

Session 1**84 Participatory Design Approach (PDA) in the establishment of favorable learning conditions for teachers**S Agung¹¹UIN Syarif Hidayatullah Jakarta

Abstract. While teachers are striving for learning, favourable conditions for them to conduct learning are not easy to be established. This study uses Participatory Design Approach (PDA) as a means of establishing favourable conditions for teachers learning through the development of community of teachers. The PDA, rooted from a design-based research, is successful in involving educational actors in supporting the community. To structure the agreements of the actors, PDA is equipped with a model that map commitment of the actors with regards to Strategies and Intended Conditions for the community. Five strategies were found that the actors agreed upon for establishing a community to provide the favourable conditions for teachers' learning. The work of the actors through this PDA was considered a major achievement in the setting of this study. Details of the strategies are described. A further study is needed on the implementation of the strategies and to what extent the intended conditions are fulfilled. This study focuses on the establishment of a community of teachers as a means of providing favorable conditions for teachers' professional development activities in a policy of decentralization of education. The research took place in *madrasah* (Islamic schools) in a district of Indonesia. The Participatory Design Approach (PDA) was used as a research approach. The actors involved in this study, i.e. the ministry at the district level, principals, and teachers, together determined agreements on establishing a community of teachers. To structure the agreements of the actors, this study used a model that visualized Strategies (S) and arguments to fulfil Intended Conditions (IC) of the community to enable teachers' professional development activities, the SIC model. Using this SIC model for qualitative analysis of the data, five strategies were found that the actors agreed upon for establishing a community to provide the intended conditions for teachers' professional development activities. The work of the

actors was considered a major achievement in the setting of this study. Details of the activities of the actors and the strategies are described. A further study is needed on the implementation of the strategies and to what extent the intended conditions are fulfilled.

Keywords: Design Based Research, Participatory Design Approach, Teachers Community; Professional Development

100 K-12 Preparedness of the senior high school teachers in a selected private school

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Abstract. The study investigates the preparedness of teachers at a private school for the implementation of the K-12 Senior High School curriculum. To know this, inquiries were made to determine whether the teachers themselves perceived themselves as being prepared for the new curriculum and whether they actually possess the eligibilities and competencies required to satisfy the criteria for prepared teachers. Investigations were also conducted to identify the supports that the school provides which the teachers recognize as contributory to their preparedness for the implementation of the new curriculum. Results show that teacher preparedness is integral to the success of curriculum implementation.

Keywords: K-12, senior high school, teacher-preparedness, professional development

111 Implementing genre pedagogy in content instruction: lessons from Sweden

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Abstract. Drawing upon studies conducted in Sweden, this article discusses possibilities and limits of implementing genre pedagogy in content instruction. The wider educational concern is how knowledge of genre and language can be used to promote a deeper engagement with content knowledge. The linguistic theory underpinning genre pedagogy and the pedagogic-practical teaching/learning cycle is explained. Then, two empirical studies of genre-based teaching in Geography in grade 6 are reviewed, with a particular focus on the texts used as models for the students' own writing. The studies show two contrasting sides of genre-based intervention: one in which generic structures and other features of texts are used productively to engage with content knowledge and one in which attention to generic structure and logical connections comes at the expense of the negotiation of content knowledge. The article concludes with recommendations for implementing genre pedagogy.

Keywords: disciplinary literacy, genre-based instruction, geography teaching, elementary school, systemic-functional linguistics, second language instruction

112 Design research and deleuzian rhizome: A case of a/r/tographic researchC S Malilang¹¹Malmö Universitet

Abstract. The current socio-political development all around the world has given a rise to the view of education as multiplicities. This new perspective calls for new approaches as opposed to the classical arborial structure of knowledge in education. Creative Writing is chosen as a case study in this paper to exemplify the rhizomatic nature of knowledge and education. As a subject, Creative writing adheres to the principle of Deleuzian rhizome, enabling it to move in the multi-planar and multidisciplinary directions. Consequently, a specific design research that accounts for the rhizomatic principle is needed. This paper aims to present a case of a/r/tographic design research used to handle the non-linear and non-hierarchical structure in creative writing and education in general. Taking approaches to teaching, learning, and researching as 'practice', a/r/tography acknowledges the various multiplicities in education and allows for more spaces and openings for critical thinking by incorporating the concept of 'praxis' from Freirean Critical Pedagogy due to the lack of hierarchical construction.

Keywords: rhizome, multiplicities. Creative writing, Critical Pedagogy, a/r/tography

115 Build up school culture through implementation of education character

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Abstract. In a Globalization era, school has to build up a positive culture to prepare Millennial Generation in science, technology and character. The passion of the founders in the school's vision and mission became the basic for building up the school culture. Every year, there must be a changing of school components, a graduating class, a freshman who will take a new class, and also the teachers and staff. That conditions make them can't work in a same passion and achieve school's goals. Building up the school culture means to build up habits in applying school's values (religiosity, nationalism, independence, mutual cooperation, and integrity), carrying out school rules, having work's habits to achieve the goals of the school. Character education in curriculum 2013, provides a space for school to build up the school culture through the habituation of character education and being a role model. Starting with respect, curiosity, perseverance and courage school culture can be stronger than the previous year and the all school components can bring good influences in the school.

Key Words : Education; School Culture; Character Education; Habituation.

127 Reflective Thinking ability of teacher candidate students based on ability level and gender

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Abstract. The purpose of this study was to describe the reflective abilities of teacher candidate students based on their level of ability and gender. This research is a qualitative descriptive study. The subjects in this study were TMA students in the 7th semester of the 2018/2019 academic year, which amounted to 6 people selected by purposive sampling. Subjects are divided into several groups based on high, medium and low ability levels and by gender. The instruments used in this study were tests and interviews. To see the validity of the research data was carried out triangulation (reducing data, presenting data in narrative form and drawing conclusions). Based on the results of research and discussion it can be concluded that 1) male and female students at both high, medium and low ability levels have been able to interpret a case based on the mathematical concepts involved even though it is not yet complete, 2) on indicators identifying mathematical concepts or formulas that involved in the question is not simple, male and female students of high and medium level have been able to do it, but at a low level students are still unable to identify mathematical concepts or formulas but correct calculations, 3) students are generally able to solve mathematical problems even though they have not complete both at high, medium and low levels and 4) at high and medium ability students both male and female are incomplete and still wrong in generalizing and analyzing generalizations, while in low ability students have not been able to generalize and analyze generalizations.

Keywords: the thinking ability, reflective thinking, ability level, gender,

130 Contribution of teacher's teaching skills and students' intrapersonal intelligence toward metacognitive awareness of students in state vocational school in Blitar

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Abstract: Vocational High School (VHS) graduates who can study independently will become lifelong learners who are responsive to change so they can compete in the workforce of the revolutionary era 4.0. But the learning process at Vocational School is still not paying attention to the development of high-level thinking skills of students. This is in line with the opinion of Mukhadis (2013: 34) that the implementation of learning in the field of technology is still less encouraging which has an impact on the lack of development of individual abilities to develop high-level thinking skills, namely metacognition. Metacognitive awareness of Vocational students is still not suspected because of several aspects, that is internal and external aspects. Internal aspects are factors that influence students from themselves, one of them is intrapersonal intelligence. Then the external aspect is a factor that influences from outside the student's teaching skills. Given the importance of this metacognitive awareness, the authors conducted a study on the contribution of teacher teaching skills, intrapersonal intelligence to the metacognitive awareness of vocational students in computer engineering and networking packages in Blitar City. This study aims to determine how much the contribution of teacher teaching skills and intrapersonal intelligence of students to the metacognitive awareness of vocational students in computer engineering and network expertise packages in Blitar City. The type and analysis of data in this study are included in quantitative research. The number of samples used was 57 students in class X. Data collection techniques for variable teaching skills, intrapersonal intelligence and metacognitive awareness using questionnaires. Data analysis includes description and multiple regression. The results show: (1) There is no significant contribution to partial teaching skills to the metakognitive consciousness; (2) There is a significant contribution to the contribution of students ' intrapersonal intelligence partially towards the students ' metakognitive awareness of 44.22% and (3) there are significant

contributions to teacher teaching skills and intrapersonal intelligence of students To the students ' metakognitive awareness of 52.8%.

Keyword: *teaching skills, intrapersonal intelligence, metacognitive awareness*

136 The appreciative conversation in classroom reflection session to promote communal solidarity

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Abstract. The exchange structure of the appreciative conversation implemented in classroom reflection session makes students capable to set the disposition to listen to the other person respectfully, through which an echo or new inspiration or movements in the person listening builds up the new way of perceiving things. It requires, however, that the conversation should be designed for the full participation of the group members, that each member communicates his own experience and ideas simply and clearly and that each is helped to appreciate what touches him/her most deeply. This paper is to explicate the implementation of the appreciative conversation model in the classroom reflection session and its impact on classroom communal solidarity. The three-round-conversation based reflection model has been designed for five weeks use and has been printed in a book entitled *Panggilan Guru: Tuntunan Refleksi Program Studi Pendidikan Profesi Guru* (L. Suharjanto, S.J., February 2019). The design has been implemented daily among 105 in-service teachers who have been attending the Teachers Professional Education Program at Sanata Dharma University, Yogyakarta between 8 March to 28 April 2019. To obtain the data about the significance of the three round conversation model for the promotion of communal solidarity, the writer distributed two sets of questionnaires among those 105 in-service teachers. The first set was distributed on the third week of the implementation of the design and the second set was distributed on the fifth week. Both sets contain different questions. The writer also conducted four sessions of focus group discussion among 27 participants on 13 April 2019. The collection of both quantitative and qualitative data is grouped, reviewed and analyzed. The research result shows that the three round conversation was highly appreciated among participants for facilitating them with a technique of conversation that promotes full participation, equality, and listening attitude. The design also highly facilitated the in-service teachers to improve self-awareness (self-knowledge), to cultivate hospitality, and to improve genuine empathy and

sympathy among members of the classroom. To conclude, the three round conversation is an effective and easy learnt model to conduct reflection session designed for appreciative atmosphere that promotes communal solidarity.

Keyword: Reflection; Appreciative Conversation; Three Round Conversation; Full Participation; Communal Solidarity

138 Student perspective on teaching factory : To improve entrepreneurship for revolution industry 4.0

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Abstract. The industrial revolution 4.0 that allows the development of the industrial world and some of the functions of workers to be replaced by technology makes the importance of entrepreneurial interests grown since the school period, especially at the level of the Vocational High School. This study aims to obtain an overview of the implementation of productive learning with the teaching factory learning model, students' perceptions of learning and how far the success of the teaching factory program in the interests of child entrepreneurship is one of the goals of the teaching factory. This evaluative study uses the CIPP model (Context, Input, Process, Product). The subjects of this study were students of class XI Tata Boga SMK N 1 Kalasan using interviews, observations, and questionnaires.

Keyword: Vocational education, student perspective, teaching factory

160 Collaborative learning concept for reducing the act of cheatingM V E Mulatsih¹¹Sanata Dharma University

Abstract. Based on the **result** of interview, none of the students from two Critical Listening and Speaking II (CLS) classes claimed that they have not cheated before. The reasons might vary from the difficulty of materials, lack of confidence, the importance of getting good score, bad preparation, and the trend of millennials. Basically, CLS II course was designed to improve students' critical thinking, but it could not be reached when students tended to cheat. For solving that problem, this article proposes the change of learning concept from individual learning process into collaborative learning process when students do not need to cheat because after they finish doing the exercise, they can share the result and criticize their friend's work. From analysing the result of observation, document analysis and questionnaire, students could avoid the act of cheating. Furthermore, they could help their friends' difficulty for their grammar, content, and the organization of the idea.

Keywords: collaborative learning concept, cheating, students.

164 Design of improving professionalism for teachers

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Abstract. The development of education at the international level, according to the results of the United Nations Educational, Scientific and Cultural Organization (UNESCO) Survey, that the quality of Indonesian teachers is ranked 10th out of 14 developing countries. Some studies reveal that there are still many teachers who are not professional in carrying out their tasks and functions, starting from planning, implementation and assessment ability. This research conducted a series of learning process activities to make teachers professional with a 3 P pattern (Training, Implementation, Mentoring) and the application of the LSLC system in collaboration with several teachers in preparing the tasks of the Share task and Jumping task. This is the basis of a design of learning that the teacher must do. The research design was chosen as the right way to achieve the objectives and carried out in 3 stages, namely Preliminary, Teacher Experiments and Retrospectives. This study involved 30 mathematics teachers spread from 4 Public High Schools. The results of the study show that with the 3P pattern through the application of LSLC, teachers are better prepared to prepare for learning until the learning and assessment process is much better, and teachers' professional abilities increase and have potential effects in the future

Keywords: LSLC system, Mathematics Learning, Design Research

180 The development of constructivism-based student worksheets

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Abstract. This study aimed to produce a constructivism-based Student Worksheet (SW) based on a valid, practical, and effective Real Analysis course. The methodology used in this study was a research design with the Plomp model, which was divided into four phases, namely preliminary investigation, design, realization/construction, and test, evaluation, and revision. The research subjects were Mathematics Education Students of FKIP ULM who took Real Analysis course in the short semester of 2016/2017 and the odd semester of 2017/2018. These students were involved during the learning process with a constructivism approach. Data collection techniques used were observation, questionnaires, and tests. The validity of the SW was based on the results of the validator's assessment of the SW and research instruments from aspects of content, language, writing, appearance, and benefits as well as comments/suggestions from the validator. The practicality of the SW was based on the results of the SW implementation observations at all meetings. The effectiveness of SW was based on the results of observation of activities, responses to SW, and completeness of student learning outcomes. The data analysis technique used was descriptive qualitative analysis to analyzed data in the form of notes, suggestions, or comments based on the results of the assessment on the validation sheet, observation sheet, student questionnaire, and descriptive statistical analysis to analyze the data in the form of scores from the results of validation, observation, questionnaire student responses, as well as learning outcomes tests. The validation results showed that the SW and research instruments met the validity criteria. Two trials in the field, aimed at measuring the practicality and effectiveness of SW, showed that the results of the first SW trial only met the criteria for validity and practicality, while the effectiveness criteria had not been fulfilled because students' mastery learning had not met the criteria set. The results of the second SW trial showed that SW had fulfilled the valid, practical, and effective criteria. Based on the research results, it can be concluded that the

SW is worthy of being used in the Real Analysis learning process.

Keywords: *design research*, student worksheet, constructivism

191 Effects of problem-based learning with character-emphasis and naturalist intelligence on critical thinking and curiosity

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Abstract. This study aimed to investigate the effects of Problem-Based Learning with Character Emphasis and naturalist intelligence on the students' critical thinking skills and curiosity. This study was conducted at Islamic Senior High Schools in Mataram and it employed 3x2 Treatment by Level design. The treatments were given to both groups of the subjects the study; the students with high naturalist intelligence (B1) and the students with low Naturalist Intelligence (B2), using the Problem-Based Learning with Character Emphasis (A1), the Problem-Based Learning (A2), and the Regular Learning (A3). The subjects of this study involved three randomly selected groups from two Islamic Senior High Schools in Mataram. The grouping of the students by B1 and B2 was based on the rank of their naturalist intelligence test scores (30% taken from the group with high naturalist intelligence and 30% from the group with low naturalist intelligence). The data on the students' naturalist intelligence and critical thinking skills were collected through test and the data on the students' curiosity were collected through self-assessment and observation sheets. The data were analyzed using manova at 5% significance level. The results of the study showed that the Problem-Based Learning with Character Emphasis affected the students' critical thinking skills and curiosity, naturalist intelligence affected the students' critical thinking skills, but it did not affect the students' curiosity, and the interaction between the Problem-Based Learning with Character Emphasis and naturalist intelligence did not affect the students' critical thinking skills and curiosity.

Keywords: problem-based learning with character emphasis (PBL-CE), problem-based learning (PBL), regular learning (RL), naturalist intelligence, critical thinking skills, curiosity

198 Reflective thinking skills analysis of Engineering students in learning statistics

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Abstract. Reflective thinking is known as assessing what they know, what they need to know, and how they bridge that gap during learning situations. Relating what students knew with what they learn today is not easy, sometimes they forget or just cannot make a connection between it. This study will analyse how the students actively participating in reflective thinking by creating project based learning on statistics lesson based on design research. Thirty-nine engineering students, in a group of four, were asked to make their own data, analyse and transfer it into a poster to inform the readers about the use of statistics in daily life. This study used the measurement of reflective thinking scales by Kember et.al 2000 to analyse students answer through the worksheet and Instructional Activities. The instructional activities succeed to reveals students thinking of all four scales; habitual action, understanding, reflection and critical reflection. Furthermore, it also discovered the misuse of some terms when used in daily life.

Keywords: Reflective Thinking Scales, Design Research, Project Based Learning, Engineering Students, Statistics

201 Development of video with discovery learning models as a reference for teachers in implementation curriculum 2013S Salam¹¹Universitas Riau

Abstract: Discovery Learning Model is one of the recommended models to be used for Curriculum 2013 implementation, yet many teachers have difficulty in using this model because of no experience and need the model. The purpose of this research is to develop Video for a teacher as a reference in implementing Discovery Learning Models. This development research uses the FOUR-D model with stages Define, Design, Develop and Dissemination. This Video uses the teacher as a model with real class situations. Learning is done by the teacher using the Discovery learning model. The video shows the stages of discovery learning model that the teacher must do. The video was displayed to 28 mathematics teachers and they were asked to fill out a questionnaire to provide an assessment of the video in terms of format, content, and language. The results of the questionnaire analysis showed an average score of 3.64 for the format aspect, 3.67 for the content and 3.59 for the language aspect. The teachers mentioned that this video helps them to learn the implementation of Discovery Learning. This video can be used by any teacher especially mathematics teachers as the model in using Discovery Learning.

Keywords: Video of learning model, Discovery Learning

202 A content and authorship analysis of south east asia design research international conference

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Abstract. South East Asia Design Research International Conference (SEA-DR IC) has been held for seven times to date. It is important to the educational design research community to know the research areas that emergence in the conference. Therefore, this study aims to analysis SEA-DR IC proceedings' content using a text-mining tool in identifying key concepts and themes emerging from 2013 until 2018. This study also employs social network analysis (SNA) to analysis the authorship network in the conference. Implications of this study with regard to research areas and collaborative research then will be presented.

Keywords: Design research; authorship analysis; content analysis

267 Developing a tolerance attitude through dialogue with people of other religions in religious education

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Abstract. Indonesian society is marked by a variety of religions and beliefs. Therefore, in our pluralistic society, interreligious dialog is a necessity for building together the society of peace and fraternity desired by all Indonesian people. However, conflict between religious groups sometimes happens in some places in Indonesia, like Ambon, Lombok, and Poso. Meanwhile, the fundamentalism and radicalism have arisen, adding the complexity of the problems. The minority groups, like Ahmadis, Protestant, Catholic and Chinese, have become the target of the extremists or the fundamentalists. In these situations, we need to develop a tolerance attitude through religious education. The purpose of this work is to educate students to have a tolerance attitude towards people of other religions. This work uses practical-experiential approach (action research) in religious education. The students are invited to have experience in having dialogue with the people of other religions. The relevance of this approach is to have the students direct experience of relating with the people of other religions. Many students have no such experience. Therefore this experience will open their mind that having dialogue with people of other religions is possible. The result of this approach is very positive. Many students become more open to people of other religions. Many students become more tolerance with other people. As conclusion, this approach is very effective to make students having a tolerance attitude towards people of other religions. Therefore, practical-experiential approach can become one of the methods to develop a tolerance attitude towards people of other religions.

Keywords: Design Research; Higher Education

307 The students development of student worksheets using integrated models with character loads at lower grades class

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Abstract. This research is motivated by problem found at the beginning of the observation that the student worksheets used in schools have not been optimal in helping the student improve attitudes, knowledge, and psychomotor, and even less activating student in learning. Therefore it is necessary to develop student worksheets that can involve active students in obtaining facts and concepts holistically and meaningfully. Learning expected from the 2013 curriculum is that learning must be integrated. The research objective was to develop the student based on integrated models that valid, practical, and effective. This development research uses 4D model consisting of 4 stages, namely defining, designing, developing, and distributing. The research subjects were first grade students at SDN 05 Padang utara. The results showed the observation in the form of questionnaire state that the student worksheet is practical. Student worksheets have been effective in terms of improve the student activities and student learning outcomes.

Keywords: Student worksheets, integrated model.

309 Validating the Indonesian version of reflective thinking questionnaire and investigating of the relationship between pre-service teachers' reflective thinking and academic achievement

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Abstract. Teacher training process must stimulate reflective thinking skill because this skill is crucial to improve teaching and learning capability. Indonesian version of standardized instrument to assess the development of reflective thinking skill in higher education, include teacher training program, is still limited. This research aimed to adapt Reflective Thinking Questionnaire (RTQ) to Indonesian version, investigate its quality, probe pre-service chemistry teachers' level of reflective thinking, investigate relationship between reflective thinking and GPA, and compare between 1st year and 4th year college students' reflective thinking skill. RTQ is a 16 items 5 point Likert scale questionnaire purposed to measure reflective thinking in 4 subscale levels: Habitual Actions (HA), Understanding (U), Reflection (R), and Critical Reflection (CR). Each subscale was assessed by 4 items questionnaire. With the help of four science education experts who are fluent in both languages, RTQ was first translated into Indonesian and then its empirical result were substantiated. The translated RTQ was given to 147 pre-service chemistry teachers from an university in Riau Islands, Indonesia. Data were analyzed using Rasch model method. Result indicated that the instrument and all 16 items nicely fit the Rasch model. The data also showed good reliability (Cronbach alpha .84). Result of this research also indicated that Understanding received the highest mean (17.70), followed by Critical Reflection (16.50), Reflection (16.48), and the lowest mean was Habitual Action (14.60). Non-parametric analysis was used because normal data distribution is not observed. Based on Wilcoxon Test result, significant difference between all subscales levels were detected, except for CR-R. Spearman Correlation result indicated that correlation between reflective thinking and GPA was not significant. Based on Mann-Whitney Test result, significant difference between 1st year and 4th year college students' reflective thinking was only detected in CR. The implications relate to

reflective thinking skill were discussed to improve the quality of learning process and its' evaluation.

Keywords: reflective thinking questionnaire, pre-service teacher, academic achievement, rasch

312 An ecological model of pedagogical competence school counselingS Hartini¹, C P Bhakti¹, M A N Ghiffari¹, B S Aji¹ and C Kurniasih¹¹Universitas Ahmad Dahlan

Abstract. The purpose of this paper is to provide a reference to the pedagogical competency model of teacher guidance and counseling, namely an ecological model. Pedagogic competence is a competency that must be possessed by teachers today, especially school counselor/guidance and counseling teachers. But in reality, there are still many teachers who pay little attention to pedagogical competencies in the learning process or service delivery process, so there are still many teachers who provide services or learning that do not think about the meaning and essence of the learning process. Whereas, pedagogical competence should be synergized with guidance and counseling teachers because pedagogical competence is the ability of educators to manage the learning process or service delivery which includes the understanding of students, designing and implementing learning or in this case providing counseling services, evaluating results, and developing students to actualize the various potentials they have. Therefore this ecological model is one of the models that can be used in the pedagogical competence of the teacher's guidance and counseling. Ecological models are approaches that take ecological concepts in general, but the ecological approach to counseling is related to humanity. The ecological model seeks to understand human interconnection and everything related to it, the purpose of this model is to create and maintain a balanced human and environmental synergy. Thus, the ecological model in pedagogic competence emphasizes the understanding of guidance and counseling teachers in synergy with various components of pedagogical competencies that guidance and counseling teachers need to have. Therefore, if this ecological model is applied in the pedagogical competence of the guidance and counseling teacher, it is expected that the teacher's pedagogical competency is not only qualified but can also develop optimally. This writing uses the literature review method, here the author uses a variety of trusted sources where correlation between models is

sought. ecology and pedagogical competence of teacher guidance and counseling.

Keywords: Ecological Model, Pedagogic Competence, School Counseling, Teacher

316 Anxiety: How was the process of the undergraduate students who were in visualization level in constructing the definition?

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Abstract. Definition is important mathematical construction which had been recorded as a challenging topic for teacher and students. This research showed the illustration of anxiety that happened on undergraduate students of Mathematics education who were in visualization level of thinking in constructing quadrilateral definition and definition form that had been successfully recorded. The analysis was done to determine the anxiety's indicator that appeared and indicators of quadrilateral's definition. Triangulation method was done to compare subjects' worksheet, observation, and interview. The result showed that anxiety was appeared when subjects started to construct the definition of quadrilateral so that the definition that had been defined was not efficient.

Keyword: Geometrics' Anxiety, Quadrilateral's Definition, Visualization, Van Hiele's Theory

320 The influence of implementing Auditory Intellectually Repetition (AIR) learning model based on learning community to students' creative thinking skills

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Abstract. The study aims at knowing the influence of implementing Auditory Intellectually repetition (AIR) learning model based on learning community to students' creative thinking skill. The research subjects were students of Lumajang MTs Negeri 1 students in class VIII B as the experimental class and class VIII A students as the control class. Experimental and Experimental Quasy are used as quantitative research designs. Data collection methods are observation, pre-test, and post-test. Instrument testing and analysis were carried out before conducting tests to measure discriminatory power, difficulty level of test items, reliability, and validity. Analysis of the data in the affective and psychomotor domains used descriptive techniques, cognitive domains using prerequisite testing, similarity of initial ability averages, and hypothesis testing. The results showed that the learning instrument has reached values above 4.0 so that they are declared valid and feasible to be used for the learning process with the aim of exploring students' creative thinking skills. The application of the Auditory Intellectually Repetition (AIR) learning model based on learning community has a positive effect on the students' creative thinking skill. The average achievement aspect of students' creative thinking skills in the experimental class is higher than the control class.

Keyword: Auditory Intellectually repetition (AIR) learning model; learning community; students' creative thinking skill

327 Developing teachers professional development programs using design research method: developng teachers' PCK

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Abstract. Since the introduction by Shulman in the early 1980s, Pedagogical Content Knowledge (PCK) has been identified as a key teachers' knowledge that influence teachers' classroom activity. The identification of this particular type of knowledge developed awareness that the improvement of teachers' competencies should take the teachers' PCK into account. If the teachers' classroom activities need to be improved, the professional development programs should also aware of the teachers' knowledge and beliefs related to their daily classroom practices. This research was aiming at developing a teacher professional development model with the development of PCK as a main improvement indicator. The research implemented Design Research method. The participants of the research were science teachers and mathematics teachers of Junior High School in Yogyakarta participating in the STEM approach project. The data collected during the processes of preparation, implementation, and evaluation-reflection of the implementation of STEM approach through interviews, focus discussion group, and questionnaires. The research resulted a model of teachers' professional development program that focuses not only on the teachers competencies but also the teachers' knowledge that drive their activities in the classroom. One of the main features of the model is on its time allocation dedicated for teachers to be aware of their value and knowledge system and to reflect on the extent to which their value and knowledge system influence their teaching practices.

