5th IFSCOM2018 PROCEEDING BOOK
ISBN: 978-605-68670-0-2

IFSCOM2018
5th Ifs And Contemporary Mathematics Conference
September, 05-09, 2018, Kahramanmaras, Turkey
pp: 8-11

MISCONCEPTIONS AND ERROR ANALYSIS OF 10TH GRADE STUDENTS ON ANALYTICAL GEOMETRY

A.ÖZKAN AND E. M. ÖZKAN

Abstract. The purpose of this research is to determine the relationship between the misconceptions of errors and concepts about analytical geometry, the attitudes of students towards analytic geometry, and the misconceptions of analytical geometry in order to overcome the object misconceptions.

In the first stage, an open-ended exam was applied to 2552 tenth-grade students studying at 19 high schools under stanbul Provincial Directorate of National Education and 299 students from two high schools were tested in the second stage and 10 students were interviewed in the last stage in the academic year of 2016-2017. Errors and misconceptions of the students in the questions covering the analytic geometry were examined. At the end, it was concluded that knowledge levels, errors and misconceptions of students in the analytic geometry should be identified to use proper instructional strategies. It is necessary to design different activities to improve the levels of students who cannot comprehend the analytic geometry on the level of their classrooms. This will ensure that the whole classroom achieves the same comprehension level. A decrease in errors and misconceptions will be observed and misconceptions will be identified more easily.

1. Introduction

Misconception is described as misunderstanding and means wrong or incomplete conception, any representation of a given concept in the mind but scientifically different from the definition of the concept [3]. Consequently, misconception is defined as the body of behaviors stemming from students misbelief and experiences. Some errors might be symptomatic of a misconception, a prototypical way of thinking, or an intuition or mislearning and excessive load of information. Moreover, misconception may be beyond an error [2]. Students bring their alternative thoughts they have acquired before with them to the classroom [1]. Since these concepts that are known by students have a certain integrity within them and are supported by some

2000 *Mathematics Subject Classification.* Primary 97B40; Secondary 97C30.
Key words and phrases. Analytical geometry, concept , error, mathematics education, misconceptions.

experiences of daily life, they are resistant to change and positive improvement [6]. This has negative impacts on students learning other concepts related to the concept misunderstood by them [4].

2. Method

The research population was composed of tenth-grade students in Istanbul in the academic year of 2016-2017. The sample of the first part of the research was 2552 tenth-grade students who were studying at 19 most successful Istanbul high schools which apply the curriculum by Ministry of National Education. The sample of the second part was 299 students of two schools with the highest error rate within the 19 schools by their school averages and the last part used a sample of 10 students out of 299 students who made errors.

A three-stage procedure was followed to collect research data. In the first stage, 10 open-ended analytic geometry questions were asked so that the students could answer the questions in a more comfortable setting and the factor of chance could be reduced. In the second stage, the test version of the open-ended questions and finally an interview was performed. The questions asked to the students covered the following subjects: coordinate system (Question 1), coordinate of a point (Question 2), relative position of two lines (Question 3 and 4), distance between two points (Question 5), distance from a point to a line (Question 6), finding the line given the equation (Question 7), relative position of two lines (Question 8), calculation of area between intersecting lines (Question 9), and finding the area of a triangle given corner points (Question 10). The Open-Ended Scale for Identifying Misconceptions was used in the first stage. The scoring applied for the open-ended questions are given in Table 1.

Criteria	Score	Criteria	Score	Total Score
True answer	1	True Explanation	2	3
True answer	1	Almost True Explanation	1	2
True answer	1	Wrong Explanation	0	1
Wrong answer	0	True Explanation	2	2
Wrong answer	0	Wrong Explanation	0	0

The scores obtained in the test were used as the criterion of whether the students had any misconception. This criterion was determined in the form of triple grading. Accordingly, the score range of 0-2552 means a misconception, the score range of 2553-5104 means a partial misconception, and the score range of 5105-7656 means the lack of any misconception. The number of correct, incorrect and non-answers were handled in the data analysis of the second stage. Number of correct answers within the range of 0-33.33% means "there is a misconception", 33.34%-66.67% means "there is a partial misconception", and 66.68%-100% means "there is no misconception." 10 interviews were evaluated in the final stage.

3. Test Result and Discussions

The results of the grading by whether the answers to the open-ended questions are correct, incorrect and by their justifications are presented in Table 2.

