Journal of Physics: Conference Series

10th International Conference on Clustering Aspects of Nuclear Structure and Dynamics (CLUSTER'12)

IOP Publishing

Table of contents

Volume 824

2017

Previous issue Next issue

The 3rd International Conference on Mathematics, Science and Education 2016
3–4 September 2016, Semarang, Indonesia

Hide all abstracts

Accepted papers received: 13 March 2017
Published online: 18 April 2017

Preface

OPEN ACCESS 011001

The 3rd International Conference on Mathematics, Science and Education 2016

− Hide abstract View article PDF

The 3rd International Conference of Mathematics, Science, and Education (ICMSE) 2016 on Semarang, 3-4 September 2016 organized by Faculty of Mathematics and Natural Science, Semarang State University. ICMSE2016 provides a platform to the researchers, experts and practitioners from academia, governments, NGOs, research institutes, and industries to meet and share cutting-edge progress in the fields of mathematics and natural science. It is reflected in this year theme "Contribution of Mathematics and Science Research for Sustainable Life in Facing Global Challenge". The scope of this conference are Mathematics, Biology, Chemistry, and Physics,

We thank to the keynote speakers and all authors of the contributed papers, for the cooperation rendered to us in the publication of the conference proceedings. In particular, we would like to place on record our thanks to the expert reviewers who have spared their time reviewing the papers. We also highly appreciate the assistance offered by many volunteers in the preparation of the conference proceedings, and of course to the sponsors assisting in funding this conference, especially Research, Technology and Higher Education Ministry of Indonesia for supporting this conference.

The committee selected 71 papers from 129 papers presented in this forum to be published in **Journal of Physics: Conference Series** (Institute of Physics Publisher) indexed by Scopus. We hope that this program will further stimulate research in Mathematics, Science, and Education; share research interest and information; and create a forum of collaboration and build trust relationship. We feel honored and privileged to serve the best recent developments in the field of Mathematics and Science Education to you through this exciting program.

Chairperson,

Dr. Margareta Rahayuningsih

COMMITTEE

International Scientific Advisory Board

Edy Cahyono (*Chemistry Department, State University of Semarang*)

Rahim Sahar (*Department of Physics, Universiti Teknologi Malaysia*)

Uda Hashim (*Institute of Nano Electronic Engineering, Universiti Malaysia Perlis*)

Sutikno (*Physics Department, State University of Semarang*)

Masturi (*Physics Department, State University of Semarang*)

Putut Marwoto (*Physics Department, State University of Semarang*)

Yu-Cheng Hsu (*Department of Natural Resources and Environmental Studies, National Dong Hwa University*)

Takeshi Sakurai (*Department of Molecular Neuroscience and Integrative Physiology, Kanazawa University*)

Ibnu Maryanto (*Zoology Division Research Centre for Biology, Indonesian Institute of Sciences*)

Hans Dieter Barke (*Westfälische Wilhelms-Universität Münster, Institut für Didaktik der Chemie*)

Roberta Hunter (*Math Education, Institute of Education, Massey University*)

Anuradha Mathrani (*Computer Science and Computer Technology, Massey University*)

Arramel (*Chemical Physics, Department of Physics, National University of Singapore*)

Organizing Committee

Chairperson:

Margareta Rahayuningsih

https://doi.org/10.1088/1742-6596/824/1/011001

This research is motivated by the interest of researchers to the phenomenon of the ability of the preservice teacher to solve problems integral to how to anticipate. It is because a preservice teacher to solve the problem using the integral another way to illustrate a given problem then just finish it. Anticipation in this study consisted of (1) interpreting, (2) predicting a result, and (3) foreseeing an action. This research aims to know how the preservice teacher who have the cognitive style field independent in solving problems of integral. The method used is the method of test and interview. The test consists of an essay and interview used an unstructured interview. The results obtained by the preservice teacher to solve the problems of integral to analyse a given problem through an initial guess (predicting) then do the problem, not in detail (foreseeing), but the conclusions are true. Preservice teacher in this study can be categorised in explorative anticipation

https://doi.org/10.1088/1742-6596/824/1/012055 References

OPEN ACCESS 012056

Representation Elements of Spatial Thinking

F R Fiantika

− Hide abstract View article PDF

This paper aims to add a reference in revealing spatial thinking. There several definitions of spatial thinking but it is not easy to defining it. We can start to discuss the concept, its basic a forming representation. Initially, the five sense catch the natural phenomenon and forward it to memory for processing. Abstraction plays a role in processing information into a concept. There are two types of representation, namely internal representation and external representation. The internal representation is also known as mental representation; this representation is in the human mind. The external representation may include images, auditory and kinesthetic which can be used to describe, explain and communicate the structure, operation, the function of the object as well as relationships. There are two main elements, representations properties and object relationships. These elements play a role in forming a representation.