Keyword: Design Reserach, PCK, Teacher Professional Development

329 Provoking students' creative thinking in learning volume of solid of revolution through project-based task

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Abstract. Learning paradigm has been shifted from core subject-based to skill-based. Teachers must realize this change and have a great preparation to serve their students to meet the needs of the future works. One of four famous skills (4Cs) that nowadays become more and more important goals to achieve in learning is creative thinking. To introduce and give a real example of a learning that promote creative thinking to their students in the future, it is necessary for student teachers to experience the learning that provoke students' creative thinking themselves. This paper aimed to describe the implementation of project-based task designed to promote students' creative thinking in learning volume of solid of revolution. This is a design research that was conducted to 37 student teachers of mathematics education study program who enrolled Integral Calculus subject. The design experiment in this study was conducted in three phases, i.e. 1) preparing the experiment, 2) the design experiment, 3) the retrospective analysis. The data obtained were analyzed by confirming the actual learning trajectory with the hypothetical learning trajectory (HLT). Based on the retrospective analysis the project-based task was able to provoke students' creative thinking. Moreover, the task and activities being experienced could be used to support students to have better understanding to the topic.

Keyword: creative thinking; project-based task; volume of solid of revolution; design research.

354 Development of data presentation instructional material based on local wisdom for preservice teachers

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Abstract. Local wisdom has pedagogical value because it aims to regulate behavior that is beneficial to the common interests of the community. Thus, this research aims to develop teaching materials of data presentation using local wisdom for preservice teachers. The feasibility of teaching materials were evaluated based on their validity and practicality. The design of this research was four-D-model, consist of Define, Design, Develop, and Disseminate. Data of this research was analyzed by quantitative descriptive. The result of this research were as follows: (1) The teaching materials that were developed which consist of lesson plan, worksheets, power point media, and assessment; (2) The instructional materials developed were valid with good category in content, construct, language, empirical validity, and contain principles of local wisdom; (3) The lecturer implemented the lesson plan well, the increased preservice teachers activities were indicated by doing investigation, analyzed the result of investigation and presentation of final product. Based on the results of the research, the teaching materials of data presentation were empowering preservice teachers' skills in data presentation using local wisdom context.

Keywords: development, teaching materials, data presentation, local wisdom

360 Using context from PISA task in problem generation and reformulation: Teachers' experience in problem posing activities

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Abstract. Designing context-based mathematics problem like in PISA is recognised as a challenging activity for teachers. This paper aims to report the experiences of a group of secondary mathematics teachers in designing context-based mathematics problems within an innovative training program which use problem-solving and problem-posing activities in deepening understanding on context-based problem. As many as 40 teachers from Jember city were involved in the program. Within five days training, the teachers were encouraged to have workshop in working out some problem-solving tasks and learning problem posing technique, namely problem generation and problem reformulation. Data were collected from teachers' designed items of context-based task produced in one hour workshop using contexts selected from two PISA task released items in 2012. Results point out that teachers designed around 8-10 items for each of problem generation and problem reformulation task. The challenges experienced by teachers were around in turning these contexts into an appropriate problem satisfying PISA framework such as regarding authenticity of context use, language structure, plausibility of the solution of the problem, and sufficiency of information in the problem designed. The implication of this study is to support teachers to design and use their own context-based mathematics task within their classroom teaching.

Keywords: teacher education; problem posing; context-based task

374 Designing division operation learning in elementary school by “JAMURAN” traditional games

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Abstract. Jamuran is a traditional Javanese game that is still popular among children. In this study it was shown how Jamuran traditional games could be used to help students understand integer division operations, including remaining division, from the informal (concrete) level to the formal (abstract) level. This research is a design research which includes stages of preliminary design, teaching experiments, and retrospective analysis. The results of the study show that using the commands “payung-n” (payung = umbrella) and “sepur-n” (sepur = train) in the Jamuran game students can find the concept of remaining division can express their opinions verbally and in writing, and have a relatively good mathematical disposition.

376 The decision-making process for a learning model: An efficiency analysis

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Abstract. Decisions are an important part of life. Likewise in education, in this case for mathematics education teacher candidates who will choose the topic for their research related to the learning process. Making a decision for a single criterion is a difficult thing to do in which the decision making related to the complexity of a topic like learning model or strategies. Teacher candidates consciously make decisions on the priority of learning designs with the aim of increasing achievement and providing a better learning environment. Sometime decisions may involve several objectives leads to multi-criteria decision-making problem or multi-criteria optimization. Teacher candidates have to decide the main objective such as knowledge development from learning process or direct the selection of activities that will facilitate learning. Operation research is only the means for making a decision and provides the data to teacher candidates as the decision maker. Several decisions are analytical and need data. Quantitative data is used in making the decisions to the teacher candidates can find appropriate decision as a sign of learning optimal conditions. This research uses Data Envelopment Analysis (DEA) as an alternative tool in the context of multi-criteria decision analysis to evaluate the performance of the learning model choose by the teacher candidates as Decision Making Unit (DMU)

Keywords: DEA, Efficiency, Decision Making Unit

379 Ignatian pedagogy learning model for a whole-person education of sanata dharma university's pre-service english teachers

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Abstract. This study aims to develop a whole-person education learning model for the pre-service English teachers using the 3Cs of Ignatian Pedagogy: Competence, Conscience and Compassion. There is a high demand for the 21st century quality English teachers in Indonesia, particularly in the use of technology in teaching, since most of the learning processes are still teacher-centered. Therefore, competent, conscientious and compassionate teachers who are able to integrate technology and create a student-centered learning are badly needed. This study will employ Educational Research and Development (R&D) method by Borg and Gall (1983). There are ten steps in the Research and Development method, namely: (1) Research and Information Collecting, (2) Planning, (3) Developing Preliminary Form of Product, (4) Preliminary Field Testing, (5) Main Product Revision, (6) Main Field Testing, (7) Operational Product Revision, (8) Operational Field Testing, (9) Final Product Revision and (10) Dissemination and Implementation. This study will be conducted from July 2019 to June 2020, using 90 students from the English Language Education Study Program of Sanata Dharma University as the participants. In addition, there will be two expert validators who are expert in technology implementation and innovation for classroom use as well. The developed learning model using flipped learning approach is expected to be able to empower and nurture students' competence, conscience and compassion in using technology. It is planned to be disseminated in Sanata Dharma University and also in Widya Mandira Catholic University, Kupang for greater benefit.

411 Trial of design means-end analysis learning model based on local cultural wisdom to improve communication ability and mathematical abstraction of middle school students in north Sumatra

I Dewi, N Siregar and A Andriani

Abstract. Student's mathematical communication skill are very necessary for learning mathematics. Another aspect of the student learning process is the need to know and develop the wisdom of local culture in their daily lives. This is because students are expected to be a smart generation and still respect their own culture that they will use as life guidance. However, the problem is how to instill the wisdom of local culture in learning mathematics? Based on these problems, the researcher designed a mathematical learning model that incorporated the wisdom of local culture in mathematics learning. The purpose of this study is to test the Means-Ends Analysis learning model based on the local Cultural Wisdom that has been designed. This learning model elaborates on the wisdom of local culture in mathematics learning. The purpose of this learning model is to improve communication skills and mathematical abstraction skills of students in grade 7. This research is development research with the subjects are Year 7 students of junior high school in the City of Berastagi and Perbaungan. During undertaking, this learning model students feel happy, and they said that with this learning model, they found it easier to understand the mathematical concepts that they learn. However, the teacher has difficulty in elaborating the problem of mathematical abstraction with the cultural, but the teacher said that the students become easy to communicate their mathematical abilities.

Keywords : Mean End Analysis, communication skill

421 Environmental conservation education model with implementation of islamic values in islamic boarding school Nurul Haramain NW Narmada West Lombok - Indonesia.

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Abstract. This research aims at discovering an environmental conservation education model as viewed from such aspects as Islamic values. The method of this research is qualitative with the phenomenology of existing models. The research is conducted in Islamic boarding school Nurul Haramain (PPNH). The data are collected using deep interview, document study, and participative observation. The data are analyzed by reducing them, displaying them and verifying them. The research results indicate that the environmental conservation education takes the form of basic, instrumental and final values. The discovered model is presented as follows: a) the owned basic values; b) the used strategy and method; c) behaviors arising out of the environmental conservation education.

Keywords: environmental conservation, islamic values, education model, implementation

462 Javanese calendar as context to learn number pattern and least common multiple

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Abstract. The main goal of this research is to investigate how Javanese calendar and primbon could be used as context to learn number pattern, least common multiple and modular arithmetic for high school students. This article is the first step for the research, as this research only just reach preliminary stage at this point, which consist of validation on worksheet, one to one and small group to gain data about students' understandings regarding connection between contexts as student perception with mathematics learning which they had learned. This research using Realistic Mathematics Education (PMRI) approach. The problems which given in this research was based PISA framework. The methodology of this research is using Design Research. This research produce valid and practical problem, module for learning material and support students to understand more about modular arithmetic even as the learning material itself only just enrichment in national curriculum.

Keywords: Modular Arithmetic, Design Research, Javanese Calendar, Primbon, PMRI.

453 Developing problem with "choosing services" context to promote student's proportional reasoning

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Abstract. This study aims to develop valid proportional reasoning problems of proportion material. The research involved seventh-grade students of the junior high school in Palembang. This research is a design research with development studies type. The validity of the problems discovered from expert review in validation process. Problems validated based on content, problem has been accord to ratio and proportion learning in seventh-grade; construct, the problem require the student's proportional reasoning and accord to abilities of the seventh-grade students; and language, the problems use of enhancing spelling, could be understood, and didn't have variety of meanings. Problems are designed using the context of choosing services ask students to determine the time needed to complete customer orders from the variety of information provided. Problems using Choosing service context can indicate how student's proportional reasoning. Problems developed indicate that students had different strategies and do not refer to the comparison formula, but with reasoning and the use of a ratio table.

Keywords: Design Research, Proportion, Proportional Reasoning

429 Design research for business introduction subject: developing think pair and share method to improving student's sharing skills and student's participation skills

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Abstract. Discussion is one of method in learning process to provide direct experience for students. Through discussion, students can develop their sharing skills and participation skills. However, in a discussion group, sometimes there are students who are too active or dominant, while there are students who are too passive and do not contribute to discussion groups. This situation makes the discussion ineffective. In business introduction subject in Economic Education Study Program, Sanata Dharma University, one of methods used by lecture is group discussion. Lecturer develop design research. This design research aims to developing think pair and share methods to improving student's sharing skills and student's participation skills. This design research is divided into three stages: design, implementation and evaluation. At design stage, researchers design learning using think pair and share method. Through this method, it is expected that group discussions conducted by students can be effective. No student is too dominant and no student is too passive in the discussion. The next stage is implementation. At this stage, lecturer applies think pair and share method in business introduction subject. And at evaluation stage, lecture evaluated the implementation of applied method. Result of this research showed that think pair and share method can improving student's sharing skills and student's participation skills.

Keywords: cooperative learning, think pair and share, sharing skill and participation skill.

464 Link between modern building and Kediri's tradition: An idea to develop teaching-learning equipment

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Abstract. *"Simpang Lima Gumul"* is monument building which the architecture value, symbolic and esthetical value at Kediri. The *"Simpang Lima Gumul"* monument is crossing representation of Kediri's tradition culture and modern building concept. In preliminary study researcher found that student have difficulties for understanding geometry subjects. Contextual teaching-learning based on culture is needed to conserve local culture through transforming it in the context of learning. The aim of this paper is describing indicator of *"Simpang Lima Gumul"* monument based on semiotics study they are denotation, connotation and meta-languages level. The result is used to develop teaching-learning equipment Start your abstract here...

Keywords: Simpang Lima Gumul, Teaching-Learning Equipment, Geometry, Ethnomatematics

469 Students' obstacles in understanding the properties of the closed sets in terms of the APOS theory

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¹Universitas Bengkulu

Abstract. An understanding of the concepts and principles of open sets can be done through activities in the form of mathematical actions, processes, objects organized in a scheme. This is the operationalization of the APOS theory (Action, Processes, Objects, and Schema). The purpose of this study is to describe students' mistakes in understanding the properties of open sets in terms of the APOS Theory. This research is part of development research. This is the stage need assessment. We want to determine the characteristics of students to determine the right learning model. The subject of this study were 15 students of mathematics education at the University of Bengkulu. Students are selected based on the tasks that they do in learning Real Analysis. Data is collected from paper and pencil results and task-based interview results. Data were analyzed qualitatively using fixed comparison techniques. The results of this study are that students can only coordinate two or more sets, and the difficulty of proving a set theorem closes. One such theorem was " F is a subset of R , F closed sets if and only if F contains all the cluster points". He can only take actions separately from the characteristics of the set given. The conclusion of this study is the difficulty of students in understanding the properties of the closed sets is the inability of students to carry out interiosisasi from actions to processes. Also, it is not able to encapsulate processes into objects. He was unable to reach the scheme of the properties of closed sets.

Keywords: obstacles, the APOS theory, the closed sets

70 The development of 21st century skills of prospective teacher students in the industrial revolution 4.0 era (the adaptation and problem-solving skill)

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Abstract. The research aims to describe the achievement of 21st century skills such as adaptation and problem solving as part of 21st century competency in Surakarta Muhammadiyah University students to prepare of the industrial revolution 4.0. Respondents of this study were 194 students with a mixed method approach through convergent parallel design. The study reveals that mostly the all the capability un 21st century skills among prospective teacher students are relatively low. The study involved 191 prospective teacher students in Universitas Muhamamdiyah Surakarta. This study is a mixed method with exploratory sequential design. The study finds that adaptation capability is quite low. The majority of students say that they prefer to wait for someone else to start the conversations. Furthermore, they are worried to enter in the new society. In problem-solving skills, most students focus on the solution when facing a problem. This is reasonably good, but some literature posits the finding a factor of the problem is the best way to solve a problem. Besides, there are still students who sceptic and tend to escape from the problem without any solution. This study suggests that it is prominent to include adaptation and problem-solving analysis for prospective teacher-student candidate before accepted in the university.

119 Local wisdom value's-based literacy education learning model in elementary school

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Abstract. The lack of a model for promoting productive learning environments and a clear major value of choice to guide practice has resulted in the needs for this research. Values are important aspects of learning, yet they are not used to their fullest potential in educational practices in Indonesia. The primary objective for this study was to propose an appropriate model with application of local wisdom value in elementary school, and synthesized strategies for challenging the value for sustainable use in schools. This paper discusses and describe possible guidelines targeting the design of learning local wisdom value's-based learning model with creative learning environments that influence student literacy skills. This research was an Educational Design Research. To develop the local wisdom value's-based learning model we need, the following five steps will be taken 1) putting several available models side by side (literature research), 2) comparing and contrasting the models (plenary study), 3) deciding most essential model components (ethnography analysing), 4) creating theoretical model and prototype (setting by Focus Group Discussion/FGD), 5) testing the prototype models with limited empirical verification sample (setting by workshop). At present, this research has been in the stage of compiling a prototype of the local wisdom value's-based literacy learning model. The next stage will be consolidated through a workshop. The outcomes of the focus group interview and future workshop activities will be synthesized into five design guidelines providing orientation for the design of a local wisdom value's-based literacy learning model. The results of this research recommend that the learning with the local wisdom value can be used as an approach to learning literacy. The model also promotes a positive classroom climate, a community of learners, developing learner responsibility, and maximizing opportunities for learning.

Keywords: Literacy, Local Wisdom, Learning Model, Moral Education.

121 The development of sukuraga as an instructional media of human literacy in elementary school

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Abstract. The difference between humans and other creatures is determined by the existence of reason and morals. Learning is a way to spread and use reason and morals. Unfortunately, we lack an instructional media in teaching reason and morals. This research focused on the development of an interactive media learning in the form of Sukuraga Puppets (Wayang Sukuraga/WS). Sukuraga is Sukabumi traditional puppets, which is the Sukabumi city's icon. Sukuraga means a body part (*Suku*=part, *Raga*=body). The figure in the WS is a part of the human body. The WS story tells about body parts conflict in carrying out moral action. It known as a contemplative puppet to reflect and initiate moral action. This research was Design Research and the study aims 1) to create a Sukuraga-based instructional media design for human literacy education media, 2) to study students' opinions for Sukuraga-based instructional media. The process of the development is a series of activities of collaboration between lecturers, students, teachers, and experts. The result showed that the Sukuraga-based instructional media recommended as a learning media to initiate a human literacy and its suitable for children of different age and levels in elementary school.

Keywords: Human Literacy, Instructional Media, Sukuraga puppets.

128 An english course for nutrition department students based on a combined content- and task-based approach

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Abstract. The aim of the research is to design the English curriculum of a recently - opened Nutrition department of one Institute of Health Sciences in Yogyakarta. A preliminary study through document studies, interviews, and a survey involving its lecturers and students was conducted to collect data on the students' learning needs, learning objectives, and graduate profile. The curriculum will be implemented in three English courses, and the first English course is named *Bahasa Inggris I* which focuses on developing students' speaking and listening skills, the second is *Bahasa Inggris II* which is to develop reading and writing skills, and *Bahasa Inggris III* course is to equip the students with international English test-taking strategies. In this research, *Bahasa Inggris I* course has been developed using a systemic approach model (Gall & Borg 2007; Dick and Carey 2009), and completed with a Semester Program Plan (February-Juni 2019), a set of content/nutrition - based and task-based English learning materials (Richards and Rodgers 2001; Amiri and Fatemi 2014; Benadallah 2012; Ellis 2008; Tomlinson 1998 and 2001), and a bilingual nutrition dictionary as a learning medium (Nabirye 2009; Bila, Kacmarova, Vankova 2017). The materials and dictionary have been implemented or tried out, and the first parts of their contents were evaluated in April 2019 during mid-semester evaluations. There were seven units of materials and exercises, and more than seven hundred lemmas compiled consisting of academic and general English words. Experts in nutrition, educational research, and language were involved to provide judgments concerning the materials and dictionary contents. The students using the materials and dictionary were observed and interviewed periodically. Based on the mid-semester evaluations, the study revealed that the students' average test score was 65,38. However, they stated that their motivation and self-confidence in expressing ideas, opinions, facts, and descriptions using the materials and medium increased. At the end of the semester, all units of materials and the dictionary will be evaluated again to

determine what effects have been imposed on the students of *Bahasa Inggris I* course and how the effects bring about the desired learning outcome as stated in the curriculum.

Keywords: learning materials; a bilingual nutrition dictionary; content-based; task-based

135 Readability of scientific literacy enrichment book on earth science context

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Abstract. Science books such as science textbook, science enrichment book, or science teacher handbook take main role on science teaching and learning as science material sources. As the learning material source that used independently, science books need to have good quality text that suit to student's school level. The purpose of this study is to analyse the readability of science book especially scientific literacy enrichment book on earth science context. The book was developed based on scientific literacy competence on PISA 2015. Method used in this study are Raygor Graph and Modified Cloze Test. Population on this study is all text on the book and the sample are some fragment of the text that suit to the criteria. Sample criteria are fragment text without graph, picture, formula or blank page. Data for Raygor Graph Method are number of long sentence and difficult words on fragment text each 100 words. Data for Modified Cloze Test are the correct answer of blank space in every 5th or 6th words on the fragment text each 250 words. Sample taken on this study consist of 9 fragment texts. Raygor Graph showed that 4 of the samples suitable for 7th grade, 4 of the samples suitable for 8th grade and 1 of samples suitable for 9th grade. Data average showed that the text suitable for 8th grade. Fragmented text given to 8th students using Modified Cloze Test. The percentage of readability of the text is 89, 80%. It means that the text is easy to read and can be read independently.

Keywords: Readability; Science Enrichment Book; Junior High School

139 Overcoming anxiety in english language learning through drama performance

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Abstract. Anxiety becomes one of the top emotional encounters a person could have (Suleimenova, 2013: 1860). Anxiety towards learning English is very common among Indonesian students, especially at Madura University. The process of studying literature is the most beneficial than another thing, it is true that some people read literature for pleasure and enjoyment, but if we study literature more for that purpose, indeed we lose the life experience that we might never endure in the real life. The writer tries to decrease student anxiety through one of literary works, Drama. The study is design to obtain information concerning the current status of the phenomena and it exists at the time of the study. The participants of the study were 21 students at 5th semester, English Department. After performing the Drama, most of the students become more confident and off course increase their motivation in learning English.

Keywords: EFL learners, Anxiety, Drama, English Language Learning

145 Example- Engagement- Motivation (E2M): Designing an early literacy learning model for elementary school

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Abstract. The finding of a preliminary study of a number of elementary schools and teachers teaching at the elementary schools in Bandung clearly indicates that a specific and research-based, learning model is needed to guide teachers in their daily actions in carrying out their duties. This study aims to design the model badly needed by teachers in schools by taking four major steps. First, through the latest theoretical studies I identified at least six models specifically developed by experts for the purpose of facilitating elementary school children in learning literacy. Second, those six models are then contrasted to see which main components are included in each model studied. Third, from the steps of comparing and contrasting of these learning models, a small number of mandatory components will be determined which basically represent three things: the role of the teacher, the task of the child, the support provided by the teacher. Fourth, the researchers made a prototype of a literacy learning model that is potentially suitable for elementary school students in early grades. This research is design based reseach. The result of this research—in the form of acronym of E2M-- will make teachers of elementary schools better able to facilitate the children's literacy development and fulfill children's needs for their literacy learning.

Keywords: Learning model, early literacy, early grade, elementary School.

163 The design of literacy environment model in primary school

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Abstract. This research is motivated by the problem of the lack of a fixed model of how to support an environment that can be used as a guide in developing literacy skills in the early grade of primary school students. The environment is an important aspect that uses as one of the keys of the success or failure the results effort education. The aim of this study is to create a legitimate basis for the development of environmental design and literacy learning for early childhood and early grade primary school students. This study discusses the development of a model that will equip the teachers with certain important aspects of the literacy environment that are suitable to be applied in primary schools. This study uses Educational Design (-Based) Research. The stages of this study first conducted a literature study of the essential environment by putting side by side with the available models. Second, comparing and contrasting the differences between the models from the learning environment available in the literature. Third, deciding the model components of an essential literacy environment. Fourth, trying to create a theoretical model and prototypes. The results of this research recommend that the design of a literacy learning environment model should be used as a guide in developing literacy skills in early grade primary school students. The design of the literacy environment model can also be used by parents at home, teachers in schools, community groups, to create a major environment in supporting the optimization of the development of literacy skills in early grade primary school students.

Keywords: Learning environment, literacy environment model, early literacy skill, early grade, primary school

323 Algebraic thinking process in middle school students viewed by self-regulated learning

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Abstract. The aims of the study was to analyze the algebraic thinking skills of grade VIII SMP in Bireuen-Aceh. This research used descriptive qualitative approach. The research subjects were 20 students of class VIII (around age 13-14 years). The instrument used was a description test and questionnaire in the form of a learning independence scale. The results showed that students were still unable to write algebraic forms correctly, had not been able to present mathematical ideas from questions into mathematical models, did not write down the rules used and did not write conclusions. If seen from the level of self-regulated learning students are at a good level.

Keywords: Process, Algebraic Thinking, Self Reguated Learning

207 Design textbooks based linguistic intelligence towards representation ability on statistics

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Abstract. An introduction to statistics is a compulsory subject taken by Indonesian Language and Literature Education (Diksatrasia) students. In this course, whether or not Diksatrasia students who have SMA / SMAK / MA cannot understand mathematical concepts. This is a challenge for lecturers who teach these subjects, because most students do not like mathematics. The results of the development of textbooks are based on linguistic intelligence on the ability of statistical representation. This study uses the ADDIE research and development method (Analysis, Design, Development, Implementation, Evaluation) that has been modified and is limited to the development stage. The results of this study indicate that textbooks are very well used with total expert validation of 94% with very valid interpretations. It can be concluded that the introductory statistical textbook that has been developed can be used in subsequent implementations

Keywords: ADDIE, Representation Ability, Linguistic Intelligence

288 An implementation of the design research for the linguistic study: A preliminary multidiscipline framework

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Abstract. This paper discusses the implementation of the Design Research for the linguistics study as a preliminary multidiscipline framework. This article took the Design Research as a framework in linguistic research. The Design Research understood as primarily *research* into the process of *design*, developing from work in *design* methods, but the concept has been expanded to include *research* embedded within the process of *design*, including work concerned with the context of *designing* and *research-based design* practice. The linguistics research defined as the study of language phenomena in the level of phonology, morphology, syntax, and semantics. The data took from the several assumption on constructing the framework for linguistics study based on Design Research paradigm. The results show four schemas of implementation, namely (a) the design research in phonology, (b) the design research in morphology, (c) the design research in syntax, and (d) the design research in semantics. In phonology schema, there is two focus that can be used, namely segmental framework and nonsegmental framework. In Morphology schema, there is two focus that can be used, namely word-classes framework and affixation framework. In syntax schema, there is two focus that can be used, namely phrase framework and clause framework. In semantics schema, there is two focus that can be used, namely lexical framework and grammatical framework. For further study, the discussion on the implementation of the Design Research for the applied linguistics field is a useful scope of research.

Keywords: The Design Research, Linguistic Study, Implementation, Multidiscipline Framework

300 Correlation of students' reading comprehension ability and math literacy ability toward geometry thinking levels

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Abstract. In Mathematics, student's reading comprehension ability is used as a part of Math literacy, an ability to change contextual Math problems into Math models. Considering that rigor level which is the highest level of geometry thinking needs a good ability in reading comprehension, we had a hypothesis that there must be a correlation between students' reading comprehension ability, Math Literacy Ability and geometry thinking levels. The subjects of this research are 36 students of a 10th grade science class. They did 10 multiple choice questions of a reading comprehension test, and 25 multiple choice questions of a van Hiele Test to check their geometry thinking levels. They also did 8 questions of an essay test to check their math literacy ability. The results of this research show that there is a correlation between students' geometry thinking and reading comprehension with 0.452 as their coefficient of correlation. There is also a correlation between Reading Comprehension Ability and Math Literacy Ability with 0.476 as their coefficient of correlation. And, there is no relation between Math Literacy Ability and Geometry thinking levels of students.

Keywords: Math Literacy Ability, Geometry Thinking Levels, Reading Comprehension Ability.

