2._Artikel_IOP_2019_Misconception_Analysis.pdf

by F Fakhriyah

Submission date: 08-Feb-2023 11:27AM (UTC+0700)
Submission ID: 2009076070
File name: 2._Artikel_IOP_2019_Misconception_Analysis.pdf (554.53K)
Word count: 3524
Character count: 19854

Misconception Analysis Based on Feedback of Computational Thinking Result of College Students

Misconception Analysis Based on Feedback of Computational Thinking Result of College Students

S Masfuah* and F Fakhriyah

Primary Educational Teacher Department, Universitas Muria Kudus, Indonesia

*Corresponding author e-mail: siti.masfuah@umk.ac.id

Abstract. This research has purposes to analyse misconceptions of college students based on feedback of their computational thinking test. This descriptive quantitative research involves fourth semester college students of 4C class of primary school education teacher program by using random sampling. The instruments are test instrument consisting of computational thinking indicators and questionnaires semi structured to identify and analyse of factor causing misconception of the students. The results were then analysed descriptively by using cluster analysis and crosschecked to questionnaire and interview results. The findings show computational thinking of the students was within algorithm stage meanwhile misconception is found in movement system material. The causal reasons of the misconception are grouped into 3 clusters. Cluster 1, the students have already understood the concept but their misconception is 33.3%. Cluster 2, misconception of the students is 38.1%. Cluster 3, the students have not understood the concept with percentage 28.6%. The contributing factors to misconception are students' arguments that animals/plants have similar natures to human, handbook, lecturer's explanation, scientific name, mathematics calculation, formula, graphic understanding, influences of peer in answering, and students' experiences in daily life.

1. Introduction

Human Resources and technology are great problems in 4.0 industrial revolution era. Its mastery by human becomes competitive power of Indonesian people to face the era. In this era, people are demanded to think comprehensively by using technology to prevent us becoming slaves of technology. Therefore, there is a need to improve skills to keep irreplaceable human resource position from technology advancement. Skill improvement may be done through educational field.

Primary school education teacher of UMK is an institution to prepare primary school teacher to have further contribution because they have roles to prepare Science, Technology, and Culture to future generation. Thinking ability, technology mastery, and life skill are abilities to have in this era. The future generations will have those skills when teachers are capable and skillful. Therefore, improvement is always done to have better and qualified skill graduate outputs.

The required skills of 21st century are scientific literacy and computational thinking [1]. Scientific literacy is an ability to understand and implement science in an individual's life [2]. It must be owned by students since it contributes to technological mastery. Technology advancement is caused by scientific innovation found by researchers. Scientific literacy is part of science, technology, and social developments whose high thinking level components, scientific attitudes, social attitudes, and integrated studies [3]. The implementation of scientific literacy will be maximal when an individual has computational thinking ability. It is used to solve complex problem by involving ideas, models, simulations as if it were computer [4]. It is needed since not every problem can be solved only by

thinking but it needs to integrate various studies by using technology, model, and simulation [5],[6]. Computational thinking is also needed to innovate in science, technology, enginery, and mathematics fields (STEM) [7]. Computational thinking as scientific domain and scientific literacy as its implementation are needed by experts and practitioners to innovate. However, the students have not had those skills maximally.

Scientific literacy of the students are still on nominal level [8]. This level allows to identify a conceptual formation but not to understand the concept clearly [3]. Students will have better literacy skill when they have better CT skills because the skill is a meant to implement scientific literacy. After measuring the scientific level of the students, they were given learning material based on scientific literacy completed by CT competences to improve both scientific literacy and computational thinking. Based on the posttest, the students were in level of finding problems and had not had capability to promote algorithm [9]. The students had found solution but could not solve problems orderly and systematically. In fact, based on score of given book's readability, the students argued the book was readable and understandable [9]. The students felt the book was readable but the posttest showed low ability. The previous study conducted on applied science course had not shown any maximum ability [10]. On the course, the students were demanded to create a project by creating tool or mini research based on the already given science concept. Basically, the students had owned good ideas dealing with mini research and manipulative demonstrative tool to create. However, the students still had difficulties to apply the concept and to relate the concept o other concepts, and to analyze the project. Those proved that students had understood science concept but they could not think comprehensively in solving given problem. It identified students had misconception or missing the concepts.