https://doi.org/10.1088/1742-6596/824/1/012056 References

OPEN ACCESS 012057

Creating Dynamic Learning Environment to Enhance Students' Engagement in Learning Geometry

Sariyasa

− Hide abstract View article PDF

Learning geometry gives many benefits to students. It strengthens the development of deductive thinking and reasoning; it also provides an opportunity to improve visualisation and spatial ability. Some studies, however, have pointed out the difficulties that students encountered when learning geometry. A preliminary study by the author in Bali revealed that one of the main problems was teachers' difficulties in delivering geometry instruction. It was partly due to the lack of appropriate instructional media. Coupling with dynamic geometry software, dynamic learning environments is a promising solution to this problem. Employing GeoGebra software supported by the well-designed

COMMITTEE

International Scientific Advisory Board

Edy Cahyono (*Chemistry Department, State University of Semarang*)
Rahim Sahar (*Department of Physics, Universiti Teknologi Malaysia*)
Uda Hashim (*Institute of Nano Electronic Engineering, Universiti Malaysia Perlis*)
Sutikno (*Physics Department, State University of Semarang*)
Masturi (*Physics Department, State University of Semarang*)
Putut Marwoto (*Physics Department, State University of Semarang*)
Yu-Cheng Hsu (*Department of Natural Resources and Environmental Studies, National Dong Hwa University*)
Takeshi Sakurai (*Department of Molecular Neuroscience and Integrative Physiology, Kanazawa University*)
Ibnu Maryanto (*Zoology Division Research Centre for Biology, Indonesian Institute of Sciences*)
Hans Dieter Barke (*Westfälische Wilhelms-Universität Münster, Institut für Didaktik der Chemie*)
Roberta Hunter (*Math Education, Institute of Education, Massey University*)
Anuradha Mathrani (*Computer Science and Computer Technology, Massey University*)
Arramel (*Chemical Physics, Department of Physics, National University of Singapore*)

Organizing Committee

Chairperson:
Margareta Rahayuningsih

Members:
Zaenuri
Hardi Suyitno
Wiyanto
Amin Retnoningsih
Wardono
Cepi Kurniawan
Isti Hidayah
Sudarmin
Endang Sugiharti
Aji Purwinarko
Dante Alighiri
Stephani Diah Pamelasari
Muhammad Abdullah

The Anticipation: How to Solve Problem in Integral?

2017 J. Phys.: Conf. Ser. 824 012055

(http://iopscience.iop.org/1742-6596/824/1/012055)

The Anticipation: How to Solve Problem in Integral?

E Yudianto[1, 4], St Suwarsono[2] and D Juniati[3]

[1]Department of Mathematics Education – University of Jember
[2]Department of Mathematics Education - Universitas Sanata Dharma
[3]Department of Mathematics - Universitas Negeri Surabaya

[4]Corresponding author: erfanyudi@unej.ac.id

Abstract.This research is motivated by the interest of researchers to the phenomenon of the ability of thepreservice teacher to solve problems integral to how to anticipate. It isbecause a preservice teacher to solve the problem using the integral another way to illustrate a given problem then just finish it. Anticipation in this study consisted of (1) interpreting, (2) predicting a result, and (3) foreseeing an action. This research aims to know how the preservice teacher who have the cognitive style field independent in solving problems of integral. The method used is the method of test and interview. The test consists of an essay and interview used an unstructured interview. The results obtained by the preservice teacher to solve the problems of integral to analyse a given problem through an initial guess (predicting) then do the problem, not in detail (foreseeing), but the conclusions are true. Preservice teacher in this study can be categorised in explorative anticipation

1. Introduction

The mathematics still often considered difficult for students. Many researchers mathematics education focus to improving students' ability in solving mathematical problems well. However, theyhave not yet to find out about students' ability in solving mathematical problems. Piaget's notion of anticipation is about intelligence. The Intelligence is a particular instance of biological adaptation and drew parallels between intellectual adaptation, and organic (i.e. physiological) adaptation, an essential characteristic of both is that strive towards equilibrium[1]. Organic adaptation refers to the readjustment of the sensorimotor structures in response to pressures from the changing environment for survival. Intellectual adaptation refers to the reorganisation of the conceptual structures to eliminate cognitive conflicts. Notion anticipation by[2] in anticipation, sometimes students need also foresight/predict any mental act performed.