478 Educational design research: designing learning inductive modeling to improve the mastery of Indonesian spelling among mappi students through a deductive paragraph

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Abstract. Deductive paragraphs are paragraphs that are generally used in Indonesian language essays. Through this deductive paragraph, a writer can easily explain the main idea that has been stated previously in great detail. To write a deductive paragraph, it is absolutely important for a writer in paragraph writing, including deductive paragraphs, to understand the Indonesian Spelling System (EBI). However, the results of a deductive paragraph written by Mappi students show that the EBI mastery is still lacking. Thus, it is an urgent need to improve the mastery of Indonesian spelling among the Mappi students to enable them to write a good paragraph. This study uses the educational design research to develop an inductive modeling. This study consists of three phases, namely the development of models, implementation of inductive modeling, and evaluation. At this stage, further development of the design of inductive modeling to enhance the mastery of EBI Mappi students will be discussed.

141 Creating category hots exercise for high school students

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Abstract. This research is aimed at generating HOTS (higher order thinking skills) exercise category creating (C6). The method applied in this study is design research type development studies. Research methodology includes preliminary and formative evaluation (self-evaluation, expert reviews, one-to-one, small group, and field test). Data is collected from related documents, walkthrough, interview, test, and observation. Descriptive method is applied to analyze the obtained data. This study is expected to generate valid, practical, and potential HOTS exercise. The exercise is validated by expert walkthrough and one-to-one student test. Practicality of the exercise is measured from the teachers' and students' difficulties in practicing the exercise. Meanwhile the potential effect of the exercise is observed through small group and field test by measuring students' mathematical literature ability.

Keywords: high order thinking skill (HOTS); creating.

187 Higher Order Thinking Skills (HOTS) first middle school of class viii students in completing the problem of polyhedron

Ma'rufi¹, M Ilyas², R F Pasandaran³, and S Agung⁴
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Abstract. The development of mathematics learning now has undergone changes in a contemporary manner. This drastic change focuses on developing the way mathematics works in a case, not just seeing mathematics as a procedure and we know it as HOTS (Higher Order Thinking Skills). This research aims to detect HOTS students in solving problems in building flat side spaces. The instrument is presented in the form of a HOTS problem that contains several indicators, namely: building complex thinking, there are no clear algorithms to solve it, difficult to predict, using approaches that are different from existing problems or with examples that have been given. The results of data analysis show that HOTS can be translated into several capabilities, namely; (1) explore information, (2) arrange conjectures, (3) logical reasoning, (4) structure problem solving, (5) communicate mathematically, and (6) connecting mathematical ideas.

Keywords: Higher Order Thinking Skills; Cubes; Beams; Students

208 High level thinking skills in class v thematic learning (case study in one of the private elementary schools in Sleman Yogyakarta district)A D S Krissandi¹¹Universitas Sanata Dharma

Abstract. This study aims to find out: (1) whether the teacher has compiled a thematic learning plan that contains indicators of high-level thinking skills; (2) whether the teacher has implemented learning activities that lead to high-level thinking skills; and (3) whether the implementation of class assessment at midterm assessments has led to the measurement of high-level thinking skills. This research is a qualitative research with case study research design. The subjects of this study were the fifth grade teachers who arranged the implementation of learning planning and applied the implementation of learning. Data were collected using questionnaire, observation, interview, and documentation techniques. The results of the study show that: (1) the lesson plan prepared by the teacher already contains indicators of high-level thinking skills; (2) the teacher is able to apply learning activities that contain high-level thinking skills; (3) class assessment in the form of PTS (Mid Semester Assessment) leads to the measurement of high-level thinking skills.

Keywords: lesson plan, learning implementation, high-level thinking skills, assesmet

218 Development of mathematic HOTS (High Order Thinking Skills) problems on trigonometric for senior high school

J Gusdinata¹, Somakim²

Abstract. The study aims to describe the development steps of the Higher-order Thinking Skill (HOTS) for the subject of trigonometric and their validation processes. Trigonometric is a subject that is considered difficult for learners due to the use of the mathematical concepts that are not real (abstract). Whilst, the 2013 curriculum demands students to have critical, collaborative, communication, creativity and innovation ability in accordance with 21st century necessities. In developing the HOTS problem, one should consider the curriculum, select the latest contextual stimulus then validate and test it. The method used in this research is a qualitative method with a formative evaluation followed with a self-evaluation phase (Tessmer, 1993; Zulkardi, 2006). The results of this study are ten item problems of HOTS based on the C-4 framework (analyze), C-5 (evaluate), and C-6 (create). After being developed, the problem was tested to the research subject, in order to check the validity, practicality and potential effects.

Keywords: Higher-order thinking Skill (HOTS), Trigonometry

262 The development of HOTS problems on algebra for junior high school

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Abstract. This study aimed at producing valid and practical HOTS questions and investigating the potential effects on the students score. This was a design research method as one type of development study. This research was conducted on class VIII students of SMP Negeri 1 Palembang which include walk through, documentation, interviews and tests for data collection. The validation was applied on the basis of the validator's assessment of the questions in terms of content, constructs, and language as well as student comments /suggestions at the one-to-one stage on clarity and readability. From the results of the students work in the field test it can be seen that the questions developed can lead to higher level thinking skills. The high-level thinking ability that emerges is analyzing (C4), Evaluating (C5) and Creating (C6) is being able to design a way to solve a problem, generalize an idea or perspective on something and organize elements or parts into structures. This research has produced HOTS mathematics as many as 10 questions HOTS statistical material that was valid and practical and had a potential effect and was feasible to use.

Keywords: Design research, HOTS, aljabar.

272 The development of hots problems on geometry and measurement for junior high school

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Abstract. This study aims to produce valid and practical HOTS questions and see the potential effects on the fieldtest. The research method used is the design research method type of development study. This research was conducted on class VIII students of SMP Negeri 1 Palembang. Data collection techniques include walk through, documentation, interviews and tests. Questions are said to be valid seen from the results of the validator's assessment of the questions in terms of content, constructs, and language as well as student comments / suggestions at the one-to-one stage on clarity and readability. The practicality of the question is shown in small groups, namely students can understand the problem well. Potential effects are seen from students' answers at the time of the fieldtest. The problem developed has a potential effect seen from the results of the field test, raises the ability to analyze (C-4), evaluates (C-5) and creates (C-6). This study has produced HOTS questions as many as 16 questions of geometry and measurement material that are valid and practical and have potential effects and are feasible to use.

Keywords: Research design, HOTS, Geometry and Measurement

276 A “Tri Hita Karana” local culture - based teaching for enhancing student’s high order thinking skill in madrasah tsanawiyah

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Abstract. This study aimed at 1) improving the student’s higher order thinking skills, and (2) describing student’s responses to a “*Tri Hita Karana*” local culture-based science learning . This study was a Classroom Action Research which was conducted in two cycles, each cycle consisting of the phases of planning, action, observation or evaluation, and reflection. The subjects of this study were 30 students of class VIIIA of MTs Al-Khairiyah Tegallingsah in academic year 2018/2019. The objects of this study were science learning based on the “*Tri Hita Karana*” local culture , higher order thinking skill, and student’s responses. Students’ higher order thinking skill data were obtained through a multiple choice test, and students’ response data were collected by questionnaire. The data were analyzed descriptively. The result of the study showed that 1) the “*Tri Hita Karana*” local culture-based science learning approach improved the higher order thinking skill of the class VIIIA MTs Al-Khairiyah Tegallingsah in the 2018/2019 school year with a mean score of 70.7 in the good category with the class level of mastery at 76.0% in the first cycle and a mean score of 81.0 in the good category with the class level of mastery at 86.0% in the second cycle, and 2) the student’s responses of the VIIIA class students MTs Al-Khairiyah Tegallingsah 2018/2019 school year to the “*Tri Hita Karana*” local culture-based learning science approach was in the positive category with a mean score of 77.8.

Keywords: Higher order thinking skill, a “*Tri Hita Karana*” local culture-based science learning.

109 The development of HOTS problems on probability and statistics for middle school

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Abstract. The lack of using high-level thinking questions (HOTS) in schools requires Indonesian students to be less successful in solving problems that demand that ability. To improve the quality of education, the government revised the curriculum which in its development refers to one of the aspects that must be raised in the learning process is HOTS. This research aims to produce valid and practical as material for student's training and see the potential effects of these questions on students' mathematical literacy abilities. This study uses the design research method for the type of development study with eighth-grade students of SMP Negeri 1 Palembang as the subject of the research. The results of the study showed that the HOTS problem developed discussed material aspects, constructs, and languages that were declared valid and practical and were feasible to use.

Keywords: Design research, Higher Order Thinking Skills (HOTS), HOTS Problems, Probability & Statistics.

Session 2**86 Android application development of exploration career based on multiple intelligence: A model hypothetical**C P Bhakti¹ and F A Rahman²¹University of Ahmad Dahlan, ²SMAN 1 Cihara

Abstract. The purpose of this study is to develop and design an android application of exploration career based on multiple intelligence that is used for high school students to provide information exploration career based on multiple intelligence. Data collection is done to find out the problems faced and to design solutions. The techniques for collecting data through literature studies. Exploration career based on multiple intelligence itself is a form of individual effort to find, obtain and manage various kinds of appropriate career information based on consideration of the intelligence possessed by each individual. Intelligence is the ability possessed by someone who includes knowledge, skills and expertise in solving problems. Basically, each individual is unique and has some intelligence such as linguistic, logical-mathematical, visual-spatial, kinesthetic, interpersonal, intrapersonal, musical, and naturalist intelligence. By understanding that each individual is born and has different types of intelligence, here the author is interested in developing an android application about exploration of careers based on multiple intelligence-. This android application will provide an interesting description and design while at the same time helping individuals, especially high school students, in understanding the intelligence they have with the right career for their future, so it is expected that the development of this android application can provide a good understanding to each individual especially in understanding their career in accordance with their intelligence.

Keywords: Android Application, Exploration Career, Multiple Intelligence, Education.

88 Initial design of blended learning for mathematics subject using the *kelase* platform by adopting content of *tri kaya parisudha*

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Abstract. Currently, e-learning is suitable to be used as one of the learning models in Mathematics subject on High School or Vocational School level as an impact of the presence of the 4.0 industrial revolution. However, this e-learning model is not always effective to be used to obtain quality learning outcomes because it can only be used to measure cognitive domains. To obtain learning outcomes in the cognitive, affective, and psychomotor domains, so another learning model innovation is needed. One model that can be used is blended learning for Mathematics subject using the *Kelase* platform with material content that is packaged based on the *Tri Kaya Parisudha* concept. The *Kelase* platform is used to create blended learning facilities that contain features needed to accommodate material content. The *Tri Kaya Parisudha* concept, which consists of manacika, wacika, and kayika, is used as the basic foundation for making material content that can measure cognitive, affective, and psychomotor domains. Based on those statements, the purpose of this study was to find out the general description of the initial design of blended learning for Mathematics subject (especially at the high school or vocational school level) that was created using the *Kelase* platform with material content based on *Tri Kaya Parisudha*. The method used in this study was R&D with the Borg and Gall model, which focuses on the stages of design development. The subjects involved in designing this blended learning were three people. The tools used to make blended learning designs, such as *Kelase* platform and *Balsamiq Mockups*. The results obtained in this study were the formation of an initial design of blended learning that created used *Kelase* platform by presenting facilities that could be used to fill *Tri Kaya Parisudha*-based Mathematics content.

Keywords: Blended Learning, Mathematics, Kelase Platform, Tri Kaya Parisudha

89 Impact of blended learning instruction in academic performance of grade 10 students in a selected private high school in San Juan City, Philippines

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Abstract. The study aimed to determine if blended learning instruction positively affected students' academic performance in a specific Science topic. Furthermore, it tried to determine if there was a difference in students' academic performance who were subjected to 20% blended learning instruction and 60% blended learning instruction. The study made use of a pre-test and post-test which were based on standardized tests. After asking permission from Xavier School and upon the approval to conduct the study, the researcher personally conducted the study to a controlled and an experimental group. After which, data were collected, checked and tallied. These were encoded and analyzed using Stata. T-test and ANOVA were used to determine the difference between the pre-test and post-test scores of the two groups. Evaluation of the blended learning lesson plan was also done through Google forms to verify the results. The study revealed that there is a significant difference between the pre-test and post-test scores of the classes. This implied that the BLP helped the students comprehend the lesson. Furthermore, the findings showed that there is a significant difference between the post-test scores of the experimental and controlled group in favor of the experimental group. This implied that 60% blended learning instruction is more effective than 20% blended learning instruction.

Keywords: blended learning, technology integration, 21st century learning, collaborative learning

90 The development of learners' key competencies using the learning activity of scientific imagineering through social media

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Abstract. According to the Basic Education Core Curriculum of Thailand, one goal in developing students relates to Learners' Key Competencies (LKCs). These consist of 1) communication capacity 2) thinking capacity 3) problem-solving capacity 4) capacity for applying life skills 5) capacity for technological application. Teachers of all subjects must create instructional activities that promote and evaluate the LKCs of students throughout the school year. The objectives of this research are 1) to design a learning activity of Scientific Imagineering (SIG) through Facebook in order to develop LKCs 2) to study the development of LKCs using the learning activity of SIG through Facebook. The research methodology is divided into two phases: 1) designing the learning activity of SIG through Facebook and creating student self-assessment with regard to a LKCs form 2) using the learning activity of SIG through Facebook to study a topic dealing with the spectrum of EM waves in a Physics class that consists of 30 grade 11 students. The result of this research showed that 1) the learning activity of SIG through Facebook consisted of six steps a) Imagine was a step that the teacher used to inspire students about EM waves b) Study was a step during which the students searched for information about the frequency range they had selected and posted it in Facebook. c) Design was a step during which a group of students brainstormed a design that explained the frequency range they had selected. d) Develop was a step during which each group of students created an Infographic. e) Present was a step during which each group of students posted their Infographic in a Facebook group. f) Evaluate was step during which each student read all of the Infographics that had been posted and hit the 'like' button for 3 of the Infographics. 2) Comparing students' self-assessment with regard to LKCs it was clear that the assessment increased significantly overall ($p < .05$).

Keywords: Scientific Imagineering; Facebook; Learners' Key Competencie

171 Designed of electronic module based android on acid base subjects in the revolution industry 4.0

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Abstract. Learning process was ideally can occurs whether or without teacher in classroom. Problems that occurred in the field that was when a teacher did not present in the learning process, students were given assignments and students find it was difficult to understand the chemical material and so that learning objectives were not maximally achieved. Therefore, in this era of industrial revolution 4.0, teachers must be innovated to make teaching materials by utilizing technology that was making electronic modules that students can used for the learning process. Application that can be used was based android. The aimed of this research was to design an android-based electronic module on acid-base material and make it was easier for students to study acid-base material. This research used Research and Development (R&D) methods with 4D which was modified until were design stage. The subjects in this research were high school students in Tanjungpinang. The steps taken were the preparation of a systematic module, material and evaluation test, and application design. The results get were modules for the availability of acid-base material, practicum guides and learning videos to improve students' science process skills. The application was created by using wordpress, which was created from the phpMyAdmin database which was entered into hosting and converted into an android application. The product result of electronic module which developed was an android application with extension .apk, included acid-base material. The results of electronic module validation by validators given very valid results, which was 95%.

Keywords: android, acid-base, electronic module, industrial revolution 4.0

181 Designing and developing augmented reality –based teaching resource of three dimensional geometry

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Abstract. Indonesia, like many other countries, sees Information and Communication Technology (ICT) as a potential tool for enhancing education and the country is keen to integrate this digital technology in the classroom classrooms. Therefore, since 2004 Indonesian Ministry Education and Culture has stipulated a regulation on the implementing the technology in teaching and learning process. Furthermore, since 2013 Indonesian government implemented a new curriculum emphasizing the use of ICT in the classroom. Recently, Augmented Reality (AR) is one of digital technologies that has received increasing attention for teaching and learning of mathematics. However, lack of research has been devoted to design and develop Augmented Reality-Based teaching resources for secondary school mathematics. This study aimed at designing and developing Augmented Reality - based teaching resources (e.g., lesson plans, student worksheets and Augmented Reality Applets) for teaching Geometry in senior secondary schools. In order to achieve the aim, in this study, we employed a design research model proposed by Plomp and Nieveen. This model consists of three phases that are preliminary phase, prototyping phase and assessment phase. It is important to note that this paper reports results from preliminary. In the preliminary phase we distributed questionnaires to teachers and students which were then followed by interviews. The findings revealed that teachers and students were keen to integrate Augmented Reality technology in teaching and learning mathematics. Furthermore, the teachers expected to be equipped with ICT-based learning resources that support discovery teaching approach. Finally, implication and future direction of this study will be also addressed in this paper.

Keywords: Augmented Reality, Teaching Resources, Three Dimensional Geometry, ICT in Mathematics Education

253 Utilizing LoRa for mini weather station base iot as stem learning media to face revolution industry 4.0

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Abstract. In the learning process, media is something important to improving student understanding. The media to support the learning process is developing, especially to face revolution industry 4.0, one of the media which used in this research is LoRa (Long Range Area) which functions as a remote data sender, this LoRa is connected with Arduino which has been connected to a sensor then placed in several places in Banda Aceh, LoRa is integrated with Network Thing to store data that will be displayed on the PC, students can see the relationship between air quality to changes in temperature, humidity and air pressure from data that has been stored from the Network Thing cloud, students are motivated in the learning process to find out by self the relationship between air quality to changes in temperature, humidity and air pressure. Student interest increases with integrated STEM in the learning process, this is demonstrated by students during the learning process, from this learning process, students are also aware of the importance of reducing air pollution.

Keywords: Learning Media, LoRa, Internet of Things, STEM, Revolution Industry 4.0.

254 Using the elvis II+ platform to create “learning is fun” atmosphere with the isle-based stem approach

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Abstract. The topic of statics and dynamic electricity is an abstract concept and relatively difficult to be understood by students. For example, the students were only taught about the electricity as a concept of electrical current as the flow of electron without accompanied by practical experiments. The topic of dynamic electricity can be an interesting and easy to understand topic if its delivered through appropriate learning media that accompany the abstract concepts with the real practical experiments. In this study, we used the equipment of ELVIS II+ (Engineering Laboratory Virtual Instrumentation Suite) that from National Instruments to achieve the aforementioned goal. Props were designed to support various basic and advance dynamic electricity experiments. Selected topics related to basic competencies 4.2 exemplified by the capacitor charging and discharging experiments are written on Permendikbud No. 24, 2016. It is expected that the activities would become interesting because the students were conducting the engineering process during the experiments, hence the learning was fun. The more interesting part of the experiments was to understand the concept of science obtained from applying Mathematics to solve the problems of differential equations. The application of Mathematics appeared naturally when students constructing and solving the differential equations in order to understand the science behind the electrical phenomena. The most fascinating part for the students is when they can successfully proofed the solutions to differential equations with experimental results. Integrating the whole STEM (Sciences, Technology, Engineering, and Mathematics) components in the learning approach is the key to the slogan of “learning is fun”. The experiment activities syntax followed the ISLE (Investigation Sciences Learning Environment) model which the learning processes will develop the process of thinking as prospective researchers for students.

Keywords: ELVIS II+, Learning is Fun, ISLE-based STEM.

338 The implementation of blended learning mediated by edmodo to learn about work and energy at advent nusra high school kupang

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Abstract. Blended learning is considered as a relevant learning method to be applied today where technology is being and will continue to grow rapidly, but also does not eliminate the interactions that are supposed to be built between teachers and students. In this study researchers chose to use Edmodo media because Edmodo is a social networking-based educational platform that is rich in learning features for the sake of learning activities that better support the fulfillment of student learning needs.

This study aims to find out: (1) Student responses to the use of Edmodo as a learning medium. (2) Effectiveness of the application of blended learning methods that utilize Edmodo media in terms of student involvement in the topic work and energy for class X MIA Nusra Kupang Advent High School Academic Year 2018/2019. (3) Effectiveness of applying blended learning methods that utilize Edmodo media in terms of learning achievement on work and energy material in class X MIA Nusra Kupang Advent High School Academic Year 2018/2019.

The type of research used in this study is descriptive research using a quantitative approach. The subjects of this study were 18 X grade students of MIA Nusra Kupang Advent High School 2018/2019 academic year. The object of this research is physics learning with blended learning method that uses Edmodo media on work and energy. Data in this study include student involvement data, student learning outcomes test data, and student response data. Data in this study were collected through questionnaires and written tests based online.

The results of the research obtained are: (1) Students' responses to the use of Edmodo as learning media look very good, which is supported by the percentage of student responses which shows a very high category of 89%. (2) The application of blended learning methods that utilize Edmodo media is effective in terms of student involvement. Student involvement obtained

through questionnaires is very high with a percentage of 89%. (3) The application of blended learning methods that utilize Edmodo media is effective in terms of student learning outcomes. Student learning outcomes show a good category, with a percentage of 77% where the average value is 81.

Keywords: Blended learning, Edmodo, effort and energy, learning methods, student involvement, student learning outcomes, student responses

**399 The feasibility of macromedia flash media in the subject
classification of living things senior high school in Tanjungpinang
Kepulauan Riau (KEPRI)**

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Abstract. Research on the feasibility of macromedia flash media in the subject classification of living things senior high school in Tanjungpinang. This study aims to determine the feasibility of macromedia flash media that can be used in the classification of living things subject. The method used is R & D (Research and Development). This method is used because it can precisely measure the feasibility of the macromedia flash media so that it can be suitably used in this material and also through a series of feasibility tested by experts in the field of media and subject. From the observations Senior High School in Tanjungpinang by conducting interviews and distributing questionnaires to the teacher and students, it was found that there was difficulty understanding this material because many Latin languages for naming a living creature could not imagine living things actually given the naming of languages in Latin and almost all senior high schools in Tanjungpinang KKM values were below standard. With the existence of this media, it is expected to increase students' understanding in the learning process in this subject. This media is said to be feasible because it obtained a feasibility value of 3.60. The feasibility value obtained is a very feasible value to use macromedia flash media, especially material for classification of living things. It is expected that after this research, the media can be distributed and used by senior high school students in Tanjungpinang. So that the difficulty in learning this material in learning can be overcome and the KKM value is obtained above the standard.

Keywords: Learning Media, Macromedia Flash, Living Classification of Living Things, Tanjungpinang.

435 Computer-based media and student worksheet for learning mathematics topic derivatives of algebraic function in senior high school

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Abstract. This study aims to develop computer-based learning media assisted by worksheets for derivative of algebraic functions. The development model used is 4D with stages (1) define, (2) design, (3) development, and (4) disseminate. At the define stage, a needs analysis is made, in the design phase a media design is made, the design is realized at the developing stage, the results are disseminated to prospective users. The initial draft was validated by four validators and revised according to the validator's suggestion. Based on the results of data analysis the average media validation was 3.65 which means valid with details of 3.56 for material aspects, 3.83 for learning aspects, 3.68 for program aspects, and 3.62 for display aspects. Based on the students' questionnaire responses, the practicality percentage was 95.83% in the small group trial which means practical with details of 100% for the material aspect, 97.2% for the learning aspect, 91.67% for the programming aspect, and 91.67% for the language aspect. In the large group test the percentage of practicality was 94.25% which means practical with details of 92% for the material aspect, 95.3% for the learning aspect, 92% for the programming aspect, and 100% for the language aspect. It was concluded that computer-based learning media assisted by this worksheet were valid and practical to be used for learning mathematics in high school.

Keywords: computer-based learning media, research and development, a derivative of algebraic functions

436 Development of computer-based learning media using mind map for learning mathematic in topics of rectangle and triangle at secondary school

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Abstract. Computer-based learning media in this rectangle and triangle subject matter uses mind map. Mind map is a technique for delivering information that emphasizes the relationship between one subject and another so that it can help convey rectangle and triangle material. Mind map presentation on rectangle and triangle material is more optimal if presented with a computer because it can provide animation that can generate motivation, help the effectiveness of the learning process, attract and direct the attention of students to concentrate on the content, facilitate the achievement of learning goals and most importantly help students to understand material that is rectangle and triangle. The research model used is a model of research and development adapted according to Borg and Gall. The aim of the study was to develop computer-based mathematics learning media using mind maps on rectangle and triangular subject matter for class VII SMP / MTs students who had met the requirements for validity and practicality. Large group trials were conducted in class VII2 MTsN 3 Pekanbaru with a total of 36 students. Based on data analysis and discussion it can be concluded that this computer-based mathematics learning media is very valid in terms of curriculum, learning, display and programs with validation results of 3.45. This learning media also meets practical requirements with an average student response of 3.47.

Keywords: Computer Based Learning Media, mind map, rectangle, triangle.

438 Didactic design research in computer programming language based courses for elementary teacher prospective students (case study of sanata dharma university pgsd students)

C Aprinastuti¹

¹Sanata Dharma University

Abstract. The ability to use IT seems to be a necessity for teachers in era 4.0. Not only using IT-based media, but the ability to make IT-based media seems to be one of the skills that teachers should have. PGSD students are prospective elementary school students who also deserve this skill. What are the obstacles for students who do not study informatics specifically? What are the challenges and efforts that can be made? This study aims to present a Didactic Learning Design framework for computer programming language-based subjects for elementary school student candidates. This study uses a design research method which includes the design, trial, and evaluation stages for each cycle. There are four areas of work that are produced, namely determining the structure of learning and content objectives, developing designs, analyzing design trials, developing local theories about the learning process.

465 How the use of comics affects the students' learning patterns concerning distance-time graphs

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Abstract. The art of teaching mathematics at all levels requires a lot of creativity and innovation from a teacher for the students to effectively grasp what they are taught. Teachers tend to devise various means always ensure that they understand the attention of a learner in mathematics lessons bearing in mind that some learners easily switch off in mathematics lessons. In this study, we explored how a teacher can effectively use comics while teaching upper secondary students the topic of Distance-Time Graphs. The research entails that problems exist among the mathematics areas where the students face a challenge in grasping the concepts they are taught and even lose concentration more quickly while the teacher is teaching thereby falsely conceptualising that mathematics is a difficult subject. The concepts involved in this paper are in concurrent to the existing literature ^that the use of comics is one of the ways to draw the attention of students while teaching them. An action research approach was adopted to determine whether students' understanding of mathematics concepts in Brunei Schools could be improved using comics. The problems that 38 Year 10 students encounter while learning Distance-Time Graphs have also been elaborated in this paper, and the methodology through which comics can be incorporated into the teaching and learning process in this area has also been shown for practical application in the Brunei Secondary School. There is also an elaboration on how the research concerning the use of comic in teaching was conducted and how the hypothesis was analysed and evaluated to have a positive outcome in the teaching and learning process.