Initially, students had owned pre-concept. This concept functions as basic initial thinking of the students. When they join learning process, this concept experienced changes. It might be concept addition, concept modification, and event concept changes contributing to latest resulted concept. This change is as process of bringing students' thought to proper scientific concept [11]. In this new concept formation, mistakes, misses, or unsynchronized initial concepts to what is learnt occur, called as misconception.

Misconception occurs due to inappropriateness of the understood concept to learnt theory. Misconception is permanent within students' thoughts and difficult to change [12]. Misconception occurs in students' thoughts in reviewing concept into conception and becoming facts [13]. If the formed intuition by students is not correct, then it is difficult to fix because consistently a wrong concept has become the guidance [14]. Therefore, it needs to seek misconception causes of the students because initial understanding of them influences further learning.

Misconception of the students is difficult to evade but it can be prevented when its causes are figured out [15]. Misconception measurement is important for a department or a program because it is used to evaluate and improve the program [16]. Many previous studies analyzing misconception of science teacher candidates but they have not reached until level of finding out misconception experienced by students. Therefore, it is important to investigate.

2. Method

It is a descriptive quantitative research with purposes to analyze misconception of students based on feedback of computational thinking result by the students. It is also a preliminary research to identify misconception of the students. The population is fourth semester students in academic year 2018/2019. The study uses C class as a research sample taken by random sampling. The researcher gave computational thinking test. Then, it was evaluated. The investigated computational thinking indicators are to analyze and find data, elaborate problems, create abstraction, find patterns of problems, algorithm, automation, simulation, and conclusion. The task was given to the students then followed by semi structured questionnaire and interview to identify and analyze the misconception The results were then descriptively analyze by using cluster analysis technique with SPSS program. SPPS analysis uses the SPSS 25 application. Cluster analysis is organizing set of patterns into cluster or group based on characteristic similarities. Cluster analysis uses non-hierarchical grouping method. The analysis is

started by determining numbers of demanded clusters. In this analysis, the researcher uses three clusters. After the clusters are determined, then the subsequent process was done without adhering hierarchical process. Conclusion drawing is subjective and depends on purposes of the research [17].

3. Results and Discussion

This preliminary research about test development is to measure misconception of the students. At the beginning, the students were given task consisting of computational thinking indicators. The test was given to measure the students' CT skills. They were given essay tasks based on computational thinking indicators covering from 16 numbers. This research is specialized on movement system of low organism movement, high organism movement, influences of movement to matter and Newton law. Based on questionnaire results and learning achievement of the students, movement system material had the lowest average score. It should be evaluated by lecturer to find out the cause and to improve learning. Basically, both lecturers and teachers have been aware of the causes. Therefore, evaluation of misconception should be done periodically. Measured evaluation activity done by teachers in accordance to misconception experienced by his students done periodically [18]. The findings show basically most of teacher had been aware of misconception but they could not find out the causes. In fact, the causes are used to improve learning.

Based on CT test, the students were on finding solution level but were not in algorithm level where they should have known the answers but could not solve problems systematically and orderly. The results are indicated the students experiencing misconception because they had known solutions but they could not solve the problems well. This misconception is most frequently experienced but they could not explain in detail about it since misconception is closely related to initial concept instilled in their thoughts [19].

To analyze misconception existence, the students were given feedback questionnaire of the already done CT test. It consisted of reasons and possibilities causing mistake in answering the task. There are 21 options becoming the reasons. They are confusion to answer, pre-conception of the students, confusion to understand the tasks, confusion to mathematically formulate, confusions about the formula, confusion in conversing the measurement, confusion in equality principle, assumption of students about human-like natures of animals and plants, difficulties to calculate, meet the phenomenon daily, guess the answers, difficulties to understand graphics/diagrams, carelessness of the students, problems of memorizing scientific/Latin names, influenced answers by peers, and other reasons to write by the students.