Every step a person in solving the problem has a shadow of the future (certain final solution) followed by way of thinking and way of understanding that interacting in the brain although the foreseeing/predicting is false. This certain final solution means that every step/certain stage of a problem that is solved, then it has a temporary solution before next stage proceeding.

Notion of anticipation by identifying three general types of anticipation: (a) implicit expectations that are present in our action, e.g., the preparation and control of our movements when we grope in the dark; (b) explicit expectation of an outcome based on certain cause-effect relationships (e.g., predicting that it will soon rain upon noticing that dark clouds are covering the sky); (c) anticipation of a desired event and the means for attaining it (e.g., a child's foresight of the means to get his parent to give in, say by throwing a temper tantrum in public)[1][3].

The three constructs mental act, away of understanding (WoU), and way of thinking (WoT) form a triad, as depicted in Figure 1[4][5].

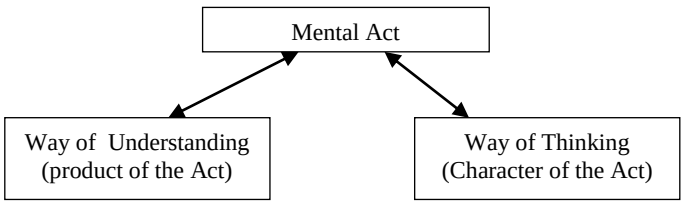


Figure 1. Harel's MA-WoU-WoT Triad

The researcher provide the triad of MA-WoU-WoT with a means analyzing based on student's statements and actions, what a student understands of a phenomenon or particular thing (i.e., what the product of the student's mental act is); and subsequently infer the manner (i.e., character of the act) in which the student engages a particular mental act to arrive at that way of understanding. Ways of understanding are neutral in the sense that it merely a certain product of a mental act and doesn't suggest what a student understands or doesn't understand. Nevertheless, a student's WoU may be desirable or undesirable about those that have been accepted by the mathematical community at large.

The students develop WoT only through the construction of WoU, and the WoU they produce are determined by the WoT they possess[6]. This principle importance of incorporating complementary WoU and WoT into cognitive objectives for instruction, which should help students reason independently and solve theproblem in mathematics. The mathematics teachers focus on imparting ways of understanding such as definitions, rules, algorithms, solutions, theorems, and proofs, without attempting to help students develop desirable WoT[6]:

> "We have observed that teachers often form, at least implicitly, cognitive objectives regarding ways of thinking, but their efforts to teach ways of thinking is often counterproductive because these efforts do not build on ways of understanding. Conversely, teachers often focus on ways of understanding but overlook the goal of helping student's abstract effective ways of thinking (WoT) from these ways of understanding (WoU)."

The implementation of WoU and WoT involves: (a) attending to students existing WoU and WoT; (b) identifying appropriate cognitive objectives, appropriate in the sense that they are aligned with student's current WoU and WoT, and that they preserve the mathematical integrity of the content; and (c) designing activities, with an understanding of the interplay among various WoU and WoT, to meet those objectives.

Teaching is the ways of thinking directly to students is unproductive[6]. According to the WoU and WoT [4], it is through the construction of WoU that students develop WoT; conversely, it is through the application of WoT that students develop their WoU. These WoU may be deficient initially but can be progressively refined towards those that are institutionalised (i.e., accepted as correct and useful by the mathematics community). Hence, the target WoT and WoU must complement each other, so that applying certain WoT will lead to the development of certain WoU, which may help to cultivate target WoT.Five anticipation that is: (1) impulsive anticipation is spontaneously proceeded with the idea that comes to mind without analyzing the problem situation and without considering the relevance of the idea to the problem situation, (2) interiorized anticipation is spontaneous proceeds with an idea without having to analyze the problem situation because one has interiorized the relevance of the anticipated action to the situation at hand, (3) analytic anticipation is analyzed the problem situation and establishes a goal or a criterion to guide one's actions, (4) explorative anticipation is explores an idea to gain a better understanding of the problem situation, and (5) tenacious anticipation is maintains and does not reevaluate one's way of understanding (prediction, problem solving approach, claim, or conclusion) of the problem situation in light of new information[2].