Keywords: Use of Comics; Distance-Time Graphs; Secondary Students; Concepts

466 Exploring the teaching of the order of operations by incorporating the use of comics

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Abstract. This study explored the use of comics in teaching secondary mathematics students the topic of 'Order of Operations'. The focus was to improve students' achievement with the use of comics as a tool to enhance the learning process and at the same time develop students' interest in learning mathematics. A total of 33 Year 7 students from one of the secondary schools in Brunei Darussalam were involved in this study. Using an action research as the design research approach, two sets of comics relating to the concept of Order of Operations were used to teach students during the intervention lessons. A pre-test was given prior to the lessons, and then a post-test after the intervention lessons were completed. The results between the scores of the students' pre- and post-tests showed improvements in their performance, indicating that the use of comics does help students in a way in learning the topic of the Order of Operations. Throughout the intervention sessions where comics were incorporated, students' reactions to comics were taken into account through classroom observations as part of the analysing process. A few selected students were interviewed to give their feedbacks and their thoughts on using comics during lessons. While most had positive views towards comics in general with the majority stating that using comics made the lessons fun and interesting, there were also those who found comics not suitable to be used in the educational setting. The overall findings suggested that using comics have the potential to be used as a tool for teachers to facilitate their students' learning.

Keywords: Secondary Mathematics; Action Research; Comics; Order of Operations.

482 Website design of *kapita selekta matematika* class for mathematics education studentsM Thahir¹, Y Roza², and A Murni³^{1,2}Universitas Riau

Abstract. This article is based on the limited learning model for *Kapita Selekt Matematika* (KSM) courses. This article aims to explore the results of the development of a website for learning Kapita Selekt Matematika (KSM) on UIN Suska Riau students that is valid, practical and effective. This research uses a development research model of Borg and Gall. The research instruments used in this article are validation sheets (validity aspects), lecturer assessment sheets and student assessment sheets (practical aspects), and student learning outcomes tests (aspects of effectiveness). The data in this research is analyzed using quantitative and qualitative descriptive. This results in a course learning website which is valid (the average overall aspect of material validation was 4.15 and the average overall aspects of validation technology is 3.98), practicality score is 4.23 with the category "GOOD", and effectivity score is 78.57%.

Keywords: Developmen research, Website, Kapita Selekt Matematika

83 Identification of misconceptions on heat and temperature among physics education students using *four-tier diagnostic tes*

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Abstract. This study aims to identify misconception among physics education students in Yogyakarta on heat and temperature topic of physics education. The sample consist of 39 freshman students (first year) majoring physics education in Yogyakarta. Data collection uses *four tier diagnostic test*. The descriptive analysis findings of this study state that the *four tier diagnostic test* instrument classifies students in five categories as the data analysis outcome about heat and temperature. They are scientific conceptual, lack of knowledge, misconception, false positive and false negative. The conceptual understanding of physics education students in Yogyakarta on heat and temperature topic varies greatly. Based on the results, the percentage of physics education students' misconceptions in Yogyakarta varies on each subtopic misconception. The biggest misconception occurs in subtopic "thermal equilibrium only occurs if both systems contact directly" which is reached %61,5. This shows that the student's misconception is in high category and need special attention for educators to carry remediation out. Moreover, biggest misconception subtopic is needed more detailed explanations. In addition, this finding is expected to used as one of lecturers' or teachers' references to take consideration on the subtopic of heat and temperature which have many potential for misconception. Therefore, the teachers are able to implement the effective teaching strategy to overcome their students' misconceptions on heat and temperature.

177 The development of teaching material on ethnoscience-based chemistry learning innovation course

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Abstract. Innovation is one of the competencies that students must have in facing the era of industrial revolution 4.0. The Chemistry Education Study Program of FKIP Lambung Mangkurat University addresses this by developing the valid and practical teaching material in Chemistry Learning Innovation courses. The teaching material was developed based on ethnoscience with a review of knowledge related to chemical sciences in wetland environments which are typical of South Kalimantan region, with the aim that students can apply learning innovations to regional cultures which mostly consist of wetlands. The development of this teaching material was carried out with a four-D design from Thiagarajan consisted of Define, Design, Develop and Disseminate stages. The validators consist of 3 experts and the trial subjects are 15 Chemistry Study Program students who have taken the subject of Chemistry Learning Innovation. The data were obtained by using the questionnaires of teaching materials validation and learning observation sheets. The data were analyzed using percentage techniques. The results of the study showed that teaching material developed is valid with an average validation score of 4.5. The teaching material developed is practical with a mean score of lecturer's activities of 4.3 and student's activities average score of 4.5. The use of chemistry-based ethnoscience innovations examples that are typical of South Kalimantan such as making *hintalu jaruk* (salted eggs), *lanting* houses, and *kelotok* vessels attract students to learn the instructional material developed and apply them in daily life.

Keywords: teaching material, Chemistry learning innovation, ethnoscience

178 Dimple model: The synthesis of stem approach and project-based learning to enhance learners' creativity and critical-thinking skills in physics course

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Abstract. The physics teachers in Thailand were encouraged to enhance learners' 21st century skills via various teaching methods. This research aimed to develop the learning process of integrated STEM approach with project-based learning (PBL) as the DIMPLE model to enhance learners' creativity and critical-thinking skills (2Cs). The research methodology was divided into three phases: 1) The documents in the 21st century skills, the creativity skill, and the critical thinking skill were synthesized to be the 2Cs-framework with each sub-skills while the documents in the field of STEM and PBL were synthesized to be the key features for designing the learning process DIMPLE model that focuses to improve 2Cs; 2) The creation and development of 2Cs-Tests; 3) The suitability of the synthesized 2Cs-framework, the learning process DIMPLE model and the 2Cs-Tests were evaluated by 5 experts who hold doctoral degrees, work as university lecturers or related to science education field and at least 5 years and have special expertise in the field of STEM or PBL or creativity skill or critical thinking skill. The results showed that the 2Cs-framework consisted of the six components of creativity skill: 1) Imagination; 2) Fluency; 3) Flexibility; 4) Originality; 5) Elaboration; and 6) Creatively Practices; also the six components of critical thinking skill: 1) Interpretation; 2) Reasoning; 3) Systematic; 4) Judgment; 5) Transferability; and 6) Critical Perspectives; the learning process DIMPLE model consisted of the four following steps: 1) Define; 2) Iceberg; 3) Modelling; and 4) PLEnty. According to the evaluation from the experts, it was shown that the experts strongly agreed on the 2Cs-framework, the developed learning process DIMPLE, and the learning process DIMPLE can enhance learners' 2Cs skills also 2Cs-Tests were agreed from the experts.

Keywords: Instruction Design; STEM; Project-Based Learning; Creativity Skill; Critical Thinking Skill

204 The implementation of stem approach through project based learning to develop student's creativity

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Abstract. One of the student's skills that must be developed suggested by the national curriculum through the learning process is creativity. The purpose of this study was to develop the student's creativity through the implementation of Science, Technology, Engineering and Mathematics (STEM) approach using Project Based Learning Method. This research was a design research where the researchers develop the design of an innovative food project made from Salak by integrating the topic of 'ratio' in mathematics and 'food additives' in science. The research subjects were eighth grade students of Budi Utama Middle School. The research instrument used is a student worksheet (LKPD). The method of data collection carried out in this study was the interactive analytical methods of Miles and Huberman. The research shows that the STEM approach could be implemented by using Project Base Learning to improve student's creativity.

Keywords: STEM approach, Project Based Learning, Creativity.

274 Developing chemical equilibrium practicum module based on guided inquiry to explore students' abilities in designing experiments

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Abstract. In welcoming chemistry learning that emphasizes the quality of students, the teacher's role is very important. As a prospective chemistry teacher, students must be prepared critically, both in terms of mastery of teaching materials and the development of learning models that are implemented. One of the alternatives offered is guided inquiry-based learning, which aims to develop students' abilities so that exploration can continue. This study aims to develop valid dan practical product of chemical equilibrium practicum module based on guided inquiry to be used by chemistry education students in the experiment, so that students are able to think critically and reflectively. This research is a design thinking through the framework of Empathize, Define, Ideate, Prototype, and Test (EDIPT), with chemistry education students. Supporting instruments of this research include consultation sheets, observation sheets, and student response questionnaires. Data analysis was conducted in quantitative descriptive. The results of the study show that the practicum module developed can help developing the flow of students' thinking carefully, analyze practical needs, design varied practicum topics, and reflect on experience during designing and implementing experiments. The average of students responds well to the effectiveness of using the practicum module.

Keywords: design thinking, practicum module, guided inquiry, chemical equilibrium

301 Ethnoscience study of the traditional pacu jalur in kuantan singingi district in physics learning

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Abstract. This study aims to uncover and explore ethnoscience at the Kuantan Singingi district pacujalur festival in physics learning. The method of this study was qualitative descriptive with retrieval of data through direct observation, questionnaires, and interviews. The obtained data were descriptive analyze, verified, reduced and reconstruction into scientific knowledge and were interpreted. The results of the study show the number of activities and elements of ethnoscience, especially physics in the culture of the Kuantan Singingi district, which can be integrated into physics learning in schools. In this article, various ethnoscience activities contained in the Kuantan Singingi pacujalur culture, starting from the planning of the Jalur to the traditional runway festival on the Kuantan river, will be presented. Then the ethnoscience activity that appears is associated with the process of learning physics in school. The results of this study are expected to inspire teachers to plan and prepare interesting physics learning media and local cultural character.

Keywords: ethnoscience, pacujalur, physics, learning.

305 An analysis identification of physics student critical thinking and creative thinking skill in physics learning

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Abstract. The quality education depends on quality of learning process. So, it was needed to know how the students initial ability. This research aimed to describe the physics students critical thinking skill and creative thinking skill about physics concept. The method was descriptive research. The research respondents was physics students of 37 person at Class A, it consists of 5 male students and of 32 female students and physics student of 35 person at Class B, it consists of 5 male students and of 30 female students which have been take thermodynamics and modern physics on odd semester, academic year 2018/2019. The research data which was collected by using test, observation and documentation. The research data was analysed by using indicator percentage and descriptive. The result showed that average of critical thinking skill was 78,65. Interpretating around 6,8 Analysing around 8,17, evaluating around 8,97, Inferensi around 8,41 and explanation ability around 6,94. The average of creative thinking skill was 78,92. Creative thinking skill was fluency was 8,09, flexibility 8,4, originality 7,58 and elaboration 7,45. Therefore, an effort needed to improve physics student critical and creative thinking skill. It can be done by using some interactive model, media and teaching material in physics learning. Beside that needed alternative solution for development learning resource on learning physics in Higher Education with another local potential context.

Keywords: Critical Thinking Skill, Creative Thinking Skill, Physics Learning

330 Application of scientific approach using posters to promote students' learning activity and achievement in a general chemistry setting

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Abstract. This study is intended to apply the scientific approach in a higher education general chemistry setting to promote the learning process and product using the simple learning resources in the form of posters. The investigation was performed using classroom action research method by including the thirty students of the second-semester Biology education as the research subject. The results of the study in three cycles showed that the classroom setting using posters as learning resources effects significantly on the increase in learning activity and achievement of students.

Keywords: Poster; scientific approach; Learning Activity; Achievement

340 Effect of the implementation of integrated science learning based on local wisdom to improve the student competency

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Abstract. The national education prioritizes the character building, religion, culture and the demands of the era in the 21st century. Local wisdom is very appropriate to build the student character which is a nurturant effect in the learning process in school. Understanding of local wisdom as one of the elements integrated into learning at school. Science learning in Junior High School based on the 2013 curriculum is presented in an integrated with themes related to the subject matter of Physics, Chemistry, Biology and Earth and Space Sciences. The observation results show that science learning in schools has not been presented in an integrated and has not yet integrated local wisdom. To integrate local wisdom requires an appropriate learning model. One learning model that can be used is an integrated learning model. Through integrated learning the students were provided with more comprehensive knowledge, so that students easily master science learning material. To implement an integrated learning model, teaching materials are needed in the form of lesson plan, student activity sheet, student book, and assessment. Therefore, integrated science learning based on local wisdom is implemented. The aim of this research is to know the effect of integrated science learning based on local wisdom on student competency. This research used quasi experiment method with pre-test post-test group control design. The research subjects of seventh grade in Junior High School in Padang, Indonesia. The data were collected use interview guide, observation sheet and learning outcome tests. The result shows that the effect of integrated science learning based on local wisdom to improving the student competencies include large category for knowledge domain and medium category for affective domain.

Keywords: Integrated science learning, local wisdom.

357 The development of an inquiry-based laboratory manual for student of biology education

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Abstract. Inquiry enables student to learn through many activities that can improve the student attitudes, process and thinking skill. Inquiry learning helps students develop their ability to solve problem, think critically and reflectively. Applying inquiry-based activities in laboratory courses is one way to prompt the student-centered learning in general biology courses. The research aims to develop the valid and practical an inquiry-based laboratory manual for biology education student. This study used ADDIE model to develop the product, the stages involves of analysis, design, development, implementation, and evaluation. The implementation was conducted to biology education students who take general biology courses. The data were collected by validation sheet and questionnaire of student response. The inquiry-based laboratory manual that have been developed get very decent category as validation result. Practical of inquiry-based laboratory manual obtained from student response and it got very practical category. The product be expected able to guide student to do inquiry process in laboratory activities.

Keywords: laboratory manual, inquiry, biology, ADDIE model

387 Reflective learning: design of elementary school physics practicum oriented to develop of the student scientific attitudes

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Abstract. The nature of science contains three domains; knowledge, skills, and scientific attitude. This research focuses on exploring how students' scientific attitudes can develop through the course of Applied Physics for Elementary Schools. The challenge in this course is the development of students' scientific attitudes which include curiosity, responsibility, and honesty that are useful for the fluency and meaningfulness of activities. This research takes an educational design research approach to help students optimize their scientific attitude

392 Combination of quadratic discriminant analysis and daubechis wavelet for classification level of misalignment on induction motor

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Abstract. Nowadays induction motor is widely used in industrial process because of high efficiency, strong construction, and inexpensive maintenance. Various environmental conditions make damage to the induction motor step by step. Misalignment on induction motor is one of the damage that often occurs. This paper is focused to simulate various of daubechis discrete wavelet transform for classification level of misalignment on induction motor. Level of misalignment in this paper is introduced as normal operation, 1mm of misalignment of motor and 1.5mm of misalignment of motor. For this task, daubechis 1-5 in first level until third level is used to extract vibration signal of induction motor. Then, feature extraction of high frequency signal, like as sum of signal, energy of signal and range of signal, is calculated. And then, quadratic discriminant analysis is used to classify level of motor misalignment. As comparison linear discriminant analysis will also be used in the classification process. The results show that daubechis 3 at first level, daubechis 4 at first and second level, and daubechis 5 at first level are able to perfectly classification level of misalignment on induction motor. The quadratic discriminant analysis is more accurate than linear discriminant analysis which is only able to classify perfectly misalignment with daubechis 3 at first level.

Keywords: misalignment induction motor, daubechis wavelet, feature extraction, quadratic discriminant analysis

408 Physics education students' perception on the use of motion detector in linear motion practicum

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Abstract. The use of technology in teaching and learning is very prevalent today. In physics learning, practicum has an important role, namely deepening the understanding of concepts and applying concepts. However, it is interesting to know the importance of using technology in practicum. This study aims to know to know the student's Physics education students' perception on the use of motion detector in linear motion practicum The present study was descriptive research using a qualitative approach. This research was carried out in mechanics experiment class with 16 students as research subjects. This study used students' reflection and interview in collecting perception's of the students. The research found that practicum with motion detector has significant role in results obtained. On the other hand, practicum with motion detector has insignificant role in the student's carefulness.

Keywords: Design research, perception, technology, practicum

414 STEM for future education

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Abstract. The aim of this research is to determine the perception of prospective teachers, especially in the field of mathematics studies on STEM-based learning. This research was using a survey method. The research sample is prospective teachers especially in the field of mathematics studies. Research result show that the enthusiasm of perception teachers towards STEM education is very high. STEM education is able to improve the creativity of using learning media very well. Prospective teachers still have integrity in their knowledge. Thus, STEM education is very much needed in the world of education.

Keywords: STEM, mathematics education, prospective teachers

423 Teachers` motivation in joining scientific paper training

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Abstract. The studies on teacher motivation have developed and expanded since the late 1990s due to the importance of teacher motivation on teaching and learning succeeds. Teacher motivation has a substantial role in education because motivated a teacher produces motivated students. This study attempts to explore teachers` motivation in scientific paper training in a suburban area in East Java, which covers: 1) what is the teachers` motivation in joining scientific paper training? 2) What types of motivation does the teacher have? This is a qualitative research and a case study. This study analyzed its data by means of a descriptive analysis. The method is chosen to elaborate the qualitative data taken from the teachers who are participating in scientific paper training. The instruments to get the data are and questionnaire and interview. The study finds that there are 8 indicators related to the teachers` motivation. It is also finds that there are two types of teachers` motivation: intrinsic and extrinsic. Intrinsically, they have a quite high motivation. Extrinsically they have low motivation in joining the training. The extrinsic motivation does not have big impact on their participation on that training. They join the training is not because their supervisor said so, yet their school principals really support their career development. On their interest on scientific paper training, the teachers have a high interest in writing scientific paper. They have low production in writing scientific paper. This is because they feel that they found some barriers in writing scientific paper. They didn't have any chance before this training. Based on the interview result, the barriers they found are their grammar and vocabulary, having less experience, less time in writing scientific paper, difficulty in determining the title, diction, and how to publish their scientific paper. The interview result shows that the main reason they join the scientific paper training is that because they need the certificate as the requirement for their rank increase or promotion as civil servant and as their self-development. This is because as a teacher after they can get their teacher certification fee from the government. They are obliged to join any training and they have to submit their certificate as the proof of their self-development. They can write

scientific paper well means that they are motivated with the scientific paper writing training.

Keywords: Teacher Motivation, Intrinsic motivation, Extrinsic Motivation, Training

437 The development of the pictorial stories about solar panels for elementary schools

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Abstract. The main objective of this research was to produce a prototype of a pictorial story with the topic "Processing Solar Thermal Energy into Electric Energy". This product could be used as a supplementary book for Grade IV of Elementary Schools. This product was made based on the limitations of the material in the 2013 Curriculum student book and the needs in the classroom. Research & Development (R & D) method was applied in this research, with six stages: (1) Potential and problem analysis, (2) Data collection, (3) Product Design, (4) Product validation, (5) Product Design Improvement, (6) Product Design Testing. The data gathering technique applied interviews, observations, and questionnaires. The product was approved by two validators with the average score of 3,16 (from a range of values 1-4); and was included in "good" quality category; so, it was worth testing in a student learning activity, after being revised. After implementing in 4th grade elementary school students, the product obtained an average score of 3,58 which was included in "very good" category. As the result of the research, the prototype was worth to be implemented as a learning medium which was also a means of literacy in supporting the "Gerakan Literasi Sekolah" (school literacy movement).

Keywords: pictorial story, solar panel, elementary school

81 From nations to ecologies: Rethinking the design of Philippine literary history

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Abstract. A salient feature affecting the structure of most literary history courses is its inextricable link towards the development of nationalism. The nation becomes the logic behind a mass of collective literary and artistic expressions, often connecting modern identities to a set of customs and traditions whose existence may or may not have any direct consequences to the nation that we know today. If not the nation, how else can we look at literary history? By looking at Philippine literature, I propose to look at the role of ecology in structuring collective responses. Literary texts are not only about cultural integration, they also narrate movement and the reterritorialization of space to adapt to new environments and forestall topographical shifts in material resources available while anticipating conflict, disaster and natural calamities. By shifting attention away from the nation and towards ecologies, the paper hopes to demonstrate how literary history courses can be incorporated in the examination of urgent contemporary problems

124 Reflection of students on *maori* life and their relationship with *white people* in New Zealand through the desca approach

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Abstract. Reflection is one of the learning activities in several learning models. This study wants to answer the student's reflections about the *Maori* Life and Their Relationship with *White People* in New Zealand through the DESCAs approach (*Dignity, Energy, Self Management, Community, Awarnes*). This research uses qualitative research with grounded theory and systematic design. Some students represent their groups in class about the History of Australia and Oceania. The results of the questionnaire also answered reflections based on material. The questionnaire adopted the DESCAs approach. Reflection is given after the learning process. This reflection can be a reference for researchers and students to follow up on the learning process and classroom action research.

Keywords: Reflection; Maori Life; *White People*; DESCAs Approach

153 Developing teaching materials two-dimensional figure-based on Palembang local cultural context

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Abstract. The purposes of the research are: 1) to produce two-dimensional figure as teaching materials based on Palembang local cultural context that are valid, practical, and have potential effect on student learning outcomes; 2) to describe the characteristics of two-dimensional figure teaching materials. This is design research and the type is a development study. The research consists of two stages, namely the preliminary stage (i.e. preparation and design stages) and the formative evaluation stage (i.e. expert reviews, one-to-one, small group, and field test stages). Data collection techniques employed observations, interviews, tests and documentation. This research was conducted in seventh graders of junior high school involving 29 students. The results of this study indicate that the teaching materials developed in this study are categorized as valid, practical and have potential effect. The average score of validity content, construct and product design were 3.65 meaning very high at validity level. The practicality was conducted in the results of tests on one-to-one and small groups. The practicality of one-to-one was 3.47 and the practicality of small group evaluation was 3.61 which was at very highly practical level. The teaching materials were categorized as effective. It showed that there were 24 students (82.75%) out of 29 students (17.24%) in plane figure test exceeded MMC (minimum mastery criterion) which was 75.

Keywords: Two-Dimensional Figure; Teaching Materials; Palembang Local Cultural Context; Design Reseach-Development Research

172 Learning trajectory in history of African state revolution to improving literation activities

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Abstract. Regional history lectures, including African History, are relatively complex for students to understand. This course examines the history of African countries with very diverse political, economic, social and cultural dynamics. One of them is the material of the revolution of African countries. The activity of reading learning resources and writing summaries can facilitate students in learning. However, most students are lazy to read and write. This underlies the researchers to design the learning history of the revolutions of African countries by growing student literacy activities. Literacy activities include reading books, listening and making presentations, and writing conclusion. The research method used is design research. This study describes how the learning trajectory developed provides a real contribution to improving students literation activities. The hope of this learning design can help students understand the history of the revolutions of African countries.

Keywords: Literacy Activities; African History; Design Research; History Education Student

106 The implementation of stem approach in teaching electricity and statistics to a group of IX grade junior high school students in Yogyakarta

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Abstract. Youth Manual (2016) predicted the increase of Science, Technology, Engineering and Mathematics (STEM) -related jobs in the next five years. One of the characteristics of these jobs is it's require capability to think and work interdisciplinary. STEM approach can be seen as a teaching approach that ask teachers to view Science, Technology, Engineering and Mathematics as an interrelated discipline and to teach the topics within the areas by using integrative and thematic approach and teach them based on a real phenomenon. This research was aiming at trying out the implementation of STEM approach to teach the topics of electricity in Science and Statistics in Mathematics to grade IX students by using real life phenomena and to measure students' learning results. The research implemented Design Research method. Data were collected by observation and test on students' understanding of the subjects. The data was analyzed quantitatively. The results demonstrate that the students' mastery on the subjects was good and excellent. This research suggested that STEM approach has a potential to be implemented in Indonesian Junior

Keywords: STEM approach; integrative; collaboration

108 Promoting global citizenship using statistics: The role of synchronous communication technology

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Abstract. The potential of synchronous communication technology to enhance distance learning has been widely explored, yet there is very little research on how this technology can be used in mathematics classroom. On the other hand, global citizenship has been increasingly discussed in international education forum these last few years. This paper report how synchronous communication technology can support statistics lesson in promoting global citizenship, as well as the potential and suggestion on the use of synchronous communication technology in the classroom.

Keywords: synchronous communication technology; global citizenship; statistics

176 Developing mathematics of HOTS high schoolYi Nopalia¹ and Somakim²^{1,2}Universitas Sriwijaya

Abstract. This study aimed at developing valid and practical HOTS questions and investigating the potential effects on the students' problem solving. This was a design research method as one type of development study. This research was conducted on eleventh grade students of SMA Negeri 1 Baturaja, which include walk through, documentation, interviews and tests for data collection. The validation was applied on the basis of the validator's assessment of the questions in terms of content, constructs, and language as well as student comments / suggestions at the one-to-one stage on clarity and readability. From the results of the students' work in the field test, it can be concluded that the questions developed can lead to higher level thinking skills. The high-level thinking ability that emerges is analyzing (C4), evaluating (C5) and creating (C6) is being able to design a way to solve a problem, generalize an idea or perspective on something and organize elements or parts into structures. This research had produced HOTS mathematics as many as ten questions HOTS that was valid and practical and it had a potential effect and was feasible to use.

Keywords : Higher Order Thinking Skill; Development Studies

235 Analysis problem solving ability through problem based learning on topic statistics in eight grade junior high school kanisius Kalasan Yogyakarta

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Abstract. The purpose of this study is : (1) to describe the learning steps on topic statistics using problem based learning. (2) knowing the problem solving abilities in eight grade junior high school of Kanisius Kalasan students on topic statistics. The type of research used is design research. The subjects in this study were class VIII^B junior high school of Kanisius Kalasan. The research instruments used were field notes and learning outcomes test sheets. Methods of collecting data obtained through the publication of documentation and the implementation of learning outcomes tests. The data analysis technique used is data reduction, data presentation and conclusion. This research was conducted in March 2019 . The results of this study are (1) steps of the problem based learning model on topic statistics with the two meetings already carried out in accordance with the design made by the researcher. design learning through problem – based learning that is well designed and can help students in problem solving with topic on statistical in eight grade junior high school Kanisius Kalasan Yogyakarta (2) Problem solving abilities of students of class Eight Grade Junior High School Kanisius Kalasan Yogyakarta based on indicators of problem solving ability according to NCTM in determining the mean median mode is not optimal yet, there are some students who have met the indicators of problem solving according to NCTM as yet none have been able to support these indicators. In this case the students cannot solve the median problem, the problem is that the students do not sort the data so that the resulting median is incorrect. Overall indicators that meet as many as 4 indicators while 1 indicator is not fulfilled.

Keywords: Problem based learning; problem solving ability, statistics, NCTM

102 A phenomenological research of mathematics teachers' belief toward mathematical connection in classroom instruction

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Abstract. The necessary skills needs in the era of Industry 4.0 is the ability to think critically. The ability to understand the logical connection between mathematical ideas is needed to become a critical thinker in mathematics. Research that investigates students' ability to understand mathematical connections has attracted many researchers' attention, but the possibility that teachers do not have belief in mathematical connections has not received special attention. Therefore, qualitative research with a phenomenological design is used to examine the teachers' beliefs toward mathematical connections and the characters that emerge. Participants in this study were mathematics teachers in the secondary school in Surakarta, Indonesia. Semi-structured interviews and observations were used to gather the data. Six phases of thematic analysis were used to analyse the data. The results show that teachers have a belief toward the connection between mathematical ideas and the application of mathematics outside the context of mathematics. Although most teacher beliefs have emerged in their teaching practices, they do not invite students to construct mathematical connections. Identifying the character of teachers' beliefs are shown to be effective in displaying the tendency of teachers' beliefs and knowing the background of it.