The questionnaire is analyzed by using cluster analysis plus and SPSS program. At the beginning, 16 tasks and 21 options were input. Then, 3 clusters were determined. The data is then analyzed and the results as follow on Table 1.

Table 1. Final Cluster Centers of Students' Questionnaire

Item Z Skor	Cluster		
	1	2	3
Zscore: A. I am confused to understand the task	-.55004	.30558	.12223
Zscore: B. I do not understand the concept	-.86605	1.24770	-.19082
Zscore: C. I am confused in mathematics formulation	-.47108	.87487	-.20189
Zscore: D. I do not memorize the formulas	-.33597	.95415	-.30909
Zscore: E. I am confused in coversing the measurements or symbols	-.43301	-.43301	.43301
Zscore: F. I do not understand equality principle	-.44379	-.08876	.26628
Zscore: G. That is my pre-conception	-.24738	-.44528	.34633
Zscore: H. I assume animals/plants are like human	1.21731	-.52171	-.34780
Zscore: I. I assume things are like human	.36596	-.36596	.00000

Item Z Skor	Cluster		
	1	2	3
Zscore: J. That is what I learn from book	1.20073	-.80777	-.19648
Zscore: K. That is what my lecturer says	.86674	-.86674	.00000
Zscore: L. I believe and argue so	.41692	-1.14318	.36313
Zscore: M. I guess the answer	-.43391	-.43391	.43391
Zscore: N. I cannot calculate	.36596	.36596	-.36596
Zscore: O. I meet the phenomenon daily	-.32545	-.91718	.62131
Zscore: P. I do not hear my lecturer well	-.50833	-.69318	.60075
Zscore: Q. I am careless	-.14002	.18003	-.02000
Zscore: R. My answers are influenced	-.25000	.95000	-.35000
Zscore: S. I do not understand the graphs	-.30121	.70282	-.20080
Zscore: T. I do not memorize scientific or latin names well	.84740	-.14123	-.35308
Zscore: U. Other reasons	.23146	-.11573	-.05786

Based on Z score which is positive on the table, it can be categorized that cluster 1 consisting of reason of assuming animals/plants are like human, assuming things are like human, that is what I learn from book, that is what my lecturer says, that is my opinion, I do not memorize the Latin or scientific names, and other reasons. Cluster 2 is categorized by options consisting of my confusion to understand the concept, I do not understand the concept, I am confused to mathematically formulate, I do not memorize the formula, I cannot calculate, I am careless, my answers are influenced by my friends, and I do not understand the graphs or diagrams. Cluster 3 consists of my confusion to converse the measurement, I do not understand equality principle, it is my initial concept, I just guess the answer, I see the phenomenon, I do not listen my lecturer well. The Z scores are categorized into 3 clusters on the Figure 1.

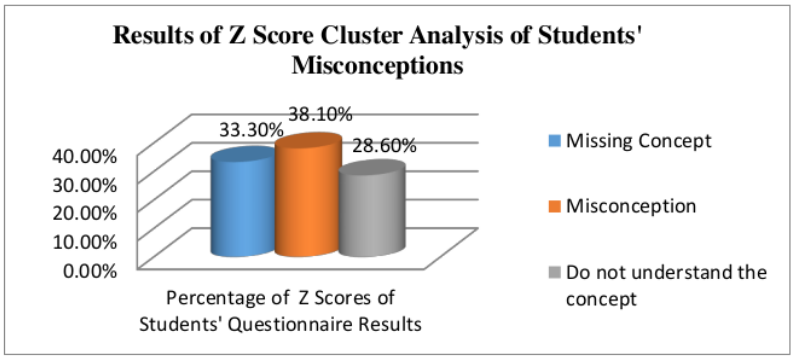

Figure 1. Misconception Clusters of the Students

Based on the analysis and procedures by using non-hierarchical method, it can be concluded that cluster 1 consisting of students whom have understood the concept but having missing concept, 33%. Cluster 2 consists of students whom understand the concept but having several weaknesses or misconceptions, 38.1%. Cluster 3 consists of students whom have not understood the concept and tend to guess the answers, 28.6%.

