curves drawing.

In this research, the influencing balance of Maple 15 Software is called independent variable, and the students’ conceptual percept the depending one. The mentioned learning software in this research is used as the technological tools, and the topic of the trigonometric and algebraic curves of the tenth class subject (a few kinds of research related to using the learning software than the other branches of mathematics have been conducted) was also taught as a topic of mathematics. Also, the main hypothesis and research questions in this research are as follow:

A. Hypothesis

The learning software applying through curve drawing has a positive effect on the conceptual realization and students’ knowledge extension.

B. Research question

A: Do the learning technologies for instance the Maple 15 learning software have an effect on the conceptual perception and knowledge extension of students on the drawing of the curve?

B: Is there a difference between learning through applying the software and the traditional method of students’ drawing of the curves?

II. RESEARCH ELABORATION

In this study, to achieve the research objective, a semi-experimental method was conducted. The experimental method from the applied algebraic and trigonometric curves concepts to determine the significant balance of teaching based upon the Maple 15 software (independent variable) on the conceptual knowledge of students (dependent variables) is a semi-experimental design.

In this design, $T_1$ expresses the pre-test, $X$ explains the method based on the Maple 15 software teaching (independent variable) and $T_2$ is the post-test. By remarking (Table 1), it can be said that in this design the two experimental groups are compared with each other, before and after operation of the independent variable. That is to say, firstly, from both groups of the students a pre-test containing their previous knowledge of the curves drawing concepts and after operation of the independent variable in the post-test experimental group pertaining the trigonometric and algebraic curves drawing of the tenth class book of both groups have been taken that were taught (Table 1).

The statistical population of this research contains the female students of the tenth class in a female high school in 2021 located in Aybak city of Samangan province. Amongst the eight classes of the female students of the mentioned school, the two classes were selected as the experimental and control groups. In the experimental group, 31 students and the control group 32 students were attended.

In the control group, the researcher conducted the traditional method (without using the software) to teach the mathematics lessons (the tenth class algebraic and trigonometric curves...
The Multivariate Analysis of Variance (MONOVA) tests, the research hypothesis was evaluated.

This research’s accomplishment continued from May 15, 2021-June 15, 2021. In another word, the experimental and control groups have been educated on the algebraic and trigonometric curves drawing in the three-one-hourly days in four weeks by the researcher. The curves drawing topic of the tenth class mathematical subject includes the first, second, and the third-degrees polynomial functions; absolute value, and trigonometric functions graph drawing; diagnosing the asymptotes of a function and graph drawing; vertical and horizontal transferring; the functions transition combination; distension, and contraction of the functions; clauses, different issues, etc. Moreover, during the teaching, it has been tried to use the appropriate learning methods for both groups to increase the conceptual perception.

III. RESULTS AND DISCUSSION

In this part of the study collected data from pre-test and post-test, interviews, and observations are analyzed qualitatively and qualitatively. To describe the data, the indexes containing mean, variance, standard deviation, etc., are evaluated. In the illative analysis, the MONOVA test is used to examine the research hypothesis. As it is seen in (Table 2), the 31 students in the experimental group and 32 in the control group are registered. It illustrates totally, 63 students participated in this study.

By remarking (Table 3), it is observed that the calculated means of both groups in pre-test numbers of conceptual knowledge do not have a significant difference. So, it can results that both groups had almost the same conceptual knowledge before the operation of the independent variable. Oppositely, in the post-test the numbers of conceptual knowledge by marking the remarkable difference that is seen between the means of both groups the students of the experimental group who were educated by applying the Maple 15 software expanded their conceptual and realizing knowledge.

To examine the hypothesis of the research, the achieved data of the written tests of both groups were analyzed illatively. Therefore, to evaluate the research hypothesis the multi-variance analysis method was applied (Table 3).

Before evaluating the required hypothesis it is necessary to examine the applying condition of the MONOVA test based upon the equality of variance and covariance. To examine the equality of covariance the Box-M test was used. Whether the null hypothesis of the matrices is accepted it means the homogeneity hypothesis of covariance acceptance. The Box-M test shows the equality of matrixes covariance. This result shows that the null hypothesis is accepted (P>0.05, F=1.588). Namely, the matrix covariance similarity is confirmed. By remarking the

<table>
<thead>
<tr>
<th>Groups</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>31</td>
<td>49.2</td>
</tr>
<tr>
<td>Control</td>
<td>32</td>
<td>50.8</td>
</tr>
</tbody>
</table>

Table 2. the qualitative statistics of the control and experimental groups

<table>
<thead>
<tr>
<th></th>
<th>Pre-test (T₁) experimental G.</th>
<th>Post-test (T₂) experimental G.</th>
<th>Pre-test (T₁) control G.</th>
<th>Post-test (T₂) control G.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>20.0</td>
<td>20.0</td>
<td>20.0</td>
<td>20.0</td>
</tr>
<tr>
<td>Mean</td>
<td>60.5</td>
<td>87.5</td>
<td>59.9</td>
<td>77.2</td>
</tr>
<tr>
<td>Median</td>
<td>58.0</td>
<td>88.0</td>
<td>57.0</td>
<td>78.0</td>
</tr>
<tr>
<td>Variance</td>
<td>74.1</td>
<td>39.3</td>
<td>44.5</td>
<td>100.4</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>8.6</td>
<td>6.3</td>
<td>6.7</td>
<td>10.0</td>
</tr>
<tr>
<td>Minimum</td>
<td>44.0</td>
<td>68.0</td>
<td>46.0</td>
<td>55.0</td>
</tr>
<tr>
<td>Maximum</td>
<td>77.0</td>
<td>96.0</td>
<td>76.0</td>
<td>90.0</td>
</tr>
</tbody>
</table>

This publication is licensed under Creative Commons Attribution CC BY.

existing information in Table 4, it is cleared that the calculated F is not significant at 0.05 level. So, the null hypothesis according to the equality of the covariance matrixes is accepted. Consequently, the MONOVA analysis for examining the research hypothesis can be applied (Table 4).