Keywords: belief; mathematical connection; phenomenological research

107 The teachers' ability in mathematical literacy for space and shape problems on PISA adaptation test

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Abstract. There were evidences suggesting that one of the factors that influence student competence in solving mathematical problems is the teacher. However, the research on teacher's competence to solve PISA's mathematical problems is still rarely conducted in Indonesia. Therefore this research aims to determine Indonesian teachers' competence in solving PISA-adapted mathematics problems for the topic of Space and Shape. This study employed case study research design that involved seven mathematics teachers from different school in surrounding Yogyakarta. They were required to solve PISA-adapted mathematics problems that were classified into four areas, namely Change and Relationship, Space and Shape, Uncertainty, and Quantity. In this paper, we will present our result just for the Space and Shape part. The study found that (1) 7 teachers could achieve level 4 for problem 1a, (2) 6 teachers could achieve level 5 for problem 1b, (3) 2 teachers could achieve level 5 for problem 2, (4) 1 teacher could achieve level 5 and 6 for problem 3, and (4) 6 teachers could achieve level 6 for problem 4.

Keywords: mathematical literacy; space and shape problems; and adaptation PISA test.

113 Application of "what-if" learning strategy to improve students' mathematical critical thinking skills in statistical method I subject

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Abstract. The aim of this study was to improve students' mathematical thinking skills through the application of "What-If" learning strategies. This research was motivated by the low critical thinking skills of students in the Statistics Method I subject. Critical thinking skills are very important to bring someone to think and work more carefully, sorting out relevant information or not, solving problems, and doing tasks on a bigger scale. This research is a classroom action research consisting of two cycles. The subjects of this study were semester IIA students of Mathematics Education Study Program, Faculty of Teacher Training and Education, Mahasaraswati University Denpasar as many as 16 students in academic year 2018/2019. Data collection techniques used observation, interviews, and tests. This study used 2 data analysis techniques namely qualitative analysis and quantitative analysis. Qualitative analysis uses models such as mathematical models and analyses that are carried out limited to data management techniques by performing descriptions. Quantitative data analysis measures the learning outcomes in the form of scores and percentages using a simple level of calculation. The results of the study showed an increase in students' mathematical critical thinking skills from the first cycle to the second cycle. In the first cycle, the completeness of students' mathematical critical thinking skills only reached 62.5% with an average value of 71.125. In the second cycle, the mathematical critical thinking skills of students experienced an increase in completeness by reaching 87.5% with an average reaching 84.125. This study concluded that the application of "What-If" learning strategies can improve students' mathematical critical thinking skills in the subject of Statistics I.

Keywords: "what-if" learning strategies; mathematical critical thinking skills; statistical method I

114 Development and validation of a test instrument to measure pre-service mathematics teachers' content knowledge and pedagogical content knowledge

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Abstract. There is a growth of research interest in developing content knowledge (CK) and pedagogical content knowledge (PCK) for pre-service mathematics teachers to prepare them in the teaching profession. On this account, it is important to assess their CK and PCK with a valid instrument test. However, there are still few scholars which have been developed and validated such instrument, especially for mathematics in high school level. Therefore, the current study aims to develop and validate a test instrument to measure CK and PCK of pre-service mathematics teachers on high school level mathematics. The current study employed research and development method and used students' empirical data in investigating the validity of the instrument. The results of the study and its implications for future research and practice then will be presented in the paper.

Keywords: Content knowledge; Pedagogical content knowledge; Mathematical knowledge for teaching; Pre-service mathematics teacher education

116 Hypothetical learning trajectory for uniform motion and gradient using the STEM approach

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Abstract. Learning in the fields of science, technology, engineering, and mathematics (STEM) has developed into a meta-discipline. Learning in all four fields is focused on the emergence of innovative solutions to a complex contextual problem facing the world today. The purpose of this study was to describe the design of teaching and learning about uniform motion in science and gradient of a line on Mathematics using the STEM approach. The type of research used in this study was the design of the Gravemeijer and Cobb models which consist of three phases. The exposure presented in this paper was only limited to the first phase of design research. The research subjects in this study were class VIII of SMPN 2 Yogyakarta. The instrument used in this study is the hypothetical learning trajectory. In the design made by researchers, researchers will experiment with dropping mahogany trees from a certain height. From this experiment, researchers will build understanding and meaning of the concepts of regular straight motion and straight line gradients.

Keywords: STEM approach; integrative; collaboration

117 Hypothetical learning trajectory for classification of animals and sets by using the STEM approach

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Abstract. STEM approach is an approach to teaching science, technology, engineering, and mathematics in an integrated manner. The aim of this study was to describe the design of teaching and learning process to teach animal classification in science and set in mathematics using the STEM approach. The type of research used in this study was the Gravemeijer and Cobb models which consist of three phases. The research subjects in this study were 34 students of class VIII D of SMPN 1 Yogyakarta. The instrument used in this study is the hypothetical learning trajectory. In the design made by the researcher, there were observations by students about animal characteristics and animal placement in the Gembiraloka zoo. From this observation process, the researcher facilitated students to understand how the process of classifying animals in science, and how to make a set, determine the terms of membership of a set, and write down the membership of a set.

Keywords: STEM approach; integrative; collaboration

118 Analysis of grade VII students' learning outcomes for animals classification and sets by using the STEM approach

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Abstract. With the global economic system emerging in the 21st century, learning in the fields of science, technology, engineering, and mathematics (STEM) has gained a very important role in increasing the role of a country in the global economy. Therefore, learning in all four fields is focused on the emergence of innovative solutions to a complex contextual problem facing the world today. The purpose of this study was to describe the learning outcomes achieved by students for animal classification in science and set in mathematics after students experienced the learning process with the STEM approach. The Gravemeijer and Cobb design research model used in this study. The research subjects in this study were 34 students of class VII D of SMPN 1 Yogyakarta. The instrument used in this study was a test. In the learning process, to help students understand how the process of classifying animals in science, and how to make sets, determine membership requirements from a set, and write down membership from a set, students were invited to make observations about animal characteristics and animal placement in the Gembiraloka zoo. 65.63% of students could define the meaning of a set, make a set along with the terms of membership, and write down the membership of a set.

Keywords: STEM approach; integrative; collaboration

122 Analyzing mathematical creative thinking ability on sample space topics grade VIII SMP Kanisius PakemA Wicaksono¹ and M N P Janu²^{1,2}Sanata Dharma University

Abstract. Students Kanisius Pakem has sufficient academic abilities. This known through the test also based on the teacher interview. From the observation in class, we found that the way student study is the lack of serious, lack of interesting in reading, and low motivation when study. In terms of problem-solving abilities, students have a tendency to follow the teacher without try to find the other one. Therefore the teacher could not take big steps in teaching mathematics. This study aimed to describe the learning process using problem-based learning for a sample space lesson and creative ability while solving the problem. The subject of this study is 16 grade VIII students of SMP Kanisius Pakem. The instrument used in this study was observation sheet, hypothesis learning trajectory (HLT) and the student's worksheet. The type of this research is design research. The result can then be classified, represented, and the conclusion can then be drawn by comparing the result from the Student's Worksheet and indicators of mathematical creative thinking ability. The results from this study are the ability of mathematical creative thinking of the topic of the sample room in grade VIII Kanisius Pakem, in general, is sufficient and can be further developed.

Keywords: Problem Based Learning; Mathematical Creative Thinking; Hypothesis Learning Trajectory; Design Research

123 Analysis of problem-solving skills in material probability in Kanisius Pakem Vocational High School

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Abstract. The purpose of this study was to describe the learning process by using the Problem Based Learning model on the topic of probability for Kanisius Pakem Vocational High School students, as well as to describe the problem-solving skills of Kanisius Pakem Vocational High School students after the implementation of learning trajectories on the topic of probability. The type of research used is design research. Data collection techniques are used, namely observation of the learning process. Then the data is analyzed by reducing data, presenting data, and concluding the results of the study. The learning trajectory was tested on 24 students of class X Kanisius Pakem Vocational High School. The research instruments used were field notes and student test sheets. The learning process consists of five stage, namely the orientation of the students to problem regarding probability, organizing students to learn related to the material probability, guiding individual/group experiences on the learning process material probability, developing and presenting the work obtained from group discussions, and conclude the results of the learning process that has been done. From the results of tests obtained by students after the learning process, four aspects of problem-solving ability will be reviewed. Viewed from the aspects of understanding the problem, the students can describe things that are known and asked in the tests given. Viewed from the aspects of planning problem-solving, students can be develop plans based on the information provided. Viewed from the aspect of implementing the plan, the students can translate the problem given in the form of mathematical sentences and students can make decisions in answering the problem. Viewed from the aspect of interpreting the results of the answers, the students have not all been able to verify the answers given.

Keywords: Learning Process; Problem-Based Learning; Problem-Solving; Probability Concepts; Design Research

125 Design research on calculus: students' journey in learning definition of definite integral

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Abstract. Some researchers report that students find difficulties in learning definition of definite integration. Therefore, classroom activities designed with design research method to help university students gain better understanding on this topic. In order to support students, realistic mathematics approach was chosen. Series of instructional activities had been designed to reach mathematical goal. Thirty of first year university students were chosen to implement the classroom activities that have been designed. This paper will report students' journey in learning definition of definite integral on classroom activities which have been designed in our finding in local instructional theory (LIT).

Keywords: Definite Integral; Design Research; RME; Local Instructional Theory

126 Characteristics of mathematics high order thinking skill problems levels

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Abstract . There are two levels of thinking skill, that is Low Order Thinking Skill (LOTS) and High Order Thinking Skill (HOTS). Now, many countries believe that HOTS is very important in mathematics education. The purpose of this study was to construct High Order Thinking Skill (HOTS) problem levels and their characteristics. This research method was literature review. The validity of the results of the study used investigator triangulation involving two experts. From this study, four levels of HOTS were constructed. Each level was combined between the cognitive process dimension of Bloom's taxonomy revised and cognitive domains of Trends in International Mathematics and Science Study (TIMSS) 2015. This paper also presented problems on each level. The teacher can use the results of this study to train students doing HOTS problems by starting from the lowest level.

Keywords: HOTS; mathematics problems; thinking skill; characteristics

129 Defragmentation of scheme translation adjustment in solving mathematical modelling problems

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Abstract. In solving mathematical modeling problems, students often feel difficulties and make errors. Difficulties and errors that occur are traced through the think aloud method and found the phenomenon fragmentation of thinking structure that occurs in the student's brain. In this case, the fragmentation that occurs is fragmentation of translation of thinking structure, which means a condition of structured thinking that is not organized where students are wrong in constructing a target representation through the representation of the sources they understand. The researcher then intervened limitedly through the creation of disequilibrium and giving scaffolding so that students defragmented the translation scheme adjustment. Student defragmentation is mapped through the framework of CRA (*Checking, Repairing, and Ascertaining*) and four frameworks of Bosse (*unpacking the source, preliminary coordination, constructing the target, and determining equivalence*). The research subjects were students of the Mathematics Education Program of the Faculty of Mathematics and Natural Sciences, State University of Malang in the even semester of 2014 and 2015 (Semester 4 and 6) consisting of 3 people (previously 85 students were tested). This study uses a descriptive and explorative qualitative approach. The results of this study are that there are three types of defragmentation of scheme translation adjustment, namely defragmentation of scheme translation adjustment from verbal representation to graphics, defragmentation of scheme translation adjustment from graph representation to symbols (algebraic forms), and defragmentation of scheme translation adjustment from graph and symbol representation (algebraic form) to mathematical models. This research is important to know the causes of students feel difficulties and make errors that are reviewed from the thought process and how students re-structured in solving problems faced.

Keywords: Defragmentation of scheme translation adjustment; fragmentation of translation of thinking structure; CRA Framework; four frameworks of Bosse; problem solving; and mathematical problem.

132 perception of mathematical education students on the use of classical learning model

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Abstract. The use of classical learning models that have long been known among educators, especially mathematics teachers. The purpose of this study was to describe the perceptions of mathematics education students towards the use of classical learning models in the learning process in the classroom. This research is a qualitative research that reveals the perceptions of students of mathematics education study programs on the effectiveness aspects of classical learning models, student aspects, material aspects, and aspects of learning strategies through giving questionnaires and interviews to students consisting of two classes with 66 people. Research subjects were involved in implementing the Classical learning model. The results of this study indicate that 77.27% of respondents agree that the use of classical learning models helps students understand mathematical concepts. As many as 65.15% of students agree that all students, both with low and high concept abilities, need learning using classical learning models. A total of 75.76% disagree that all mathematical material needs to be taught using classical learning models and as many as 63.64% of students argue agree that special strategies are needed in teaching mathematics using classical learning models. The student's perception will continue to be developed in studying mathematics learning strategy subjects.

137 Student's understanding of the equal signs: A case study in suburban school

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Abstract. This article involves the research carried out in the 22 student in grade VII of SMP in Pekanbaru, Riau, which has a misconception focusing of equality, that is, the equal signs. This research was given to seventh-grade students in the second semester who had been available material in algebraic form and its operations. This study aims to gain an understanding of students after introducing learning algebra. This study took the part form of a qualitative and chose the case study used in this study. Data collection methods consist of student worksheets and group interviews. Students answer deliberately selected questions and focus on interviews with students' understanding of the concepts of equality and the equal sign. The results show that only a few students have a relational idea in solving a given problem. More students use computation, and even students solve by using redactional issues, namely in short case that the students solve by using calculation from left to right. Students decide on the meaning of the equal sign as consisting of responses. Students are more devoted to making computations rather than the relational concept. Therefore, there needs to be more to considerate this problem and how to reduce the misunderstanding of students about the equal sign with this.

Keywords: Equal Sign; Student understanding; Algebraic Thinking

140 Development of learning worksheet in modeling with financial context for senior high school student

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Abstract. Development of LKPD learning Mathematical modelling to extract. This study aims to produce LKPD (Student Worksheet) learning mathematical modelling using a financial context for high school students who are valid and practical. In addition, this study also aims to determine the potential effects of LKPD (Student Worksheet) on mathematical modelling learning using the financial context of students' mathematical modelling abilities. This research was conducted in the XI IPA class in Senior high school no.11 Palembang city, school year 2018-2019 involving 39 students. This type of research is development studies of development studies that consist of the preliminary stage including the stages of analysis, design, and development and the formative evaluation phase includes self-evaluation, prototyping (expert reviews, one-to-one, small group) and field tests. Data collection techniques from this study are walkthroughs, observations, and interviews. The results of this study are LKPD mathematical modelling learning using a valid and practical compound interest material financial context. Valid based on context, construct and language seen from the stage of expert review and one to one, small group, and in analyzing student answers in the field test stage.

Keywords: LKPD; financial mathematical modelling

142 Developing a hypothetical learning trajectory of fraction based on RME for junior high school

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Abstract. The result of preliminary study indicate that learning trajectory of set in school textbook that has not facilitated students to reinvention the concept of fractions. Therefore, the aim of this study is to produce a Hypothetical Learning Trajectory (HLT) for teaching fraction using Realistic Mathematics Education (RME). This type of research is design research with the Gravemeijer & Cobb model which consists of three stages, namely preparing for the experiment, conducting classroom experiment, and performing retrospective analysis. This study involved 25 students of Public Junior High School (SMPN) 1 in Timpeh, West Sumatra. The instruments used were student activity sheets, videos, field notes, and interviews. The data analysis technique used is descriptive analysis techniques. Based on data analysis, it was shown that HLT for teaching fraction using RME can be applied to all levels of students. This HLT helps students find concepts through horizontal and vertical mathematical processes, facilitates students to make their own models from informal to formal, and improves interactions between students and teachers.

Keywords : Design Research

Session 3**144 Students' logical mathematical intelligent in completing mathematical problems with natural disaster context**S Fatimah¹¹Syiah Kuala University

Abstract. Disaster awareness in the community is necessary to be improved continuously, especially for regions in Indonesia that are prone to natural disasters. One way to do is to integrate disaster problems in mathematics learning. Teachers need to train students to solve mathematical problems in the context of disaster. Through this problem, it is expected that students' logical mathematical intelligence will increase. This research is a preliminary study to determine the logical mathematical intelligence of students in solving mathematical problems in the context of disaster. The participants in this study were 23 junior high school students in Aceh Besar who were domiciled in the 2004 tsunami-affected areas registered as one of Disaster Preparedness Schools (SSB). The data in this study were collected through tests and interviews which were analyzed descriptively. Based on the indicators of logical mathematical intelligence, it was concluded that students' logical mathematical abilities in solving mathematical problems in the context of disaster were in the low category, even though students in these schools already had knowledge of disaster through disaster simulation activities. Thus the mathematical learning design is needed to improve students' logical mathematical intelligence in solving mathematical problems in the context of disaster.

Keywords: logic-mathematic intelligence; contextual learning; problem solving, disaster preparedness

146 The ability of multi-representation of junior high school students in solving algebra problem in the TIMSS model

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Abstract. Algebra is one of mathematical topics that is difficult to understand by students. Many symbols in algebra make students difficult, so multi-representation can help any student to understand. This study is to describe students ability of multi-representation in solving algebra problems. The sample of this qualitative study is the 8th grade students of SMPN 2 Waru Sidoarjo, East Java, there are eight class from A to G, we choose class VIII B was purposively chosen from eight classes and contains 20 girls and 18 boys. All students were given both maths ability test and problem solving test. There were 10 students with the high ability in algebra, 25 students with medium ability in algebra and 3 students with low ability in algebra. Two volunteer students with high ability in algebra who had interesting strategy were chosen as our respondents. The semi-structured interview was utilized to investigate the process, strategy and students conceptual of algebra. The representation use by the first student is symbolic representation and visual representation. The representation use by the second student is symbolic representation and verbal representation.

Keywords: Multi-representation; Algebraic Problem

149 Learning using a worksheet characterized by recognition of mathematical symbols

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Abstract. One of the purposes of learning mathematics in college is to improve the ability of critical thinking and problem-solving. Before it, the college students need to recognize the problems that want to be solved. Thereover it is important for the problem solver to aware and recognizes the meaning of mathematics symbols or called recognition of mathematical symbols. The aim of this research is to describe the teaching activity using a worksheet characterized by the recognition of mathematical symbol through action research. This research emphasizes the use of the worksheet to improve teaching and learning practice such that students get better to recognize mathematics symbols such that they can solve the problems correctly. The research approach that is used is qualitative and quantitative research approach. the method of this action research are 1) identification of focus field that is the ability to recognize mathematics symbols, 2) collecting data, while teaching and learning mathematics using worksheet, 3) analysis and interpretation data, based on the data type that are qualitative data through recording of interview an quantitative data through scoring test and questioner, and 4) developing an action plan, by applying learning practice that has been fixed based evaluation of learning practice before. This action research is a spiral shape that rotates over step collecting data – focus field – collecting data – analysis – interpretation. The subject of this research is college students of Civil Engineering that take a 2nd calculus course. This action research help lecturer to improve their practice in teaching mathematics such that students have a better ability to recognize mathematics symbols. The worksheet consists of activity to know and aware about variables, the function of two or more variables, the derivative of two or more variables. At the end of the learning practice, college students that doing error to recognize mathematics symbols are less than at the first teaching practice. The college students can recognize mathematical symbols well and then solve the problem correctly using correct mathematics symbols.

Keywords: recognition of mathematics symbols; worksheet; learning mathematics; action research.

152 Design of mathematical modeling learning in two-variable linear equation systemN Pitriana¹¹Sriwijaya University

Abstract. This research aims to produce a trajectory of mathematical modeling learning in the context of Malnutrition in Indonesia using the Model-Eliciting Activities (MEAs) approach in the material of two-variable linear equations system. In mathematical modeling classes, students learn to solve real problems using mathematical procedures and concepts. The method used is a design research type of validation study which aims to prove the theories of learning. The research design consists of three stages; initial design, teaching experiments, and retrospective analysis. The research subjects were class VII students of junior high school 21 Palembang. Data collection techniques are video recordings, interviews, and documentation. Data were analyzed by comparing the Hypothetical Learning Trajectory (HLT) and what happened during the learning process. This study resulted in a trajectory of mathematical modeling learning in the context of Malnutrition in Indonesia using the Model-Eliciting Activities (MEAs) approach in the material of two-variable linear equations system. The results of this study indicate that through a series of mathematical modeling activities can help students in understanding the material of two-variable linear equations system.

Keyword: Mathematical Modeling; Malnutrition in Indonesia; SPLDV; MEAs

157 Mathematical critical thinking ability of students grade VII in solving one variable linear equation questions based on their cognitive style

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Abstract. To face the industrial revolution 4.0, the abilities that should be possessed by students are high-level thinking skills that include mathematical critical thinking skills. Critical thinking is the ability to analyze information obtained based on facts in order to make reasonable conclusions. This is a qualitative descriptive study that aimed to determine and illustrate the critical thinking skill of students with filed dependent (FD) and filed independent (FI) cognitive in solving a single variable linear equation problem. Two students selected based on the GEFT test acted as the subjects of this study. One of them had FD cognitive while the other had the FI cognitive. The instruments used in this study were (1) mathematical critical thinking tests, (2) cognitive style tests in the form of GEFT, and (3) interviews. Data analysis techniques in this study consisted of (1) data reduction, (2) data presentation, (3) verification and conclusion. The indicators of students' mathematical critical thinking skill included (1) reason and (2) clarity. It was found that (1) student with filed dependent style on reason indicator needed to get used to making an argument or reason, while for clarity indicators, FD subject could change statements into mathematical symbols clearly and precisely. (2) Students with cognitive style FI, chose and gave reasons and drew conclusions correctly, changed statements into mathematical symbols clearly and precisely.

Keywords: Mathematical critical thinking skills; Cognitive styles; One variable linear equations

158 Mathematics teacher's Pedagogic Content Knowledge (PCK) in mathematics learning

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Abstract. The purpose of writing this article is to find out the teacher's Pedagogic Content Knowledge (PCK), to find out the PCK perspective, to know the role of mathematics teachers in PCK. A teacher in carrying out his professional duties must have competence that is always maintained. Therefore, competency development is an important requirement to ensure that the quality of learning in the class adapts to the development and demands of the times. Competence that is always maintained also ensures that the implementation of education is consistent in achieving educational goals. Professional development is a learning experience that is both naturally acquired and through conscious and planned activities and contributes to improving the quality of learning in the classroom. PCK is knowledge that is a combination of content and pedagogic knowledge in understanding topics, problems or issues and how the integrated knowledge is organized, so that it can be adapted from a variety of student abilities and interests which are then implemented in learning, knowledge of ways to represent and explain a material to make the material understandable to others.

Keywords: Pedagogic Content Knowledge (PCK); Mathematics Teacher's; Mathematics Learning

179 PBL-team teaching: Vocational school of mathematical learning in the era of industri 4.0A Maharani¹¹Universitas Swadaya Gunung Djati

Abstract. The learning trend in the industrial era 4.0 is learning that is able to boost the ability of students especially vocational students to become analysts rather than practitioners. In accordance with its characteristics, the implementation of Problem Based Learning (PBL) with the team teaching method is considered capable of describing the needs of learning models in this Industrial 4.0 era. PBL-team teaching (PBLT) in vocational mathematics learning is a learning model presented with PBL steps and collating the scientific field through team teaching between mathematics and vocational teachers. The second role of the teacher in learning has consequences for both of them to be able to collaborate in integrating subject matter. One of the mathematical abilities that can be upgraded through the use of the PBLT model is the ability of mathematical logical thinking. The results of the study revealed that the mathematical logical thinking ability of students who received the PBLT model as a whole was better when compared to students who received the PBL and Conventional (Kv) models.

Keywords: Problem Based Learning; Team Teaching; Vocational School

182 An analysis of the students' anxiety in solving creative thinking problem on geometry according to van hiele's theory

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Abstract. This research aimed at describing the students' anxiety in solving the creative thinking problem in geometry according to Van Hiele's theory. This is a descriptive research with qualitative approach. The data were collected by using test, observation, and interview methods. The subjects of the research were 249 VIIIth grade students of SMP Negeri 1 Cluring. The subjects were selected by using classification test of Van Hiele's level. The results of this research showed that the students of visualization level were at the level of creative thinking (TKBK) 3 or creative level and showed the anxiety symptoms in the components of psychological and physiological. The students of analysis level were at the level of creative thinking (TKBK) 3 or creative level and showed the anxiety symptoms in the components of psychological and physiological. The students of informal deduction level were at the level of creative thinking (TKBK) 4 or very creative level and showed the anxiety symptoms in the components of psychological.

Keywords: anxiety; creative thinking; Van Hiele Theory

183 Studies of level visual thinking on the geometry of middle school students

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Abstract. Learning mathematics is how students get information that is built capable of solving a problem. One way of thinking someone is by visual thinking. Visual thinking has an important role in the success of mathematics learning, especially in solving mathematical problems that require high-level reasoning, one of them in solving the problems of abstract geometry. Although to help students develop their ability to think visually or visualize, first the teacher must pay attention to the level of visual thinking of students. This paper aims to determine the level of visual thinking in geometry. Based on the results of the literature review the authors built three levels of visual thinking in geometry, namely level 0: Non-visual (NV), level 1: local visual (LV) and level 2: Global Visual (GV).

Keywords: Visual Thinking; Geometry; Non-Visual Local Visual; Global Visual

185 Civil engineering student's ability in representing symbol of partial derivatives as metonymy and metaphor

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Abstract. Symbol representation is a form of interpretation of someone's idea to make it easier to solve problems. Symbol representation is a very important because it reflects the meaning of a concept. Symbol representation involves metonymy and metaphor. Metonymy as a chain of markers, in this case a symbol, while a metaphor as a meaning of a marker (symbol). Metonymy and metaphor are interrelated and involved in the system of symbolization when one finds new symbols in the process of learning mathematics. Civil Engineering students find many new symbols in Calculus II lectures, such as the function symbols of two or more variables and their derivatives. These symbols are certainly different from the function symbols of one variable and derivatives that have been studied in the previous semester's Calculus I. This study aims to describe the ability of Civil Engineering students to represent symbols as metonymy and metaphor through solving problems of Partial Derivatives. This is a descriptive qualitative research, as one of the efforts to detect student difficulties in learning Partial Derivatives. Students are given a worksheet containing the problem of Partial Derivatives which is focused on the representation of symbols as metonymy and metaphor. The results of problem solving on the worksheet are analyzed based on (1) the marking and meaning of the Partial Derivatives symbol, and (2) the marking and meaning of the Partial Derivatives symbol through problem solving. Interviews and observations were conducted to strengthen the results of problem solving on the worksheet. Civil Engineering students are not too good at representing the Partial Derivative symbols of functions to or y by giving the sign . This is due to the student analogy that derivative symbols use accent () as in the derivative of one variable function, so that this symbol is carried in a partial derivative. The analogy is the meaning of an inferior derivative symbol. Students can determine the final completion of the Partial Derivative correctly, but it is not too good at marking a partial derivative symbol. Error using the derivative symbol of the function of two variables is not realized by

students. Students attach importance to completion procedures, regardless of the symbols used.