In cluster 1, the students actually have understood the concept but some of the concepts are missing. They were able to answer but limited by technical terms such as assuming animals, plants, or non-living things were like human. They assumed both animals and plants had similar natures to human. It means

they assumed based on what they saw without having strong initial concept. They might have understood the natures of plants and animals but not in detail. They assumed that plants and animals were living creature, thus they had similar natures to human. They also assumed that non-living things owned humans' attributes because human was also a thing, without considering other parameters. Those are the misconceptions where students miss several concepts of certain material. Aufschnaiter and Christian [20] explains that missing concepts occurs when students cannot explain a specific concept explicitly. Their answers could be gained from any phenomenon they see. They do not adhere to instruction well and do not control possible affective variable. Besides that, theories of plant, seed, and movement system also cause misconception of teacher candidates [21].

Besides that, the students experienced difficulties in naming. The scientific language style tends to be more difficult to understand. Therefore, it contributes to misconception of the students. This misconception influences learning process and even learning achievement. It is strengthened by [22], finding that misconception occurs when students have problems of mastering certain language phrase related to scientific language [22]. The difference of daily language to scientific language causes confusion and misconception [23]. Language as communication meant has important role in scientific literacy [22].

Cluster 2 consists of group with misconception. They were sure of their answers but their assumptions were contradicted to current theories. Besides that they were not able to answer properly due to their limited mathematics calculation, formulas, and poor understanding about graphs and diagrams. Meanwhile, cluster 3 consists of students with very poor understanding of the concept. They tended to guess the answers without considering the background or reasons. This misconception was caused by measurement conversion, equality, pre-conception, guess, and less attention. This misconception experienced by students was caused by many factors such as environment, handbook, personal argument, and the given learning [24].

Based on Z score results, the contributive factors to misconceptions are incorrect assumption of animals/plants to own similar natures as human, handbook, lecturer's explanation, scientific names, mathematics calculation, formulas, graphic understandings, peer influences in answering, and students' experiences in daily life. It is strengthened by [18] and [25] that causes of misconceptions are students' daily life experiences, teacher's handbook, environment, friends, learning strategy, and teacher. Similar research telling that teacher is main factor to determine success of learning who sometimes triggers any misconception [26],[27]. Therefore, teachers and lecturers must be capable of predicting any misconception which may appear during learning.

After the questionnaire was given, students were interviewed about the causes of misconception and what materials or concepts are assumed to be most difficult and have most misconceptions. Based on descriptive data analysis, the most difficult materials and contributes to misconception are Newton law, effect of force to moving matter, and movement system of low level creatures

4. Conclusion and Suggestion

It can be concluded that students have misconception from the test result. Based on the data, 33.3% of them have missing concept, 38.1% have misconception, and 28.6% do not understand the concept. The most contributive factors are students' assumptions of animals/plants to have similar natures as human, the learnt textbooks, lecturer's explanation, scientific name, mathematics calculation, formula, graphic understanding, peer influences in answering, students' experiences in daily life. Based on the questionnaire and interview, the most contributive materials to misconception are Newton law, effect of force to moving matter, and movement system of low level creatures.

It is suggested to create more detail questionnaire for the students related to misconception causes experienced by them so that clustering step is more accurate.

Acknowledgments

Thanks to research team of Universitas Muria Kudus, Dr. Insih Wilujeng, M.Pd and Prof. Djemari Mardapi, M.Pd., Ph.D from Universitas Negeri Yogyakarta, to cooperate in this research. Thanks to the chief of Primary School Education Teacher Department of Universitas Muria Kudus to support and allow this research. Thanks to Direktorat Riset dan Pengabdian Masyarakat Kemenristek Dikti to financially support this research. Thanks to all parties to have helped this research.