2. Method

The purpose of this research is to know how the preservice teacher who have the cognitive style field independent in solving problems of integral. The method used is the method of test and interview. The test consists of an essay and interview used an unstructured interview. During an investigation, the researcher acts as the main instrument that means where researchers cannotbe replaced by someone

else or something else. In this research did not manipulate a variable too, but preferably things that do preservice teacher at the time of data collection activities.Thus, this research used a qualitative approach [7]. Subjects in this research were preservice teachers fourth semesters of mathematics education with field-independent cognitive style.

3. Result and Discussion

The problem was given to astudent is:

Which the larger between $\int_0^1 x\,dx$ or $\int_1^2 x\,dx$? Explain, please!

The predicting and foreseeing these research that is: (1) predicting (a result) is the mental act of conceiving an expectation for the result of an event without actually performing the operations associated with the event, and (2) foreseeing (an action) is the mental act of conceiving an expectation that the leads to the volition for an action, prior the performing the operations associated with the action[2].

The subject began reading the problem with mumbling and then explained the purpose of the repeat question (not detailed) given aproblem. When researchers re-confirm the aim of the question, the subject try to theunderstanding of problem for 2 seconds and then answer that "*di soaliniditanyakanhasilyangterbesarantara integral kiri dan kanan*". This is consider preservice teacher respons.

P : Maksud soal apa mas? (menanyakan kedua kalinya)
F : Di soal ini ditanyakan hasil yang terbesar antara integral kiri dan kanan (menunjuk soal)
P : Integral kiri dan kananya?
F : Iya ... (berpikir 5 detik) hem ... maksudnya hasil integralnya pak
P : O hasilintegralnya ya?
F : Iya pak ... jadi jika ini diintegralkan .. dikerjakan yang kiri hasilnya sesuatu dan yang kanan juga hasilnya sesuatu nanti hasil keduanya dibandingkan. Yang paling besar itu jawabnya pak

In the prediction phase, the subject answered that the answer of that question is right. This means the best results is $\int_1^2 x\,dx$. The consider preservice teacher respons below.

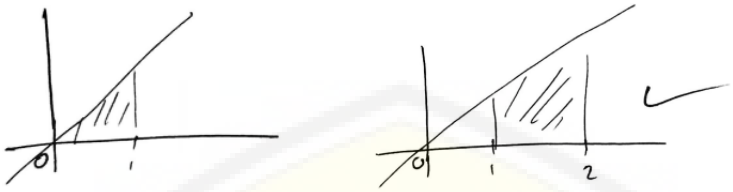
P : Kira-kira menurut mas hasilnya apa ya? ***Predicting***
F : Hasilnya .... (berpikir 10 detik)yang kanan pak yaitu $\int_1^2 x\,dx$
P : Trus
F : Maksudnya pak?
P : Dari mana masbisamenjawabitu?
F : Ini pak kalau kita gambar (subjek tidak menggambar tapi menjelaskan dengan memainkan tangannya) yang kiri melalui nol dan sampai satu sedangkan yang kanan juga melalui nol tapi dari satu sampai 2. Jadi lebih luas kanan.
P : terus
F : Ya jelas jawabannya lebih besar yang kanan pak.
P : O...o...

While foreseeing, the subject in finishing the problem for five seconds is donewhile thinking about the results obtained.It isevident from the answers of a subject that are integral to the right is larger. Then, when the subject asked to indicate the results which have been obtained, the subject began to explain the results that have been obtained (prediction). Consider the following interview excerpts.

P : Menurut pendapat mas, kira-kira jawaban dari soal itu apa mas? ***(Predicting)***
F : (berpikir5detik) yang kananpak
P : Yakin?
F : Yakin pak
*P : Coba tunjukkanmz! (**Foreseeing**)*
F : Ini yang integral kiri gambarnya seperti ini (gambar sebelah kiri dengan batas 0 sampai 1) sedangkan yang integral kanan gambarnya seperti ini (gambar

sebelah kanan dengan batas 1 sampai 2)
P : *Yakin mas?*
F : *Iya yakin …*

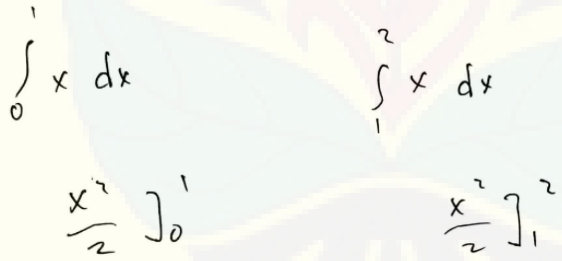
The subject explains the problem based on geometric shapes. Based on the excerpts of the interview above, subject verbally explains that "this integral picture left like this (*gambarsebelahkiridenganbatas 0 sampai 1*) while the integral right of the picture like this (picture to the right with a limit of 1 to 2)". The explanation of the subject can be seen in figure 2 below.