Keywords: representation; symbol; partial derivative; metonymy; metaphor.

189 The effectiveness comparison of mathematics learning through think-pair-share and team assisted individualization cooperative learning in junior high school students in Walenrang

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Abstract. This study aimed to describe and compare the effectiveness of Think-Pair-Share (TPS) and Team Assisted Individualization (TAI) cooperative learning. The learning effectiveness is subject to the significant improvement in learning outcomes, the minimum average of student activities in the active category, and the minimum students' response in the positive category. This study employed quasi-experimental design with pretest and posttest involving two experimental classes. The population in this study were Year 7 students in one of the junior high schools in Walenrang, Indonesia, and the samples were two Year 7 classes, one learned mathematics through TPS cooperative learning and the other through TAI cooperative learning. The instruments in this study included a test instrument, i.e., the test of mathematics learning outcomes, and non-test instruments, i.e., the observation sheet of student activities and student response questionnaire. One sample t-test at a significance level of 5% was conducted to determine the effectiveness of mathematics learning through TPS and TAI cooperative learning. Independent sample t-test was then carried out to compare the effectiveness of the two cooperative learning types. The results showed that both TPS and TAI cooperative learning were effective for student mathematics learning as indicated by a significant increase in learning outcomes, the average student activities were in the active category, and students' responses were in a positive category. The results also revealed that there was no significant difference between TPS and TAI cooperative learning Year 7 classes of one of the junior high schools in Walenrang, Indonesia.

Keywords: Think Pair Share; Team Assisted Individualization; Activity; Response; Learning Outcomes

193 Development of middle school mathematics worksheet based on M-APOS approach to improve students' problem solving ability

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Abstract. The purpose of this study is to produce a junior high school mathematics worksheet based on the M-APOS theory to improve students' problem solving abilities. Low ability on problem solving skills identifies as the consequences of the usual worksheet which is used. This happens because the usual worksheet does not support the development of students' problem solving abilities. This research is a development research using the Plomp model. The Plomp development model consists of three stages, namely the preliminary analysis stage, the prototype development stage, and the assessment stage. In the preliminary stage, Needs analysis, curriculum analysis, concept analysis and analysis of students are carried out. At the prototype development stage a formative evaluation is carried out consisting of self evaluation, one-on-one evaluation, expert / expert review, small group evaluation, and field testing. The subjects of this study are VII grade students of SMP Negeri 2 Pasaman. The results showed that the M-APOS-based mathematical worksheet is valid, practical and effective. The worksheet is valid from aspects of content, presentation, language, and graphics. It is also practical in terms of implementation, time, ease of use and effective in terms of its potential impact on students' mathematical problem solving abilities

Keywords: Worksheet; M-APOS Theory; Problem Solving Ability

195 The practicality of the mathematics learning module on triangles developed using GeoGebra software

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Abstract. Curriculum 2013 in Indonesia requires students to be able to develop knowledge independently, creatively and skillfully in solving mathematics problems. One way that can be taken by professional mathematics teachers to support the curriculum is to develop precise learning modules that integrate software dynamically and open source, such as GeoGebra. This study aims to determine the practicality of the module developed in mathematics learning on triangles using GeoGebra software. This study uses the Plomp development model, which consists of three phases, namely preliminary research, prototyping phase, and assessment phase. The trial was conducted four times on students of class VII of SMP 1 Ildi Rayeuk, Aceh. The results showed that the mathematics learning module using GeoGebra software on triangles in class VII of SMP was included as valid and practical criteria. The validity of the module is obtained based on the results of validation by five validators according to the Nieveen's (1999) indicator. Meanwhile, the practicality of the module is achieved based on the recommendations of five validators stated that the module could be used with a minor revision and the level of implementation of learning using the module is good. Therefore, the module produced in this study can be used by mathematics teachers to support mathematics learning, especially on triangles. Future research can apply this study to a broader scale to determine the effectiveness of the module.

Keywords: GeoGebra Software; Mathematics Learning; The Practicality; Triangle

197 Mathematics teachers creativity in designing mathematics assessment: Phenomenology of creativity to support education for sustainable development

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Abstract. There are several factors that hinder the creativity of mathematics teachers including the lack of teacher confidence in students. This is also experienced by mathematics teachers in designing mathematical assessments. The teacher is not confident to provide mathematical problems that can develop students' creative thinking skills by designing creative mathematical problems. Therefore, teachers tend to design problems that are monotonous and not varied especially the problems that are applied in social, economic and environmental aspects. This study aims to analyze the creativity of mathematics teachers in designing mathematical assessments. This research was conducted in a qualitative type of phenomenology with 13 respondents, namely high school mathematics teachers. Based on the results of in-depth interviews and teacher design mathematics assessment documentation, the results showed that mathematical problems designed only followed mathematical problems in the mathematics textbook or were slightly modified. Problems are not focused on the context of application in social, economic and environmental aspects but are limited to problems that require an algorithmic solution. Information was also obtained that mathematics teachers had difficulty in designing mathematical test instruments in the form of descriptions, especially the description questions applied in daily life. This difficulty is caused by the teacher having difficulty in finding relevant ideas and difficulties connecting the material / mathematical concepts with their context in everyday life. The teacher feels that it takes a lot of time to compile a mathematical test instrument in the form of a description that is applied in everyday life. (The design of the math test questions made by the teacher can be seen in the appendix). From the teacher's experience, information is also obtained that students also experience difficulties when given a description question which is an application in daily life. This is because students must understand the questions properly and correctly, then solve mathematical problems given

based on the mathematical concepts that have been learned. If students misunderstand the questions given, students will also be wrong in solving the problems given. Therefore, teachers rarely design mathematical test questions in the form of descriptions that are applications in everyday life.

Keywords: Pre-service teachers creativiti; Education for Sustainable Development

203 Learning trajectory for teaching number patterns using RME approach in secondary school

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Abstract. A learning trajectory (LT) for teaching number patterns using Realistic Mathematics Education (RME) approach has been developed through this research in order to improve students' reasoning abilities. The research used design research approached proposed by Gravemeijer and Cobb which characterized by a cyclic process of preparing for the experiment, conducting the experiment, and retrospective analyses. Several activities have been conducted during preparing for the experiment phase, such as analyzing the curriculum, essential concepts about number patterns, students' characteristics, to design the hypothetical learning trajectory (HLT) for teaching number patterns. After the validation and revision processes, the HLT was implemented in a small group during the experiment phase. The HLT was revised after the retrospective analysis phase. Then, it was implemented for the second time to investigate its effectiveness on students' reasoning abilities. The subjects of the research were 32 grade eight students in a secondary school. Data were collected by using questionnaire, observations, interviews, analyzing students' works, videotaping, and test. Collected data were analyzed descriptively. The results of the research shows that the LT developed for teaching number patterns using RME approach meet the criteria of validity, practicality, and effectiveness. The LT could facilitate the students to reinvent some concepts about number patterns by themselves. The LT could also improve the students' reasoning abilities.

Keywords: Learning Trajectory; RME, Number Patterns

209 The genetic decomposition of students about infinite series through the ethnomathematics of Bengkulu, Indonesia

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Abstract. The cognitive theory views individuals as active information processors, so that individuals are able to represent each information according to the level of knowledge they have. Student representation can be seen as its genetic decomposition. Ethnomathematics is a vehicle for unlimited series learning. The purpose of this study is to describe the genetical decomposition of students about infinite series through the Bengkulu ethnomathematics. This is the initial research from a series of development research. This stage we interviewed in depth 10 Bengkulu High School students, Indonesia. The research instrument is the researchers themselves who are guided by interview guides about understanding concepts and the principle of infinite series. Interviews were conducted during and after Bengkulu's ethnomathematics learning. Data were analyzed through fixed comparison techniques. The results of this study are found that students can coordinate two or more actions about convergence of sequences, but not for convergence of infinite series. Conversely, there are students who can describe a particular object about converging an infinite series but not coordinated with the processes that are built for converging sequences. Also, there are students who can coordinate the action-process related objects so that a schema of converging sequence is formed, but for infinite series only in the form of separate actions or processes. The conclusion of this study was the genetic decomposition of students in understanding the infinite series through ethnomathematics learning at the intermediate level (inter level). The student before ethnomathematics learning was at the lower level (intra and pre-intra levels).

Keywords: Ethnomathematics

210 Learning design on set materials using the model problem based learning

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Abstract. This study aims to: produce learning trajectories to teach set material using PBL models in class VII junior high school of Kanisius Kalasan. This research was conducted in Kanisius Kalasan Middle School Yogyakarta in September-December 2018. This type of research is design research. The subjects in this study were VII_C class students (trial class) and VII_A class students (research class). The stages in this study are initial design, trial and implementation of learning. Data collection methods used are documentation of research, written tests, interviews and field notes. The data analysis technique used is data reduction, data presentation and conclusions or verification. Researchers designed learning using PBL models on set operating material (intersection and union) and final test analysis of mathematical problem solving abilities. The results showed that: the learning trajectory with the PBL model as follows: (a) The researcher conveys the learning objectives so that students can set strategies to solve problems according to the learning objectives and researchers provide real problems verbally with context in the class about set operations (intersection and joint); (b) Researchers form students in groups and provide problems related to set operating material (intersection and union); (c) Next the researcher accompanies students; (d) After students have finished solving the problem, then presented (e) Then the researcher and students evaluate the problem solving process by students. (f) Next the researcher gives a test related to the real problem related to the material of the set operation (intersection and union) to be analyzed based on the students' problem solving abilities.

Keywords: Problem Based Learning; Design Research; Set Operations (intersection and union).

211 Implementation of virtual manipulative using problem based learning on topic algebra for seventh grade student

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Abstract. The aims of this study to find out the learning design of virtual manipulative using Problem Based Learning (PBL) on seventh grade student in algebra concept. This study was conducted at Junior High School Santo Aloysius Turi from October to February 2019. The research subjects were students of class VII_B (pilot experiment) and VII_A (teaching experiment) in 2018/2019. The type of research used in this study is design research, where researchers design HLT to teach topic algebraic operating using virtual manipulatives with PBL models. The research stages are preliminary design, design experiment include pilot experiment and teaching experiments, and retrospective analysis. Data collection methods used are documentation, field notes, written tests, and unstructured interviews. Technical data analysis used according to Miles and Huberman includes data reduction, data display, and verification or conclusion. The results showed that the design of learning with virtual manipulative using the Problem Based Learning (PBL) model on topic algebraic in class VII of Junior High School Santo Aloysius Turi is as follows: in giving the preliminary test, it is known that students still have difficulty in connecting problems into algebraic forms, using the concept of associative and distributive properties to simplify algebraic forms according to their operations in addition, subtraction and multiplication of algebraic forms. By using virtual manipulative with PBL model, it can help students to construct their knowledge to understand assosiative and distributive properties used to simplify algebraic forms.

Keywords: virtual manipulatives; problem based learning (PBL); design research; algebra.

213 Ethnomathematics: Design mathematics learning at secondary schools through traditional game of Melayu RiauY Roza¹¹Universitas Riau

Abstract. Riau Province has been committed to become the center of Malay language and culture in 2020. Various efforts need to be made to introduce the Cultural Heritage both inside and outside the province. This research supports government commitment by designing mathematics learning. This research will design mathematics learning at the Secondary School using the traditional game. The findings will be used in mathematics learning to introduce culture while bringing mathematics closer to student life. This study is a design research with Four-D approach. Game identification is done at Define Stage, Instructional Design is done at the design stage, Learning material is created at development stage. The Instructional design is disseminated into teachers and students of Secondary Schools. Data collection is done through documentation studies and interviews. The traditional games explored in this study are the game of Rimau, Ligu and, Guli. These games are used for various mathematical concepts of algebra, Geometry, and statistics for mathematics learning in secondary school.

Keywords: Ethnomathematics; Traditional Game; Game-based Learning

214 Learning design of *geometri lukis* to support the ability of submitting questions to pre-service mathematics teachers

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Abstract. This study aims to design the design of mathematics *geometri lukis* to support the ability to submit pre-service mathematic teachers. Design research is chosen as a type of research consisting of preliminary design, experimental pilot and teaching experiment. By integrating the ability to submit questions in painting geometry, learning design was obtained with the local instructional theory which included activities: The pilot experiment was carried out in STKIP PGRI Sidorajo by involving 6 semester 4th pre-service mathematic teachers. This activity was held for 3 meetings, with the following activities: 1) pretest, 2) Sketch of istimewa angle using dividing angles and lines concept, 3) Sketch a triangle using lines and angles concept. The things that are done in the Preliminary design phase are: 1) analyzing the learning objectives, 2) determining and determining the initial conditions of the study, 3) designing and discussing the conjecture or HLT to be developed.

Keywords: Geometri Lukis; Learning Design; Prospective Teachers

217 Design and validation of learning sequences of PGSD sanata dharma university student to teach the fraction concept for primary student using montessori media

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Abstract. Fraction concept is one of the learning problems that often occurs in elementary students. Elementary student's misconceptions can be caused by teacher's misconceptions. PGSD students are teacher candidates, so they must have the correct concept then they can teach the concept of fractions correctly too. Learning must be an inspiration for students when they become teachers later. One medium that can be used to teach fraction concepts is media based on Montessori. Local culture can support the use of Montessori media. This study aims to design and validate the learning sequence of PGSD Students in using Montessori media, to develop design principles to teach fraction concepts in elementary school students. The approach in this research is design research which includes three phases, namely design, trial and assessment. In the design phase, researchers formulate students' prior knowledge and learning objectives. This is used as the basis for the sequence of learning. This stage of learning is evaluated in a repeat trial phase, the hypothesis design principle is developed and from which the learning stages are redesigned. The results of the assessment phase, together with the experience of the previous cycle and research review, are used to perfect the design principles of the student's learning sequences so they can teach the concept of fractions correctly.

Keywords: Fraction, Montessori

219 The quality of teacher's questions in mathematics learning based on ELPSA framework

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Abstract. Teacher's question to encourage students building their understanding is an essential aspect of mathematics learning. However, teachers show little concern about the quality of questions posed to students. Teachers can implement various strategies in conducting their role as facilitators in developing students' understanding. One of which is through questions. ELPSA framework requires teachers to ask questions to help students construct their knowledge. This framework consists of five components: Experience, Language, Pictorial, Symbol, and Application. This study discussed the development of the quality of teacher's questions based on ELPSA framework. The quality was identified by the types of questions, namely: factual, convergent, divergent and evaluative questions. This study employed a qualitative research design using an observation sheet as the instrument. The subject of the study was a mathematics teacher from one of the junior high school in Banda Aceh. The results concluded that the quality of teachers' questions in Year 8 of one of junior high school in Banda Aceh developed for each component of ELPSA framework. These developments were indicated by the suitability of the types of teachers' questions and the types of questions expected in the components of ELPSA framework

Keywords: Teacher questions, Quality of questions, ELPSA framework.

223 Design research: Development of learning using Indonesian realistic mathematics education approach to build students' relational understanding in function derivative learning of students in class XI cikarang utara senior high school

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Abstract. Design Research: research method aims to develop the local instructional theory on learning derivative to build relational understanding in class XI Cikarang Utara Senior High School using Indonesian Realistic Mathematics Education (PMRI) approach. The method used is design research which consists of three phases that are preparation and design, teaching experiment and retrospective analysis. Stages of building a relational understanding of students assisted by using the context of changes in body weight in infants, and momentary speed. This study has 6 activities organized in Local Instructional Objectives. Subjects of this study consisted of 6 senior high School students XI MIPA Cikarang Utara. The data collection has done by using paper and pencil method, interview method and the method ostensive. The validity of the data using internal and external validity. While the reliability of data using triangulation of data and cross interpretation. All data collected and analyzed in retrospective analysis. A retrospective analysis showed that the context used can develop the students' relational abilities derivative functions. Teacher played a major role in directing the learning activities that the learning objectives achieved as instructional objectives that have been prepared.

Keywords: Design Research, Derivative, PMRI, Relational Understanding.

232 The prototype of PISA-like digital mathematics tasksM Meryansumayeka¹, Z Zulkardi¹, R I I Putri¹ and C Hiltrimartin¹¹Universitas Sriwijaya

Abstract. This article describes a part of study aimed to develop digital mathematical tasks like PISA which are valid, practice, and having potential effect to secondary students' 21th century competencies. The discussion of this article is limited to the description of the first prototype of PISA like digital mathematical tasks. Design research type development study is chosen as research methodology in this study. Data were gathered using documents, observation, and interview and they were analysed qualitatively. The first prototype was produced after experiencing changes in the choice of context, content, types of mathematical process, and conformity with the level of the PISA problem.

Keywords: Design research, PISA, Digital mathematics tasks.

236 Supporting students' understanding of partitive fraction division through models

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Abstract. This article aims to describe primary students' understanding of partitive fraction division and synthesize the ways to support that understanding through the use of multiple models. It is a part of design research which produces mathematical activities to develop students' understanding of fraction division. Eleven students in two groups involved in the two teaching experiments. Students' work in group and individual, transcript of the interview, video recording and field notes were retrospectively analysed to examine and contrast the hypothetical learning trajectories with the actual learning process. Several crucial findings were found, i.e., (1) students are difficult in relating a not-cake sharing context to models which involve simplified fractions as a dividend. This difficulty associates with students' understanding of unit in fraction; (2) students' understanding on measurement type of fraction division, e.g., $2\frac{1}{2}$, is not much helpful for understanding the concept of partitive fraction division (e.g., $\frac{1}{2} \div 2$); and (3) context of the task, the relation of context with the use of models and the sequence of fractions used do support students' understanding. Drawing upon the findings, four ways are offered to support students' understanding of partitive fraction division, i.e., the lesson could be (1) starting from whole number division to develop the sense of division, (2) strengthening the concept of unit in fraction and partitioning, (3) choosing appropriate contexts which relate to the use of models, and (4) sequencing the fractions used, from a simple to advanced form.

Keywords: Partitive, Fraction division, Understanding, Models.

239 Learning quadrilateral betweenness relations using geometry's puzzle for blind students

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Abstract. Geometry is one of the fields in mathematics that deals with the shape, size, and properties of space that doesn't require prior skills like basic arithmetic. Although the model of geometry's object familiar and found in everyday life, it doesn't mean that geometry is easily learned by students, especially to blind students who have limited visualization. A quadrilateral is a geometry matter which in its learning is often emphasized in the use of formulas and memorization so that students don't understand the concept of each shape and its relation between another quadrilateral. So, this underlies the researcher to design a learning trajectory of betweenness relation quadrilateral using geometry's puzzle based on direct experience of blind students. The purpose of this research was determining the role of learning quadrilateral betweenness relation using geometry's puzzle to help students understand learning quadrilateral concepts. The method used is design research with Gravemeijer and Cobb's model that through three stages, i.e preliminary design, teaching experiments, and retrospective analysis. This research describes how geometry's puzzle in learning betweenness relation quadrilateral contribute to the understanding of quadrilateral concepts for blind students of MTs Yaketunis Yogyakarta. The result of this research shows that geometry's puzzles can help students understand the concept of each quadrilateral shapes through the construction of knowledge about betweenness relation quadrilaterals so that students don't need to memorize the definitions or properties of each quadrilateral shapes and achieve the defined minimum completeness criteria, that is 70.

Keywords: learning, quadrilateral, relation, geometry's puzzle, blind students.

241 Analysis the problem solving skill of seventh grade students in junior institute indonesia yogyakarta high school on triangle materials after the application of problem based learning model

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Abstract. The objectives of this study were (1) to describe the learning steps of triangular material using a problem-based learning model (2) to describe the problem-solving skills of class VII students of the Yogyakarta Institute of Indonesia Junior High School in triangular material, after learning using problem-based learning. This type of research is design research. The research instruments used were field notes and learning outcomes test sheets. Field notes are used to describe the steps of problem-based learning while the learning outcomes test sheet is used to see students' problem solving skills according to NCTM. Method of collecting data is in the form of documentation and test results. Data analysis techniques carried out are data reduction, data presentation, and conclusion. This research was conducted in March 2019. The research subjects were 20 seventh grade students of the Yogyakarta Indonesian Institute Junior High School. The results of this study are in the form of a description of the implementation of a problem-based learning model in triangular material and the analysis of problem solving skills of seventh grade students of the Yogyakarta Indonesian Institute Junior High School after the learning outcomes test. For analysis of problem solving skills, in the number one problem, students have reached 4 indicators of problem solving skills according to NCTM. Whereas in question number two, students have reached 3 indicators of problem solving skills according to NCTM.

Keywords: Problem based learning, learning design, problem solving skills.

242 Analysis of spatial ability of eight grade students in junior institute Indonesian Yogyakarta high school using problem based learning on topic of cuboids and cubes

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Abstract. The goals of this research were (1) to describe implementation of learning about cuboids and cube nets by using problem based learning (PBL), (2) to describe the spatial ability (spatial representation) of students by using problem based learning about cuboids and cubes nets. The type of research is design research. The research subjects were 28 grade VIII SMP Institute Indonesia Yogyakarta. Data was collected using field notes, documentation and results/answer of LKS 1, LKS 2. The data analysis technique used is qualitative descriptive. The research was conducted in March, 2019. The research about the learning process by using problem based learning.

The results of the research show that the learning design made in this research is good and the spatial ability of grade VIII students SMP Institut Indonesia Yogyakarta in making cuboids and cubes nets have fulfilled the first indicator (1). This is indicated by the majority of students able to describe cuboids and cubes nets. In addition, some students have not fulfilled the second indicator about identifying cuboids and cubes nets.

Keywords: Problem Based Learning (PBL), Spatial Ability, Cuboids and Cubes Nets

247 Analysis of problem solving ability through problem-based learning in triangle perimeter of 7th grade in kanisius kalasan junior high school

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Abstract. This study aims to design problem-based learning in the triangle perimeter through problem-based learning in triangle perimeter of 7th Grade in Kanisius Kalasan Junior High School. Students of 7th Grade in Kanisius Kalasan do not get any opportunity to develop problem solving skills because the teacher still use conventional methods. According to the National Council of Teacher of Mathematics (2000) the development of problem solving abilities is one of the goals in the process of learning mathematics, it is an aspect that can make students develop mathematical thinking skills. The type of research used in this study is design research. The subjects of this study were 22 students of class 7B in Kanisius Kalasan. The research instrument in this study is a test sheet. The results of research related to the learning process show that the stages of the process that occur are as follows: (1) the orientation phase of students about the problem regarding of triangle perimeter, (2) organizing learners to learn related to the topic of triangle perimeter, (3) guiding individual/group experience on the process of learning triangle perimeter, (4) developing and presenting the work obtained from the discussion group, and (5) conclude the results of the learning process that has been done. The following results below are obtained based on students problem solving abilities: there are 14 students who are qualified within 4 out of 5 indicators, namely students can identify the elements that are known, asked, and the adequacy of the elements needed, students can form mathematical problems or develop mathematical models, students can apply strategies to solve various problems within or outside mathematics, and students can use mathematics significantly and there are 8 students who qualified within 2 out of 5 indicators namely students can identify the elements that are known, asked, and the adequacy of elements needed and students can use mathematics meaningfully.

Keywords: Problem based learning, Problem solving ability, and triangle perimeter.

248 Analysis of problem solving ability of eight grade students of santo aloysius sleman junior high school in mathematical learning using problem based learning approach to inner tangent between the two circles material

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Abstract. This study aims to describe the steps of the learning process using the Problem Based Learning (PBL) approach and students' problem solving ability in inner tangent between the two circles material after experiencing the learning process using the PBL approach. The type of research used is design research. The subjects of this study were eighth grade students of Santo Aloysius Sleman junior high school. The object of this research is problem solving ability of eighth grade students of Santo Aloysius Sleman junior high school using the PBL approach. The stages carried out in this study were the initial design, trial, and implementation of learning. Data analysis techniques in this study are data reduction, data presentation and conclusions or verification. In this study the researchers designed and developed the Hypothetical Learning Trajectory (HLT) with the PBL approach to inner tangent between the two circles material as the learning model. HLT is made, implemented in learning to describe the steps of the learning process that occurs and analyze students' problem solving abilities. The results of research related to the learning process show that the stages of the process that occur are as follows: learners' orientation to the problem of tangent common in two circles; organizing students to learn; guiding individual or group experience in the learning process; develop and present the work obtained from group discussions; and conclude the results of the learning process that has been done. From the results of tests and interviews for students' problem solving abilities, the following results were obtained Overall students meet the five indicators of mathematical problem solving abilities according to NCTM.

Keywords: Problem based learning; Problem solving ability; Inner tangent between the two circles; Design Research.

249 An analysis of mathematics pre-service teachers' knowledge, beliefs and attitude toward mathematics HOTS problemsN Ayuningtyas¹ and N Ishartono²¹STKIP PGRI Sidoarjo and ²UMS

Abstract. Higher Order Thinking Skill (HOTS) recently becomes an issue among educators as this type of skill requires student's high ability of thinking that is important for students to be mastered. However, the question that arises is whether educational instruments, especially mathematics pre-service teachers, have known, understood, and ready to teach the HOTS concept. Thus, this study aims to analyse pre-service mathematics teachers' belief, attitude and knowledge regarding to HOTS. The sample of this study was 323 pre-services mathematics teachers from seven universities in Indonesia. Data were collected through the knowledge of HOTS test and attitudes and beliefs questionnaires. The study result of attitude mathematics pre-service teacher toward HOTS shows that most of the respondents argue that it is hard to implement HOTS in the learning process. Moreover, they gave the reason of why that statement was true because they do not have any idea of on how to teach mathematics by involving HOTS in it and how to integrate HOTS into the learning process. On other hand the result of belief toward HOTS was most of them belief that the implementation of HOTS immerge some problems related to the learning process such as learning anxiety, in enthusiasm and hate toward mathematics. But they still belief that understanding HOTS will benefit the students in learning mathematics. Knowledge mathematics pre-service teacher of HOTS problems was so poor and needs a lot of improvement.

Keywords: Higher Order Thinking Skills; Mathematics Pre-service Teachers; Teaching Mathematics.

266 Analysis of student errors in solving geometry problems based on mathematical anxiety in terms of van hiele's theory

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Abstract. The aim of this research was to describe the students' error analysis in solving geometry problems based on the mathematical anxiety under the theory of Van Hiele. This research was a descriptive research with a qualitative approach. The data were collected by using observation, test and interview methods. The selection of the research subjects were by using Van Hiele test. Van Hiele test was given to 202 students of class VIII of SMP Negeri 2 Purwoharjo. Thus, it obtained the students who were at the visualization level of 49.5%, analysis level of 11.9% and informal deduction level of 1%. The results of this research showed that the students of visualization level experienced errors in five stages, namely reading error, reading comprehension, transform error, process skill, encoding and showed the anxiety symptoms with indicators of physiological, cognitive and affective. At the analysis level experienced errors in four stages, namely reading error, transform error, process skill, encoding and showed the anxiety symptoms with indicators of physiological, cognitive and affective. While, at the informal deduction level experienced errors in three stages, namely transform error, process skill, encoding and showed the anxiety symptom with cognitive indicator.