References

[1] Wing J M 2006 *Communication of the ACM* **49(3)** 33-35
[2] R Bybee, B McCrae, R Laurie 2009 *Journal of Research in Scince Teaching* **46(8)** 865-883
[3] Holbrook and Rannikmae 2009 *International Journal of Environmental & Science Education* **4(3)**: 275-288
[4] Qualls J A and Linda B S 2010 *Journal of Computing Sciences in Colleges* **25(5)** 66-71
[5] Liu J and Wang L 2010 *IEEE 2nd International Workshop on Education Technology and Computer Science* 413-416
[6] Voskoglou M and Sherly B 2012 *Egyptian Computer Science Journal ECS* **36(4)** 45-46
[7] Swaid S I 2015 *Procedia Manufacturing* **3** 3657-3662
[8] Fakhriyah F, S Masfuah, M Roysa, A Rusilowati, E S Rahayu 2017 *Indonesian Journal of Science Education* **6(1)** 81-87
[9] Fakhriyah F, S Masfuah, M Roysa 2018 *Proceeding: Advances in Social Science, Education and Humanities Research* **262** 165-169
[10] Masfuah S and F Fakhriyah 2017 *UNNES Science Eduction Journal* **6(3)** 1708-1716
[11] Agiande D U, Williams J W, Dunnamah A Y, Tumba D P 2015 *European Scientific Journal* **11 (35)** 395-408
[12] Morgil I, Seyhan H G, Secken N 2009 *Chemistry Education* **18(3)** 53-60
[13] Wiyono F, M Sugiyanto, E Yulianti 2016 *Jurnal Penelitian Fisika dan Aplikasinya* **6(2)** 61-69
[14] Tayubi Y R 2005 *Mimbar Pendidikan* **24(3)** 4-9
[15] Sadler P M and Sonnert G 2016 *American Educator* **1** 26-31
[16] B A Couch, W B Wood, J K Knight 2015 *CBE-Life Science Education* **14** 1-11.
[17] Ghozali I 2018 *Aplikasi Analisis Multivariate dengan IBM SPSS 25 edisi 9*. (Badan Penerbit Universitas Diponegoro: Semarang)
[18] Anam I M S 2018 *International Journal for Cross-Disciplinary Subjects in Education (IJCDSE)* **9(1)** 3323-3328
[19] Schmidt A L 2011 *Creative Education* **2(5)** 435
[20] Aufschnaiter C V and Christian R 2010 *Eurasia Journal Mathematics, Science and Technology Education* **6(1)** 3-18
[21] Yangin S, Sabri S, Yasin G 2014 *Journal of Baltic Science Education* **13(3)** 105-117
[22] Chrzanowski M M, Grajkowski W, Zuchowski S, Spalik K, Ostrowska E B 2018 *Journal of Turkish Science Education* **15(4)** 29-54
[23] Page K 2012 *Science Scope* **35(8)** 12-15
[24] Thompson F 2006 *International Education Journal* **7(4)** 553-559
[25] Oberoi M 2017 *IJSRE* **5(3)** 6274-6280
[26] Lin J W, Yen M H, Liang J C, Chiu M H, Guo C J 2016 *Eurasia Journal of Mathematics, Science & Technology Education* **12(9)** 2617-2646
[27] Gomez-Zweip S 2008 *Journal of Science Teacher Education* **19(5)** 437-454

2._Artikel_IOP_2019_Misconception_Analysis.pdf

ORIGINALITY REPORT

7%	6%	6%	6%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

MATCH ALL SOURCES (ONLY SELECTED SOURCE PRINTED)

9%

★ www.researchgate.net

Internet Source

Exclude quotes	On	Exclude matches	< 3%
Exclude bibliography	On		

2._Artikel_IOP_2019_Misconception_Analysis.pdf

GRADEMARK REPORT

FINAL GRADE

/0

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7