Table 4. the Box-M-test to determine the equality of covariance matrixes

<table>
<thead>
<tr>
<th>Box-M</th>
<th>F</th>
<th>df1</th>
<th>df2</th>
<th>sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.416</td>
<td>1.588</td>
<td>3</td>
<td>2880</td>
<td>0.19</td>
</tr>
</tbody>
</table>

df= degree freedom
sig=significance

For applying the variance analyzing test to each dependent variable, the equality hypothesis variance assessment should be remarked separately. To evaluate the null hypothesis equation of the variances’ errors the Leven-test was used. If the null hypothesis equation of the variances’ errors is accepted it means the standardized hypothesis of variance acceptation. Therefore, the Leven-test was applied for the equality of the two groups variances, and both of the two dependent variables. The Leven-test shows the equality of variances for the two dependent variables from the equality of variances errors. By considering the Table 5 data it is found that the null equality hypothesis of the variances error for both depending variables of both groups are accepted because the F values of both depending variables at (P>0.05) is not significant. This information means that applying variance-analysis-test to each dependent variable is accepted separately. To study the research hypothesis One-Way-ANOVA was applied (Table 5).

Table 5. the Leven test equation to specify the error of the variances

<table>
<thead>
<tr>
<th></th>
<th>F</th>
<th>df1</th>
<th>df2</th>
<th>sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-test conceptual numbers</td>
<td>0.45</td>
<td>4.00</td>
<td>26.00</td>
<td>0.90</td>
</tr>
<tr>
<td>Post-test knowledge expansion</td>
<td>0.57</td>
<td>4.00</td>
<td>26.00</td>
<td>0.84</td>
</tr>
</tbody>
</table>

The values of the indexes in Table 6 explain that the statistical results gotten from variance analysis show the null hypothesis (P>0.05) is accepted. In another word, the independent variable (the Maple 15 learning software) affected the dependent variables (conceptual knowledge and knowledge expansion). So, it reflects that there is a significant difference in conceptual perception and knowledge extension between the experimental and control group. This issue illustrates that learning based on the Maple 15 software than traditional learning has more effect on conceptual perception, and the students’ knowledge expansion of curves drawing. This reality reflects the acceptance of the research hypothesis (Table 6).

Table 6. analysis of variance relevant to the numbers’ difference of conceptual perception and knowledge expansion of the experimental and control groups

<table>
<thead>
<tr>
<th>Variable Resource</th>
<th>Total squares</th>
<th>df</th>
<th>Mean square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conceptual percept</td>
<td>46.0</td>
<td>1</td>
<td>46.03</td>
<td>5.5</td>
<td>0.005</td>
</tr>
<tr>
<td>Knowledge expansion</td>
<td>42.0</td>
<td>1</td>
<td>42.05</td>
<td>6.3</td>
<td>0.013</td>
</tr>
<tr>
<td>Conceptual percept error</td>
<td>355.9</td>
<td>30</td>
<td>8.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge expansion error</td>
<td>282.0</td>
<td>30</td>
<td>6.69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First total</td>
<td>402.8</td>
<td>41</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second total</td>
<td>323.2</td>
<td>41</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IV. CONCLUSION

By considering the statements in interpretation and justification of the gained result from data of this research it can be said that the teaching method with emphasizing on the learning software provides the necessary context for positive changes in the writing of the students relevant to the concepts realizing of the curves drawing and their learning that causes knowledge expansion and motivation enhancement on mathematics learning. Applying the Maple 15 software increases the students’ perception of mathematics, enjoying mathematics, and subsequently their motivation enhanced for learning. Of course, it seems that motivation is a combined relation of a student. That is to say, the positive theory on the algebraic and
trigonometric curves drawing causes the enhancement of learning, and the increasing of learning progress causes the positive thought enhancing that consequently, the combination of these two enhancements create the mathematical motivation of the students.

The researches that have been done in different countries at different educational levels explain that learning software can play a determiner contribution to the students' mathematics learning. Because it cannot be expected from the students to reach high learning levels in the classes that the new educational tools and instruments are not implemented in, and have a dry environment due to applying the traditional methods of teaching. In these classes, the students will remain without interest in the lesson because their learning needs are not provided, and such classes are a dull environment bringer for their teachers and students. On another side, by remarking the reached experiences from this research, the absolute learning software using (without compilation with the other teaching methods) could not be caused better satisfaction of the students on mathematics lesson.

The value of learning softwares is in many methods because of knowledge supply. The students can learn the abstract principles by writing, and observe through dynamic displaying or visual software helping. They can accelerate the learning duration via active knowledge perseverance, and pay to the extension of the contemplation and argumentation skills. By remaking the conclusions, it seems if any instrument applied well in mathematics educating and learning, the students’ theory and beliefs will be better relating to mathematics and find further self-confidence.

A. Suggestions
1. The various teaching approaches should be applied in the mathematics classes in which can be a better help on the students learning with different abilities.
2. In using learning softwares, we would not consider them as the only factor of success but also would consider the learning space and proportion of the literacy level and the students’ skills.
3. The mathematics softwares as the beneficial tools for facilitating the teaching-learning duration of its subjects should be provided for students.

REFERENCES