Keywords: Mistakes, mathematics anxiety, van hiele.

270 The effect of gender and cognitive style on students' relational thinking skills in solving mathematical problems

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Abstract. The aims of this study were (1) to explore the relationships between gender and cognitive style with relational thinking ability of a group of 7th grade students (n=32), and (2) to identify the interaction effect of the two personal factors on relational thinking ability. Cognitive style of the students was measured by Group Embedded Figures Test (GEFT) and Mathematical ability tests have been used to see equivalent abilities. Results of the MANCOVA test indicate that gender was significantly correlated with relational thinking ability, while cognitive style was positively and significantly correlated with all of the five aspect relational thinking ability, i.e. creates an image, find its inner structure, looks for the key element or relation in the situation, constructs a solving strategy. Results indicate that gender and cognitive style were significant factors of relational thinking ability. However, no significant interaction effect of the two variables on overall relational thinking ability was found.

273 The anxiety of students on deduction level in proving the geometry theorem

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Abstract. This study aims to describe the anxiety of university students who were on deduction level in proving the geometry theorem. This was conducted to find out how student anxiety, so that it can be handled and anticipated. Anxiety is a description of feeling uncomfortable, worried, and afraid. The type of this research is qualitative-descriptive. The subjects were taken as many as 3 students who were at the deduction level based on the Van Hiele geometry ability test. Data was collected through theorem proofing tests and interviews conducted after the test. The results of this study indicate that the symptoms of cognitive anxiety (uneasy, nervousness and confuse) occur when the subject begins to understand the problem in the theorem. Symptoms of physiological anxiety (sweating, body feels heat) and behavioral symptoms (physical tension, impatience) appeared when the subjects connected the elements of proof on theorem in geometry. The results of this study are expected to be used by students or lecturers, especially in learning to teach how to proof theorem in geometry.

Keywords: Paper.

277 Ethnomathematics based on javanese calendarN W Utami¹, S A Sayuti¹ and J Jailani¹¹Universitas Negeri Yogyakarta

Abstract. The calendar is a system for a period of time. The calendar has days, dates, and months. Likewise, the Javanese calendar has days, dates, months, years, and also dina pasaran. The use of dina pasaran in Javanese society is essential. Activities such as spiritual activities, traditional market, social gathering activities, village meeting activities use dina pasaran in the Javanese Calender. Dina pasaran in the life of Javanese people has ethnomathematics value. This study aims to reveal the ethnomathematics values of Javanese Calenders. This study uses qualitative methods. Data collection techniques use interviews with traditional elders, observation, and document analysis. We propose ethnomathematics values such as the Lowest Common Multiple in formal mathematics associated with dina pasaran in the Javanese Calender. This ethnomathematics value can be used in the learning of mathematics in the Lowest Common Multiply in the school.

Keywords: Ethnomathematics, Javanese Calender, Lowest Common Multiply.

280 Experiences of sanata dharma university students in learning of mathematical modelling course conducted in english

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Abstract. This paper reports experiences of students in learning of mathematical modelling course conducted in English. The students are of Sanata Dharma University in the third year of their bachelor's level at the Department of Mathematics. We note that the bachelor's level in Indonesia is a four year program. In this paper, we make an observation and analysis of students' experiences, as based on the acknowledgements of the students, this course is the first conducted in English during their study at Sanata Dharma University other than the English course. The mathematical modelling course is the one offered in the Even Semester of the academic year 2018/2019. We obtain that even though students need to struggle more using English, this course which is conducted in English is more challenging and enjoyable for students. Therefore, this condition helps in achieving the learning outcomes.

Keywords: learning, mathematical modelling, students experience.

286 Media abacus in solving problem related to multiplication operation for mental retardation student

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Abstract. Multiplication counting operation is part of arithmetic which in learning requires students to possess knowledge about the other basic counting operation such as addition. Generally, teachers teach the multiplication operation using the compounded method and memorized. Both of use of these methods often implied its difficulties for students because higher the level of operation of the multiplication count, the more difficult it is to memorize it. Besides this, students can also experience boredom with monotonous and procedural learning. These problems are also experienced by mental retardation students who have weaknesses in thinking and reasoning. This underlies researcher to conduct experimental research related to multiplication operation through a fun method so that students can understand multiplication operation quickly and easily, such as the utilization of media abacus. The purpose of this research was to find out how much influence learning with media abacus given to mental retardation student in solving problems related to multiplication operation. The research design used is Single Subject Research (SSR) where learning outcomes are measured variables and describe student learning activities in solving problems of multiplication operation using media abacus. Data collection techniques are carried out by observation, interview, and test. The instruments used were observation sheets and interview sheets to see student activities during learning, test sheets to see the results of student problem solving. Analysis of the research data was analyzed under conditions and between conditions. The results showed that students experienced an increase in solving the problem of multiplication operations and students gave a good response to the use of abacus media in learning of basic arithmetic operation.

Keywords: abacus, multiplication, mental retardation, solving problem.

289 The local instructional theory development for social arithmetic topic based on problem-based instruction in junior high schools

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Abstract. Social arithmetic learning in school textbooks was still not able to develop students' mathematical problem solving abilities. The low mathematical problem solving ability can be overcome through the selection of Problem Based Instruction (PBI) learning models. This PBI model begins with presenting an authentic and meaningful problem. The purpose of this research was to produce valid, practical, and effective Local Instructional Theory (LIT) based on social arithmetic learning based on Problem Based Instruction (PBI), which can facilitate mathematical problem solving skills for junior high school students. LIT design was implemented in student worksheets. This research method was Research and Development (R & D) with ADDIE model. This research was conducted in SMPN 20 Pekanbaru. The research subjects were material experts and instructional media experts who came from lecturers and teachers, as well as students of SMPN 20 Pekanbaru. The sample in this study was the VIIA class as the control class and the VIIC class as the experimental class. The instrument of data collection was questionnaires and tests. The results showed that the quality of LIT developed was categorized as very valid (92.35%) and very practical (89.63% for small groups and 89% for large groups). While the value of t-count was 3.20 and the t-table value at the 5% significance level is 2,0003 then $t\text{-count} > t\text{-table}$ or $3.20 > 2,0003$, so there was a significant difference between the experimental class students and the control class students. The development of PBI-based LIT can improve students' mathematical problem solving abilities. This LIT can be used as one of the learning media to improve students' mathematical problem solving abilities.

291 The local instructional theory development for social arithmetic topic based on problem-based instruction in junior high schools

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Abstract. Evaluation is a measure of learning outcomes, so evaluation is a description of the success of learning that has been done by educators. Because of this, the aim of this study was to produce an evaluation tool for IT-based learning using the Wondershare Quiz Creator software with the title of developing an IT-based mathematical communication skills evaluation tool for junior high school students who obtained feasibility and validity as an evaluation tool for mathematics learning, especially in triangular material. rectangular. This research is R & D (Research and Development) research. This evaluation tool was developed with a 4-D learning device development model that was modified to 3-D (Define, Design, Develop). The research instruments used were interview guidelines and questionnaires. Data collection techniques of research conducted were interviews, validation sheets, and response questionnaire sheets. Based on the results of the validation conducted by 3 experts, it was found that the learning evaluation tool that had been made was very valid with an average percentage of 88.89%. While the results of the user response questionnaire that the percentage of the results of the overall student response questionnaire amounted to 88.33% and the percentage of the results of the overall teacher response questionnaire amounted to 91.67%, thus both results of the questionnaire responses have very good criteria. So the IT-based mathematical communication skills evaluation tool for junior high school students is a practical evaluation tool.

Keywords: Learning Evaluation Tools, Mathematical Communication, Wondershare Quizcreator, Triangle and Quadrilateral.

292 The development of mathematics higher order thinking learning using metacognitive strategies in term of model effectiveness

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Abstract. The study developed a learning model of higher order thinking in mathematics learning employing metacognitive strategies, utilizing the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model. This article discusses the results of developing a learning model based on the implementation stage. The aim of this study was to test the effectiveness of the model and examine the development trends of students' higher order thinking skills and difficulties in the learning applying the metacognitive strategies. The research instruments were a student worksheet, a student activity observation sheet, formative tests, and a final test. The field trial was carried out on 30 Year 10 students in one of the senior high schools. The data were analyzed qualitatively based on the criterion of a practical and effective product. The findings of this study were the development trend of students' higher order thinking skills (HOTS) in the formative and final test were increased. Students' difficulties were mostly for the indicators of evaluating and creating. The results of this study concluded that the mathematics learning model of higher order thinking was practical and effective for senior high school students.

Keywords: ADDIE model; HOTS; Metacognitive Strategies; Effectiveness.

299 Development of appy pie learning media based on metacognitive approach for mathematical reflective thinking ability in geometryR Amalia¹, F Fadilah¹ and A Anwar¹¹Universitas Samudra

Abstract. This research aims to produce appy pie learning media based on a metacognitive approach to mathematical reflective thinking skills that are appropriate for use in geometry. Feasibility of learning media in terms of validity, practicality, and effectiveness. The research method used is the Research and Development (R & D) method with ADDIE Model, namely *Analysis – Design – Development – Implementation – Evaluation*. In the implementation stage, on media trial step, the One-Shot Case Study type pre-experiment design research method was used. Based on the results of validation, the learning media is categorized very well with a validity percentage of 85.66%. Based on the results of the student response questionnaire, the learning media is categorized well with a practicality percentage of 84.12%. Based on the results of the test of mathematical reflective thinking ability, the learning media was declared effective with the percentage of students who got a value of ≥ 70 of 79.16%. Thus, appy pie learning media based on a metacognitive approach to mathematical reflective thinking skills is declared feasible on geometry.

Keywords: Learning media, Appy pie, Metacognitive approach, Mathematical reflective ability, Geometry

304 The profile of metacognitive skills of students in solving mathematics word problem

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Abstract. This study aimed to describe the profile of metacognitive skills of students with high math ability and low math ability in solving the mathematics word problem, from the aspects of metacognitive skills of planning, monitoring and evaluating. The type of this research is qualitative descriptive. Subjects of the study are two students of Senior High School in Yogyakarta. Data collection techniques are observation, test, documentation and interviews. The validity of the data using a triangulation method. Data analysis techniques of this research are data reduction, data display, and conclusion / verification. The results of the study show that students who have high mathematical abilities meet the indicators of metacognitive skills in the planning, monitoring and evaluating stages. While students who have low mathematical abilities meet indicators of metacognitive skills in the planning stage, but have not fully met the indicators of metacognitive skills in the monitoring and evaluating stages in solving problems.

Keywords: metacognitive, metacognitive skills, problem solving, mathematics word problem.

306 Development of mathematical learning device based on computer multimedia on circle materials in class VIII angkasa lanud pattimura middle school

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Abstract. This study aims to develop mathematical learning tools based on multimedia that are valid and practical in circle material. Learning tools developed are Lesson Plan, Teaching Materials and Student Worksheets. This type of research is development research that uses a 4-D (Four-D) development model developed by Thiagarajan and consists of 4 stages namely define, design, development, and dissemination, but due to time constraints, it is only limited to the development stage. The research subjects were seventh-grade junior high school students at the Angkasa Lanud Pattimura Ambon. The results of the study show that the learning devices developed are valid and practical. This is indicated by the general average validator rating for the three devices is 3.44; practicality of learning 92.98% and mastery of students taught by using the results of the development of 71.42%.

Keywords: development, mathematical learning tools, Four-D Model.

308 An introduction to the rasch measurement model: A case of bachelor of mathematics education students comprehensive testE Elizar¹ and C Khairunnisak¹¹Universitas Syiah Kuala

Abstract. Mathematics assessments need to be designed to cater to all students, regardless of their background, including gender. Rasch analysis, developed based on Item Response Theory (IRT), is one of the primary tools to analyse the inclusiveness of mathematics assessment. However, the mathematics test development in Indonesia has often been dominated by Classical Test Theory (CTT). Limited research has been conducted to employ Rasch analysis. This a preliminary study to evaluate the rigor of mathematics comprehensive test. This study aimed to demonstrate the use of Rasch analysis by assessing the appropriateness of the mathematics education comprehensive test to measure students' mathematics understanding. Data were obtained from one cycle of mathematics comprehensive test involving 48 students of bachelor of mathematics education students in one of the University in Aceh, Indonesia. Rasch analysis was conducted using ACER Conquest 4 software to assess the item difficulty and differential item functioning (DIF). The results showed that item 17 related to geometry was the easiest item for students, while students found item 11 concerning calculus as the easiest item. The results also indicated the comprehensive mathematics test was viable to measure students mathematics understanding as stated no evidence of DIF. Gender has been drawn for each of the test items. The assessment showed that the test was inclusive. More application of Rasch analysis should be conducted to create a thorough and robust mathematics assessment.

Keywords: Rasch model, Item Response Theory, Differential Item Functioning, Item difficulty analysis, Measurement.

310 Analysis of student learning outcomes in proving trigonometric identities from problem based learning class

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Abstract. The topic of trigonometric identity verification given by researchers through problem-based learning in a high school in Yogyakarta has provided opportunities for students to conclude that in solving trigonometric identity verification problems three strategies can be used. This research aims to determine the learning outcomes of students in solving trigonometric identity verification questions after the learning. Observation of learning outcomes is done by analyzing the abilities and errors of students based on Indicators of Achievement of Competence. The research conducted was qualitative research with data obtained through give a 15-minutes test containing two problems, which given to students, and interviews to three students chosen based on variations in different answers. The results obtained are from the three students, only one student can solve all the problems. Two other students were unable to complete those problems, both the first and the second. The reason for this is not because the two students did not understand how to prove trigonometric identity, but because the two students were less skilled in performing basic algebraic operations related to fraction forms.

Keywords: learning outcomes; proving; strategies; trigonometric identities; problem based learning.

311 Academic engagement: Linking effort and initiative taking to student achievement through STEM-PjBL model

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Abstract. Student engagement in learning is the sincerity of the student in learning activities seen from the actions, affections, and efforts of the student. It is divided into four types which are academic, behavioral, cognitive, and effective engagement. Academic engagement refers to behaviors related directly to the learning process. Student academic engagement got less attention from the teacher. One of the strategies that can be used is by implementing *Science, Technology, Engineering, and Mathematics* (STEM) approach through Project Based Learning (PjBL) model. It is also able to help the student to understand a lesson by connecting it to real life and the other knowledge using a project. The goal of this study is to describe student academic engagement through STEM-PjBL. This study uses a qualitative approach with descriptive type. This paper reports on a study of five students who were at 7th grade of Junior High School in Banda Aceh. The students were divided into 5 groups based on student cognitive grade. One group was selected as the subject randomly. Data was collected using observation sheets about student academic engagement and achievement test. The result shows that student engaged actively in effort and initiative-taking scale during learning process through STEM-PjBL approach. Most of indicators appear in all three meetings. Of the five students observed, it can be concluded that there are three students have more frequent engaged in initiative-taking scale than other two students. Link to their achievement, the dominant of initiative-taking scale is the impact of increasing the student achievement.

Keywords: engagement, STEM, Project-Based Learning, achievement.

314 Probability learning trajectory: Students' emerging relational understanding of probability through comparison

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Abstract. This paper presents a probability learning trajectory, a trajectory identifying and characterizing middle eight grade students initial and developing relational understanding of probability. The probability learning trajectory explicates student thinking and learning over time in relation to a set of tasks and activities developed to engender a probability view as a comparison. The probability learning trajectory helped by context problem, be found in the daily lives of students. This learning trajectory is presented along with six individual students progression through the trajectory as a way to illustrate the variation present in how the participants made sense of ideas about probability.

Keywords: hypothetical learning trajectory; realistic mathematics education; relational understanding; probability.

319 Designing learning environment in supporting pre-service mathematics teacher to conduct higher-order thinking oriented learning in micro-teaching course

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Abstract. Many research revealed that teachers or pre-service teachers still misunderstand about higher-order thinking skills (HOTS) and it impacts on their ability in designing learning activities that support students' HOTS. Considering this fact, this research aims to design a learning environment that can support pre-service Mathematics Teacher to conduct higher-order thinking oriented learning in microteaching course. This research used design research method as an appropriate means to achieve the research aim. This research involved three third-year pre-service secondary mathematics teachers at Sanata Dharma University undertaking microteaching course. Methods of data collection used in this research include observation, interviews, and documentation. The result of the teaching experiment showed that pre-service teachers' learning experience influenced their teaching practice.

Keywords: Higher-Order Thinking, Microteaching course, Pre-Service Mathematics Teachers.

323 Algebraic thinking process in middle school students viewed by self-regulated learning

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Abstract. The aims of the study was to analyze the algebraic thinking skills of grade VIII SMP in Bireuen-Aceh. This research used descriptive qualitative approach. The research subjects were 20 students of class VIII (around age 13-14 years). The instrument used was a description test and questionnaire in the form of a learning independence scale. The results showed that students were still unable to write algebraic forms correctly, had not been able to present mathematical ideas from questions into mathematical models, did not write down the rules used and did not write conclusions. If seen from the level of self-regulated learning students are at a good level.

Keywords: Process, Algebraic Thinking, Self Reguated Learning.

325 The learning trajectory of number pattern learning using barathayudha war stories and uno stacko

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Abstract. This research is aimed to design mathematics learning trajectory in pattern number using Barathayudha War Stories and Uno Stacko games as starting point or context in the learning process with Pendidikan Matematika Realistik Indonesia (PMRI) approach. The method used is a design research that contains three stages, that is preliminary design, teaching experiment, and retrospective analysis. The result of this research is the design learning trajectory of number pattern learning using Barathayudha war stories and uno stacko that consists four activities, which is a detective of Barathayudha war; rebuilt Abimayu fortress at the battlefield of Kurusetra; find the unique secret number code of Abimayu fortress; built another fortress using number pattern. The results showed barathayudha war stories and uno stacko can stimulate students to understand their knowledge of pattern number concept and the stages in the learning trajectory of student have an important role in understanding the concept.

Keywords: Learning trajectory, number pattern, barathayudha war stories, uno stacko, design research.

332 Student perception of oral pretest and online quiz pre-test implementation in pre-experiment activity

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Abstract. An Experiment is activities that can improve student's scientific skill. However, students sometimes do not prepare themselves before experimental activities, so pre-experimental activities are needed to help students prepare themselves. This study wanted to know the student's perception of pre-experimental activities that form as oral and written pretests. The samples in this study were students who took the Modern Physics Experiment. At the first meeting, students directly conducted experiments without any pre-experimental activities. The second meeting, they must answer questions that have been prepared in the google form one day before conducting the experiment. The third meeting, the students conducted a direct oral pretest before the experiment. Afterward, they filled out a questionnaire to be able to compare which pre-experimental methods were most helpful in preparing the experimental activities. The results obtained 57% preferred the written pretest method, 31% chose the oral pretest, and 12% wanted no pre-experimental activities. Then to support the results, interviews were conducted with several students. Students choose a written pretest as a pre-experimental activity because it can help them prepare themselves before conducting an experiment and it doesn't take much time because it can be done at home. While the written pretest method takes a lot of time to experiment, other than that nervous factors make it difficult for them to answer well.

Keywords: pre-experiemntal, oral pretest, written pretest, perception.

333 Students' thinking process in solving mathematical literacy problem with space and shape content

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Abstract. Thinking process is one of the important skills in solving mathematical literacy problem. Thus, this paper aimed to identify two students' thinking process in solving mathematical literacy problem with space and shape content. This study used descriptive research with a qualitative approach. Data were collected by giving the mathematical literacy problem with space and shape contents and using think aloud. Next, data were analysed by studying the three types of thinking processes: conceptual, semi conceptual, and computational. The results of this study pointed out that the students' thinking process were conceptual and computational. The activities carried out by students could be grouped into four categories, namely 1) stating what is known in the problem with their own language or changing in mathematical sentences, 2) stating what is asked in a problem with their own language or changing in mathematical sentences, 3) making a plan to solve problem completely, and 4) stating the steps taken in solving the problem using the concepts that have been studied. The type of thinking process of students influences the activities carried out by students in solving mathematical literacy problem so that teachers were supposed to consider this aspect when teaching mathematics especially topics that related to mathematical literacy.

Keywords: students, thinking process, mathematical literacy problem, space and shape contents

335 Opportunity-to-learn fraction division through mathematics tasks in Indonesia's mathematics textbooks

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Abstract. This paper discusses the results of analysis and the instruments developed to examine opportunity-to-learn (OTL) fraction division (FD) through mathematics tasks on primary mathematics textbooks in Indonesia. Four grade 5 mathematics textbooks were selected. Three aspects of vertical analysis of specific topics in a textbook were developed and used, i.e., mathematical content of the tasks, types of the tasks, and cognitive demand of the tasks. The first deals with the nature of fraction division which involves types of FD, the sequence of FD, conceptual approach, the order of content presentation and types of models. The second categorizes the tasks into the representation-based task, context-based task and no-context tasks. The last reveal the cognitive demand provided by the tasks. The four textbooks were analyzed based on the three aspects. The results show that the mathematics tasks in the textbooks: (1) overlook two important part of the nature of fraction division, i.e., types and sequence of fraction divisions; (2) the content presentation is dominated by formal-model-context; (3) use the single model e.g., area model; (4) mostly has no context; and (5) are dominated by lower cognitive demand. The rationale of the three aspects is elaborated thoroughly in this paper. The results imply that a profound analysis of the nature of the topics, rich context, and cognitive demands should be a crucial consideration to support students' OTL in a mathematics textbook.

Keywords: Opportunity-to-learn; Mathematics Textbook; Fraction Division.

339 Student's metacognitive abilities using problem solving for the application of absolute value material in linear equations and linear inequality in the senior high school

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Abstract. Metacognition is a person's awareness of the process and results of his thinking (cognition) and his ability to control and evaluate the cognition process. Therefore the teacher's handling of the mathematics learning process must be balanced between doing and thinking. Starting from the things stated above, it can be said that metacognition has an important role in regulating and controlling one's cognitive processes in learning and thinking by someone becomes efficient and effective. This research has many advantages if it is used as an alternative to mathematics learning for student's thinking abilities. Through developing metacognitive awareness, students are expected to accustomed to always monitoring, controlling and evaluating what was been done. Mathematical problem solving will help students to improve their ability to analyze and use it in different situations. The researcher took the research with the title because students were studying material so he needed to be aware of his knowledge about the concept of knowing and understanding his settlement procedures and being aware of abilities to solve mathematical problems. Problem solving also helps students learn about the facts of concepts and principles through illustrations of mathematical objects and the links between these objects. This study uses a type of design research. The research subjects were twenty one students. The researchers tested the application of absolute values in linear equations and linear inequalities in class ten by dividing the question sheets to be tested as many as three meetings, each meeting having different question and the level of difficulty adjusted to the ability of the students to be tested try the first student activity sheet of the student activity sheets and the final test of the three question sheets obtained that as many as 80% have fulfilled and can be done.

Keywords: Metacognition, problem solving

342 Teacher and student needs analysis to the problem of mathematics in context of disaster

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Abstract. Indonesia is an island country located at the end of the movement of three plates of the world, Eurasian, Indo-Australian and Pacific. Indonesia's geographical location causes Indonesia to become a disaster prone country so that disasters can be used as one of the context in learning Mathematics. The presentation of mathematics in the context of disaster can improve mathematical literacy, ability to solve mathematical problems, and reduce risk of disaster. Teachers need to familiarize students to solve mathematical problems with the context of disaster. Therefore, it is necessary to develop math problems with the context of disaster. This research is an early stage of development research. The purpose of this study was to analyze the needs of teachers and students for math problems in the context of disaster. The participants in this study were one mathematics teacher and 53 students of year 7 and year 8 from SMP Negeri 1 Banda Aceh located in affected area of Tsunami. Data was collected through an open questionnaire with 12 questions for teacher questionnaires and student questionnaires. Data analysis was carried out descriptively. The results of research on the importance of mathematical questions in the context of disaster include: (1) Teachers often provide math questions in the form of stories during learning and around 42% of children like to solve math problems in the form of stories; (2) the teacher has never read math questions in the context of disaster and only three students who have read a math questions with the context of disaster obtained outside the school; and (3) teachers and 72% of students agree are willing to give/solve math problems with the context of disaster during the learning process. The results of this study showed that the availability of mathematical questions with the context of disaster is still very lacking so that mathematical questions need to be developed in the context of disaster.

Keywords: math problems, the context of disaster.

343 Learning design about proving trigonometry identity using Problem-based learning (PBL)

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Abstract. This study aims to develop the design of learning proof of identity trigonometry in class X MIPA using PBL. Learning design is compiled using design research according to Gravemeijer & Cobb (in Akker, Gravemeijer, McKeney, and Nieveen, 2006), focusing on the first stage, namely: preparing for the experiment. The results of the study were in the form of a trigonometric identity proof learning design using PBL which had been tested on 33 students of class X MIPA 2 in one of the private high schools in Yogyakarta. The learning process is adjusted to the syntax of PBL according to Ibrahim and Nur (Rusman, 2016). Phase 1: Orientation of students to the problem. Educators convey material topics, apperception, and explain in general the processes that will be experienced by students. Phase 2: Organize students to learn. Educators divide students into groups to work on Student Worksheet 1. Phase 3: Guiding individual or group experiences. Educators go around to each group to provide support in solving problems. Phase 4: Develop and present the work. Educators ask students to collect Student Worksheet 1 answers and then ask two students to present their group answers in front of the class. Phase 5: Analyze and evaluate the problem solving process. Educators guide the analysis and evaluation process in accordance with the learning objectives to be achieved.

Keywords: desain pembelajaran, identitas trigonometri, sintaks PBM.

344 Didactic trajectory of learning device development using project-based learning

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Abstract. The purpose of this study is describe the role of project-based learning in design a learning trajectory of learning device development to improve mathematical knowledge for teaching of prospective mathematics teachers. The method use is design research with three stages, namely, preliminary design; teaching experiment; retrospective analysis. The subjects of research are prospective mathematics teacher class of 2019 from one university in Kuningan, Indonesia. The use of project-based learning in designing learning trajectory of learning device development plays an essential role as an elicited to improve mathematical knowledge for teaching. This study also describes the design principles and characteristics of the learning trajectory namely didactic trajectory designed by the role of project-based learning syntax.