Question	T. Exp.	Alm.T. Exp.	W. Exp.	T. Exp.	W. Exp.	Score
Question1	874	15	0	43	348	2739
Question2	775	0	0	17	192	2359
Question3	1714	26	0	283	130	5760
Question4	1451	12	0	332	221	5041
Question5	491	13	0	473	569	2445
Question6	302	2	0	249	1168	1408
Question7	784	3	0	217	769	2792
Question8	208	202	0	406	792	1840
Question9	225	67	146	477	1124	1909
Question10	1002	0	0	67	394	3140
Total Score	7826	340	146	2564	5707	29432

According to Table 2, in a general overview of the questions, there were misconceptions in the five subjects of analytic geometry while partial misconceptions were observed in 4 questions and there was no misconception only in one question. Whereas it was observed in the first question covering the coordinate system that there was a partial misconception, the scoring was close to the misconception. By whether the justifications are correct, about 36% of students' justifications are correct. It was observed that 30% of the students gave the correct answer to the Question 2 which covered the coordinate of a point while the rate of students who provided the correct justification was about 31%. It is seen that 85% of the students gave answer to the Question 2 about perpendicularity in the subject "relative position of two lines". 67% of those students gave the correct answer, and 78% of them had the correct justification. The scoring was about 75 and it can be clearly understood that there is no misconception of the subject. As for the answers to Question 4 about parallelism, about 70% of the students had the correct justification to their answers and there was a partial misconception while the scoring was closer to the upper limit.

The score of Question 5 (distance between two points) is in the range of 32% and this means that there was a misconception of the subject. Scoring of Question 6 which investigated whether there was a misconception of the subject "distance from a point to a line" remained in the part of 33%, which means there was a misconception of this subject. When examining the results of Question 7 covering the subject "finding the line given the equation", the scoring of about 70% shows that there was a partial misconception. It was found that there was a misconception among students in the subject "relative position of two lines" (Question 8). Whereas 62% of the students provided incorrect justification for the calculation of the area between intersecting lines (Question 9), 44% of the students provided both incorrect answer and justification. According to the scoring results, there is a clear misconception. In Question 10 covering the subject "finding the area of a triangle given corner points", 58% of the students did not answer, the scoring remained at 41.01%, meaning that there was a partial misconception.

4. Conclusion

In the first stage, an open-ended exam was applied to 2552 tenth-grade students studying at 19 high schools under Istanbul Provincial Directorate of National Education and 299 students from two high schools were tested in the second stage and

10 students were interviewed in the last stage in the academic year of 2016-2017. Errors and misconceptions of the students in the questions covering the analytic geometry were examined.

At the end, it was concluded that knowledge levels, errors and misconceptions of students in the analytic geometry should be identified to use proper instructional strategies. It is necessary to design different activities to improve the levels of students who cannot comprehend the analytic geometry on the level of their classrooms. This will ensure that the whole classroom achieves the same comprehension level. A decrease in errors and misconceptions will be observed and misconceptions will be identified more easily. Eliminating the misconceptions is possible by getting beyond the traditional instructional methods and keeping the teacher from the role of information transferer and the student from the role of passive listener.

References

[1] Fischbein, E.,Intuition in science and mathematics: An educational approach. Boston: D. Reidel, (1987).

[2] Goris, T. and Dyrenfurth, M. , Students' misconceptions in science, technology, and engineering. In ASEE Illinois/Indiana Section Conference. (2010)

[3] Hadjidemetriou, C. and Williams, J., Children's graphical conceptions, *Research in Mathematics Education* **4**(1) (2002) 69-87

[4] Kustos, P. and Zelkowski, J., Grade-continuum trajectories of four known probabilistic misconceptions: What are students' perceptions of self-efficacy in completing probability tasks?, *The Journal of Mathematical Behavior* **32** (3) (2013) 508-526

[5] Ozkan, A., Ozkan, E. M. and Karapicak, S. On the Misconceptions of 10th Grade Students about Analytical Geometry, *The Educational Review, USA* **2** (8) (2018) 417-426

[6] Simmons, J. P.and Nelson, L. D.,). Intuitive confidence: Choosing between intuitive and nonintuitive alternatives, *Journal of Experimental Psychology* **135**(3) (2006) 409-428

(author one) Yildiz Technical University,Department of Mathematics, 34210, Istanbul, Turkey

Current address: Yıldız Technical University,Department of Mathematics, 34210, Istanbul, Turkey

E-mail address, author one: aytenust.ozkan@gmail.com

(author two) Yildiz Technical University,Department of Mathematics, 34210, Istanbul, Turkey

E-mail address, author two: emehmetozkan@gmail.com