a b

Figure 2. Foreseeing of Subject (Geometry Shape)

In the Figure 2.a, subject describes the functions $\int_0^1 x\,dx$ and the figure 2.b; the subject describes the functions $\int_1^2 x\,dx$ based on geometric shapes. The subject compares both of these functions using a graphic illustration. He assumed that the area $\int_1^2 x\,dx$ wider than the area $\int_0^1 x\,dx$ So that the subject concluded that the function of the right side is larger than the function of the left side. Alsoby using the geometric form, the subject also calculations for convinced researchers on this problem. The result of the calculation subject can be seen in the following figure.



a b

Figure 3. Foreseeing of Subject

The subject explained that the calculation results together equal the results made of a sketch graph (Figure 2). When the subject is substituting the boundaries of function $\int_0^1 x\,dx$ and function $\int_1^2 x\,dx$ the subject goes on to explain the results to be obtained the larger is the right side. The importance of conceptual structures to solving the problem that "the basic and the most determine anticipation is a conceptual structure[8]. Building the confidence of students, [9] said that the importance of anticipating student responses in resolving the problem. This method is used to build a strategy on how students in solving mathematical problems. Furthermore, [10] said that current students need anticipation guide in solving a mathematics problem. However, students with high math ability are not necessarily anticipated analytically. These results were reported by [11] that student high mathematical ability internationalised anticipation. As a note, theunsuccessful anticipation of student thinking might reveal to teachers' need to rethink the ways in which learning occurred in the classroom. What is purely an error of students? It is also probably because of there are contributions from teachers. What is purely an error of students? No, it is also possible there are contributions from

teachers. This case was reported by [12] that equally important is a teacher's ability of further accommodate students learning when there is a mismatch between the teacher and student perspectives.

Based on above that can be concluded the subject using explorative anticipation. It can be seen from the way the subject matter of counting and drawing the illustrations in front of the subject face. Based on research reports [13] regarding the anticipation of explorative (1) read the questions more than once, (2) the finding might ask and what is known, (3) outlining the problem in detail, (4) incorporate criteria known, and (5) solve the problem by considering an alternative solution. Further results of the study [14] if subject explorative anticipation, then the subject will try (trial and error) even though in the end the subject right in understanding it.

4. Conclusion

Based on the above results it can be concluded that preservice teacher to solve the problems of integral to analyse a given problem through an initial guess (predicting) then do the problem is not in detail (foreseeing) but the result is true. The results of this research subject can be categorised in explorative anticipation.

5. References

[1] J. Piaget, , 1985 IL: University of Chicago Press,.
[2] K. H. Lim, 2006 in *Proceedings of the 28th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*, vol. 2, pp. 102–109.
[3] E. von Glasersfeld, 1998, pp. 1–10.
[4] G. Harel, 2006, pp. 1–26.
[5] G. Harel, 2014 *Intellectual Need*. Springer Science+Business Media New York.
[6] G. Harel and L. 2005 Sowder, *Math. Think. Learn.*, vol. 7, no. 1, pp. 27–50.
[7] L. J. Moleong, 2011Bandung: PT Remaja Rosdakarya.
[8] P. Cobb, 1985 *Educ. Stud. Math.*, vol. 16, pp. 111–126.
[9] S. Evans and M. Swan, 2014 *J. Int. Soc. Des. Dev. Educ.*, vol. 2, no. 7, pp. 1–31.
[10] A. E. Adams, J. Pegg, and M. Case, 2015. [Online]. Available: http://www.nctm.org/Publications/mathematics-teacher/2015/Vol108/Issue7/Anticipation-Guides_-Reading-for-Mathematics-Understanding/.
[11] E. Yudianto, *Kreano*, vol. 6, no. 1, pp. 21–25, 2015.
[12] D. Kotsopoulos and S. Lavigne 2008 *Int. Electron. J. Math. Educ.*, vol. 3, no. 1, pp. 1–23.
[13] E. Yudianto, "STUDI KASUS : KARAKTERISTIK ANTISIPASI EKSPLORATIF," vol. 6, no. 1, pp. 1–6, 2016.
[14] E. Yudianto, 2016 in *Seminar Nasional Matematika dan Pendidikan Matematika UNY*, pp. 327–334.