Keywords: Design Research, Learning Trajectory, Mathematical Knowledge for Teaching, Project-Based Learning

363 Improving the communication skills of grade vii students for animals classification and set by using stem approach

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Abstract. Communication ability is one of the most important abilities in the 21st century, but at this time students' ability to communicate is very limited. The STEM (Science Technology Engineering and Mathematics) approach helps teachers integrate between science, technology, engineering and mathematics in learning. Learning using the STEM approach makes the knowledge possessed by students intact and able to create effective communication in various forms and contents verbally, written, and using multimedia. This study aims to describe the communication skills of 34 students of Grade VII D on Science and Mathematics subjects with the STEM approach. The research method used is design research (data collection instrument method) The results of the study are in the form of presentations in the form of science and mathematics subjects. This research was conducted at Yogyakarta State Middle School 1 for grade VII students. The results of the study indicate that students' communication skills can be trained structurally indicated by the results of the videos made. The average score of 28 shows good value. The results of this study indicate that science and mathematics learning with the STEM approach has the potential to develop students' communication skills.

Keywords: STEM approach; integrative; collaboration.

364 The efforts to develop the geometry teaching-learning tools based on acehnese culture through problem based learning in junior high school students

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Abstract. The implementation of the mathematics teaching-learning based on the curriculum 2013 in Indonesia requires teachers to develop their own tools. The tools must be compiled in a complete and systematic manner so that the teaching-learning takes place in an interactive, inspiring, fun, challenging, efficient, motivating the students to actively participate and provide enough space for innovation, creativity, and independence in accordance with their talents, interests, and physical development as well as psychological learners. However, considering the diverse geographical conditions of Indonesia, certainly the tool preparation needs to be adjusted to the cultural background of the students. This study aims to develop teaching-learning tools on geometry based on Acehese culture consisting of learning implementation plans (RPP), student worksheets (LKPD), learning outcomes tests (THB) and teaching materials through the Problem Based Learning (PBL) model. This study uses the Dick and Carry development model, consists of ten stages. However, this study only did seven of the ten stages. The observation was carried out at SMPN 1 Meureudu, Aceh. The results show that 1) the students were able to understand geometric concepts well through group discussions, so that they could solve problems related to the real world, 2) the teachers were still limited in preparing learning tools based on Acehese culture because teachers were still guided by prepared textbooks by the Minister of Education, 3) the participants' initial ability still needs to be explored further because students have not sufficient prerequisite material, 4) the learners know to build curved side spaces, are able to distinguish the elements with the help of flat spaces, are able to use surface area formulas and volume up side spaces independently curved and able to solve real problems using the concept of building a side space, 5) the suitable questions were developed at LKPD and learning outcomes tests (THB) in the form is essay questions, 6) the learning

strategies that are suitable to be applied to achieve the learning objectives to be achieved by students are choosing Problem Based Learning learning models by integrating Acehese culture, 7) the format for preparing teaching materials refers to the Ministry of National Education 2008 in Indonesia which consists of an evaluation component which includes the feasibility of content, language and presentation. At this stage, improvements were made to the draft of RPP, LKPD, THB and teaching materials in the form of a preliminary design of a teaching-learning tools called Prototype 1.

Keywords: Development; geometry learning tools; Aceh culture; Problem Based Learning.

367 Development of proving ability in geometry

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Abstract. This research was designed to develop students' proving ability in geometry. Initially three undergraduate students were given several geometry problems, each of which asked the students to prove a certain statement in geometry. Initially they were not successful in proving those statements. The errors that the students made were then analyzed using Error Classification Model proposed by Movshovitz-Hadar, Zaslavsky, and Inbar (1987). The errors that the students had made were then shown to the students. The students were then given instruction (guidance) in methods of proving statements in geometry. Several new problems which were considered equal to the earlier problems in the level of difficulty were then given to the students, each of which also asked the students to prove a certain statement in geometry. It was found that there was an increase in the correctness and accuracy of their attempted proofs compared to their earlier work, which was an indication of improvement in their proving ability in geometry.

Keywords: proving ability, error analysis, methods of proving statements, geometry.

368 Supporting students' creativity in solving trigonometric ratio problems through inquiry-based learning using clinometer

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Abstract. This article focuses on a form of instructional design which supports students' creativity in applying the concept of trigonometric ratios to solve problems through inquiry-based learning assisted with clinometer as a mathematical tool. In particular, it uses design research methods to investigate students' creativity in applying trigonometric ratios throughout a cycle of a teaching experiment designed to support students' creativity in applying trigonometric ratios to solve problems assisted with a clinometer as a mathematical tool. The instructional design of this study was design by using Realistic Mathematics Education (RME) as the main theory. Because inquiry-based learning is a learning model that satisfies all principles of RME, we designed inquiry-based learning with RME approach to provide a series of learning activities that can encourage students' creativity in applying a mathematical concept of trigonometric ratios. Findings suggest that inquiry-based learning can support students' creativity in applying trigonometric ratios to solve problems. Moreover, teachers have an important role during learning activities such as providing some problems that can encourage students' creativity, directing students to construct their own understanding, and guiding students to get the correct conclusion.

Keywords: trigonometric ratios, inquiry-based learning, creativity.

369 Teaching volumes of solids of revolution to mathematics education study program students using earthenware

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Abstract. Volumes of solids of revolution is one of the sub-material from application of integrals which are often studied in abstract. Usually students memorize formulas and do calculations. This often happens because there is no good understanding of calculating the volumes of solids obtained by rotating the region. This study aims to find out how to teach the concept of volumes of solids of revolution to students of the Mathematics Education Study Program using the context of earthenware. The earthenware context is an approach that aims to bridge the real life activity to abstraction of volumes of solids of revolution. The research method used in this study was design research. It consists of three phases; they are preliminary design, teaching experiment and retrospective analysis. The instrument used was a written test instrument. This study show that earthenware context can help students understand the concept volumes of solids of revolution.

Keywords: Design Research, Volumes of solids of revolution, earthenware context.

377 Students' specializing in mathematics problem solvingA K Putri¹, A Lukito¹ and P Wijayanti¹¹Universitas Negeri Surabaya

Abstract. The ability to think mathematically in solving problems is an important goal of schooling. It is an ultimate goal of teaching that students will be able to conduct mathematical investigation by themselves, and that they will be able to identify where the mathematics they have learned is applicable in real world situations. The first phase of mathematical thinking is specializing. Specializing means turning to some examples to learn more about the main goal of a concept or problem and these examples are specific and particular instances of more general situation in a concept or problem. This study based on students' difficulties to think mathematically in mathematical problem solving. There are still many students who feel confused when solving problems. The purpose of this study is to investigate students' specializing of two six grades students in solving problems. They were selected from ten student taking math skill and problem solving tests. They were classified in high and low mathematics abilities. Then they were interviewed based on their work of the given tasks. When solving the problems, subject with high mathematical ability was able to describe the known, the way to determine the solution and try to looking at the other examples. While, the subject with low mathematical ability knows about concept that can be used help the problems but she don't know the way to determine the solution. Even though taking more time, by applying both a structured-scaffolding and using specializing systematically that fit the problems they succeeded solving them. These results may contribute math teachers in a way how to help students use specializing in solving problems.

Keywords: mathematical thinking, specializing, problem solving, mathematic education.

383 Design research: Learning improvement using pendidikan matematika realistik indonesia (PMRI) approachment for constructing the relational understanding of the topic sequence and series grade 8 at smp pelangi kasih

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Abstract. SMP Pelangi Kasih have two curriculum, that is National Curriculum (KTSP 2006) and Cambridge Curriculum. Curriculum combination have impact in the topics to learn by students in this school. The impact also in mathematics subject. Students need to learn more topics to passed on National Examination and IGCSE (International General Certificate of Secondary Education). By teacher experience and verification by student test, discovered that topic Sequence and Series at grade 8 is difficult to learn. One of the difficulties is to many formulas to be remembered. The effort that teacher use is using PMRI approachment for constructing relational understanding in this topic.

Teacher use the Asian Games become phenomenological exploration, especially in Stadion Utama Gelora Bung Karno (SUGBK) running lanes. By the running lanes, student is expected to understand the definition of sequence, of course the students should find the circumference from every lanes first. Still on the running sport, students also can learn about Series by relay run (lari estafet).

The research is do in one class grade 8 SMP Pelangi Kasih on May 2018. The students is divide to be 6 groups, each group consist of 4 students. Every group have already mix and match by the personality and mathematics ability. Every learning activity have been design carefully and with purpose, all the teacher-student activity in a class is summarized on Hypothetical Learning Trajectory (HLT). Students is guide to be rationally thinking by doing a learning activity paper. There are 6 students be the subject in this research, teacher is guide the class and one shadow teacher is observe the 6 students. For every leaning activity there is a recording audio of each group and video shoot in the class.

The result of this design research is 6 students, from small to big ability in mathematics and from the quiet and talker, all the students can understand the Sequence and Series topics by PMRI and relational understanding. It is can be discovered by the post test of each student at the end of experiment.

Keywords: Design Research, PMRI, Asian Games, Running Lanes, Relational Understanding, SMP Pelangi Kasih

388 Designing PISA like tasks considering levels of context use for mathematical problem

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Abstract. One of the crucial feature in designing PISA like task is finding and turning a context into an authentic task. The aim of this study is to develop a set of PISA like tasks which considers the revised classification of levels of context use developed by Salgado (2016). The classification consists of two criteria, i.e. formulation and Interpretation, in which the first use and second use of context are emphasised in the tasks to reflect an increasing use of context from the lowest level to the highest level of context. The tasks were developed within a developmental study by employing formative evaluation stages: preliminary study, self evaluation, one-to-one, expert review, small group, and field test by involving three experts and thirty secondary students. Results point out that the tasks were empirically valid and practical as well as has potential effect in promoting students' mathematical literacy, attract their seriousness, and develop their interest in solving the PISA-like tasks being developed. This study suggest PISA like task designers to use the tasks resulted in this study within teaching practices to examine their potency in improving students' mathematical literacy. Furthermore, PISA like task designers need to challenge themselves in considering the constraints of assumptions in the information provided in the tasks, varying contexts, as well as meeting the complexity of the language use.

Keywords: design research, developmental study.

389 Learning pythagorean theorem from ancient china: A preliminary study

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Abstract. In this article, we explore how History of the Pythagorean theorem, especially from ancient China, as a source of inspiration for learning design. Based on historical examples and problem solving from the history of mathematics, we try to arrange instructional tasks for seventh-grade secondary education students and how its role in supporting students' understanding of Pythagorean theorem. We focus on explaining the preliminary studies or the first phase of the three main phases in design research. The basic idea of instructional design is to introduce historical geometric diagrams and solve the right triangle problem in the manner of Liu Hui (3rd century CE). The purpose of introducing geometric diagrams is to connect students' symbolic algebraic thinking with visual thinking about geometric shapes especially in the case of right triangles. In this study, we also conducted interviews and debrief sessions with teachers and tested the student's history-based tasks to several students for initial investigation in the matter of developing the Hypothetical Learning Trajectory. Results of this study show that teachers have a positive response toward the history-based instructional task developed. On the other hand, we find the resolution of Right Triangles problems with diagrams by the students involving three steps: *translation*, *transformation*, and *diagrammatic reasoning*.

Keywords: pythagorean theorem, history of mathematics, ancient china, problem solving, geometric diagrams, design research.

390 Design research: Implementation of pendidikan matematika realistik indonesia (PMRI) in efforts to improve student's algebraic thinking skills ability

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Abstract. Algebra is one of the important thing in problem solving, especially in contextual problems. Algebra mostly used as a tool for solving problems in mathematics, science, economics, business, finances, etc. This make algebraic thinking skills included in one of the most important discussions in mathematics education. The results of the trials that have been conducted at school shows that student's representation skills was still very lacking, thus influencing the lack of student's problem solving abilities, especially in contextual problems. The student's understanding of the Circle is also poor, it can be seen from the gap between understanding the circle in graphical representation and the circle in algebraic form. This research aims to develop a Hypothetical Learning Trajectory (HLT) to improve student's algebraic thinking skills in Circle by applying PMRI. Using a design research method, this study consist of three cyclic phases; (1) the preparation and design phases, (2) the implementation phases, and (3) the retrospective analysis phases. The instruments used in this study were videos, student's worksheets, interview results, field notes, and HLT. Activities in the classrooms use one main theme which is currently popular among high school students, namely "Ojek Online," where the contextual situation is carried out by various activities that provide opportunities for students to do mathematics. Based on the results of the retrospective analysis, activities designed in the context of "Ojek Online" can help students develop their representative skills. The series of activities in this design research also can help student develop their algebraic thinking skills and understand the concept of Circle. Class discussions also contributed to developing student's algebraic thinking skills in learning Circle.

Keywords: design research, algebraic thinking, algebra, circles, PMRI.

391 Developing learning trajectories with the RME of pythagoras material

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Abstract. There are three main parts of the hypothetical learning trajectory (HLT), are (1) learning objectives, (2) learning activities, (3) student understanding and problem solving strategies. The researcher tried to develop a context that helped students in finding the concept of the pythagoras theorem using the RME approach. In this study, the type of research used by researchers was design research developed by Gravemeijer and Cobb. There are three phases in design research according to Gravemeijer and Cobb, namely preliminary design, experimental design, and retrospective analysis. In this paper, researchers describe limited to the first phase of design research.

Keywords: Hypothetical Learning Trajectory (HLT), Realistic Mathematics Education (RME), pythagoras.

394 Land subdivision: How students determine equal area of a triangleA Hendroanto¹¹Universitas Ahmad Dahlan

Abstract. This study aims to support student's understanding of the properties of a bisector related to the area of the triangle. A context and a set of activities is design based on Realistic Mathematics Education (RME) theory to develop students' understanding and to engage them in meaningful activities. Design research is chosen as the research approach with two cycles of experiment. A context of land subdivision problem was selected to activate students' prior knowledge and to bring them into the activities. At First, the activities is presented in small group of mathematics students and in the regional mathematics competition as one of the final question for the finalists. Then, the second cycle is conducted in the classroom with students from mathematics education program in Universitas Ahmad Dahlan. The result showed that none of the students and finalists in the competition were able to solve the question because they do not have idea how to do land subdivision. They cannot use their prior knowledge of bisector to solve the problem. After revising the activities, in the classroom, all groups in the class were able to solve the problem. These activities are land subdivision with three different levels of difficulties and purposes.

Keywords: Bisector, Triangle, Realistic Mathematics Education, Design Research, Land Subdivision.

402 Designing learning trajectory in supporting pre-service mathematics teachers to develop learning instructional based on reflective pedagogy paradigm

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Abstract. Designing Learning Trajectory in supporting Pre-service Mathematics Teachers to develop learning instructional designing LT is needed so that lecturers can help students develop mathematics learning in schools according to the demands of the 21st century. The competencies expected to be mastered in the 21st century include critical thinking and problem-solving, creativity and innovation, collaboration and communication. Then in learning developed by students also should accommodate these competencies. Learning trajectory that used a hypothetical learning trajectory (HLT) for instructional decisions. In this paper, the researcher will present a learning trajectory in supporting pre-service mathematics teacher using reflective pedagogy paradigm to develop learning instructional. The type of research used by the researcher in this study was the design research developed by Gravemeijer and Cobb. There were three phases in the research development, namely (1) the preparation of the design, (2) testing the design, and (3) the retrospective analysis.

Keywords: design research, teacher education.

404 The effectiveness of teacher's interpersonal behaviour on students' attitudes in mathematics classroom

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Abstract. The aim of this study is to investigate how students interpret their teacher's interpersonal behaviour and how this students' perceptions of their teacher's interpersonal behaviour influence their attitudes in mathematics classroom. The subject of this study were 30 students in one Primary School in Surabaya, Indonesia. This study was survey research. Questionnaire on Teaching Interaction (QTI) and Test of Mathematics-Related Attitudes (TOMRA) were used to collect the data about students' perception on their teacher interpersonal behaviour and their attitudes in mathematics classroom. The simple correlation between the data from the QTI and the TOMRA will be done to look the influence of students' perceptions about teachers' interpersonal behaviour to students' attitudes in mathematics classrooms. The result showed that there is a significance correlation between students' perceptions of teacher's interpersonal behaviour and students' attitudes in mathematics classroom.

Keywords: student attitude, teacher interpersonal behaviour, QTI, TOMRA.

412 How should the teacher provide feedback and its follow-up in assessing mathematics learning?

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Abstract. Assessment is one of the important things that can affect the learning process and results. During the assessment phase, teachers are required to be able to provide effective feedback and its follow-up in order to get student learning goal. This study aims to present the facts that related to how forms of feedback and follow-up carried out by mathematics teachers in a one of public high school in Cimahi, West Java. Qualitative descriptive research method is equipped with observation, interview and questionnaire used to collect the research data. Through the data collection technique, it was found that the feedback that teacher presented from the entire learning process and the assessment process was still very insufficient. Students only get information about the scores obtained from the assessment in the form of a written test. There is no descriptive feedback and appropriate follow-up that makes students still feel difficulties in implementing mathematics learning. At the end of this article, it is also presented a recommendation for providing effective feedback based on theoretical studies of the results on previous studies.

Keywords: assessing mathematics learning, feedback.

416 Integrating the hypothetical learning trajectory of teaching mathematics with realistic mathematics education approach to in-service teachers' professional development

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Abstract. This study aimed at integrating the notion of Hypothetical Learning Trajectory (HLT) of teaching mathematics with Realistic Mathematics approach to in-service teachers' Professional Development. We constructed a teachers' training program to develop teachers' understanding on designing mathematics lesson with Realistic Approach. 60 secondary teachers were participated in the workshop and all have contribution in designing lesson in 20 groups. Most teachers tried to follow the direction to develop lesson with regards students' capacity that direct to one-way direction from teachers in which students' action is based on teachers' action. There were two groups of teachers consider to highlight hands on activity that lead to developing concept by using characteristics of Realistic Mathematics Education. We exemplify the process considering learning goals in lesson on similarities figures and exponential numbers.

Keywords: Hypothetical Learning Trajectory, Realistic Mathematics, Teachers' Professional Development.

418 Teachers' use of classroom assessment in primary school mathematics education in Jambi Indonesia

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Abstract. This paper reports on a survey of the classroom assessment practices of Jambi city primary school teachers in mathematics education. We investigated, using questionnaire, how teachers' assessment methods, purpose, and beliefs about the usefulness of assessment are related. In total 100 teachers at 80 from 3 primary schools responded to the questionnaire. Observation-based assessment methods of questioning, observing, and correcting written work, were the most frequently – that is weekly – applied methods, whereas instrument-based methods, particularly using textbook test and student monitoring tests were employed several times a year. Teachers used assessment mainly for formative purpose and they considered the assessment methods they used themselves as most relevant.

Keywords: classroom assessment, primary school, mathematics education, survey study.

420 The cognitive process of students in understanding the parallels axiom through ethnomatematics learning

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Abstract. The cognitive process of students in understanding the parallels axiom through ethnomatematics learning Abstract Activities of remembering, analyzing, understanding, judging, reasoning, imagining and speaking are needed in learning geometry. This is the cognitive process of students. Lobachevsky's axiom of parallelism is difficult to understand through low thinking. Ethnomatematics is one solution. The purpose of this study is to describe the cognitive process of students in understanding parallels through ethnomatematics learning. This research is the initial stage of development research. We conducted in-depth interviews with 8 Bengkulu high school students in Indonesia. The research instrument was the researcher himself who was guided by an interview guide on understanding the Lobachevsky Axiom of Alignment. Interviews were conducted during geometry through the ethnomatematics learning approach. Data were analyzed qualitatively through fixed comparison techniques. The results of this study are that students can encapsulate two or more traits in the Lobachevsky alignment axiom through ethnomatematics in the form of bubu. (Bubu is a traditional fishing gear in the village community in Bengkulu). The next cognitive process is that students can build an object about infinite lines that are parallel to certain gari. The encapsulation activity produces a correct understanding based on the properties of woven mats. The conclusion of this study is that through the ethnomatematics approach students can achieve trans level cognitive processes.

Keywords: ethnomatematics, cognitive process, the parallels axiom.

422 Experience of a Mathematics Teacher Practitioner and Mathematics Educator Concerning the Teaching and Learning of Mathematics in Indonesia

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Abstract. It is cannot be denied that the fourth industrial revolution, industry 4.0., will affect the very essence of each country economic development, especially from year 2025. Inadequate preparation of Indonesian students during the teaching and learning of mathematics imposes a serious problem of Indonesia. Based on its experience as a mathematics teacher and as an educator, it can be identified three problems: (1) the weakness of Indonesian to compete with other people from other countries, (2) the weakness of education in facilitating students to be 'creative' and 'critical' and (3) it is difficult to change and to improve the quality of teaching and learning process from a "typical" mathematics classroom to the new one and more innovative. Therefore, the new direction of the curriculum are that the learning in the classroom must refer to the 'Strengthening of Character Education', 'Literacy', '4C' and 'Higher Order Thinking Skill'. Again, based on its experience the question can be aroused is: 'has and how the direction of the curriculum been implemented by Indonesian mathematics teachers?' This study aims to: determine the thinking skills and character that students must possess; determine the learning process in the classroom that must be done by mathematics teachers and determine the role of mathematics teachers during the learning process so that students are able to compete with students from other countries in the industrial era 4.0. The two aspects that must be taken into account by mathematics teacher are 'creativity' and 'critical thinking'. During the learning process the teacher can implement a problem solving approach or scientific approach and the learning process should be started with 'problems', 'activity' or 'task' to ensure that Indonesian students can be facilitated to learn to think, to solve problem and to explore in order to help them to be 'creative' and 'critical'. The education motto of Ki Hadjar Dewantara (KHD), *ing ngarsa sung tuladha, ing*

madya mangun karsa, tut wuri handayani, can be used to improve the teaching and learning of mathematics in the classroom.

Keywords: industry 4.0, creativity, critical thinking, problem solving approach and scientific approach.

424 Visual aids to develop the ability on learning math for children with the special needs (slow learner and dyscalculia)

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Abstract. The visual aids is a concrete object that can help children generally in understanding learning any matter, especially those who have special needs in primary school. Lack of use concrete objects like the visual aids that can help the son of special needs in understanding matter of learning especially learning mathematics, are obstacles occurring in primary school. This article focus on described the visual aids with its quality to develop the ability of children learning mathematics with special needs (Slow learner and Dyscalculia). The interesting visual aids will be the attraction for children with special needs (Slow learner and Dyscalculia) in understanding learning mathematics. The visual aids are designed using features developed by Maria Montessori. Montessori developed five tool traits visuals that are interesting, graded, auto-correction, auto-education and contextual. The developed visual aids is the visual aids board multiplication for the slow learner and the visual aids the division without the 1-30 for the diskakulia. On each visual aids which is developed on this article based on the problems that were found in the field to help children with special needs in overcoming the existing problems. Therefore this article was described the visual aids with its quality to develop the ability for children who learn math with special needs (slow learner and dyscalculia).

Keywords: the visual aids, slow learner, dyscalculia, and mathematics.

425 The development a waste-based mathematics education mediumS M Amin¹, A Lukito¹, and S Khabibah¹Universitas Negeri Surabaya

Abstract. Indonesian people's environmental awareness, especially on waste management, is not up to par. This can be seen from Indonesia's position as the world's second biggest contributor to waste, especially plastic. This is why an innovation is needed to transform waste into a useful product. One of the possibilities is to use it as a media for mathematics education. This research is intended to develop a waste-based mathematics education medium. This research is a multi-phase developmental research involving preparatory and development phase, testing phase, analytical-retrospective phase, and dissemination phase. Research shows that waste-based mathematics education can be split into two: non-processed (direct) waste medium, and processed (indirect) medium. Both mediums can be effectively be used for education on topics such as two-, and three-dimensional objects, volume, area, mixed operation, addition and subtraction of integers, data manipulation and statistics, patters, as well as spatial capability.

Keywords: development, waste-based, mathematics education medium.

426 Designing learning activities using rigorous mathematical thinking (RMT) approach in application of derivatives

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Abstract. Learning design is one of the factors that support the learning process in order to achieve learning objectives in all subjects including mathematics. Many approaches can be employed by a teacher in making learning design, one of which is rigorous mathematical thinking (RMT) approach. The RMT approach puts forward students actively in constructing their knowledge through the use of psychological tools and mediation. This article reports a set of learning activities designed through a developmental study using the RMT approach in the topic of application of derivatives. In the learning process, students use psychological tools to connect their previous knowledge to the material being studied. This makes students able to construct their own knowledge more thoroughly. On the other hand, with the mediation carried out by the teacher, students can focus more and understand each material well and bridge the conceptual errors. Based on the results of the study and some literature, the results of the application of learning design with the RMT approach could improve high-level thinking skills such as reflective thinking, critical thinking, and creative thinking.

427 Elementary school teachers' perceptions of the integration STEM education in mathematics classroom

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Abstract. At the moment, educational issues are developing and rapidly increasing. One of the examples is the integration of Science, Technology, Engineering, and Mathematics called STEM. In Indonesia, STEM is a relatively new concept that is booming with potential. In the mathematics classroom, teachers have to facilitate students exploring STEM activities in the learning process. In response to this, SEAMEO Regional Centre for QITEP in Mathematics has embarked its programme through training and research. This paper reports on a study that investigated the teachers' perceptions of STEM Education and integrative nature of these disciplines after experiencing STEM activities. The STEM activities designed are related to the concept of resilience in bungee jump (Science) and proportional relationships between quantities (Mathematics). Data were collected using Likert-scale questionnaires and interviews. Both qualitative and quantitative data were collected and analyzed using the mixed method methodologies. The results of this study provided an initial understanding of teachers' perceptions of STEM. These findings also suggest some recommendations of mathematics teachers pedagogical needs to support the integration of STEM education in the mathematics classroom, especially in the Indonesian context.

Keywords: STEM, teachers perceptions, bungee jump, activities, mathematics, training.

430 Design research on realistic mathematics approach to shift the passive traditional classroom social norm towards an active

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Abstract. Social norm is considered an issue to be solved in eastern countries especially in Indonesia. Affected by the eastern culture in which students can not speak their opinion freely, otherwise it is correct, and in which students should listen to every word of the teacher and not argue it since teacher is always right. That produce passive students. They are not confident to speak their idea and opinion. They lack of initiative to take a lead or think of an idea. They also not so critical and only take what the teacher explain. Realistic mathematics, in contrary, were developed based on the Freudenthal's idea that view mathematics as human activity. Hence, realistic mathematics education promotes the shifting of mathematics teaching from transferring knowledge to constructing knowledge. This require active participation of the students and produce on interaction among students and teacher-students' interaction. Furthermore, it promotes active social norm in the classroom. This study aims to describe the social norm happened in mathematics realistic classroom and its changing from passive to active. The mathematics realistic classroom which is stated in this study is a classroom in where a series of mathematics activities in learning coordinate system is conducted as part of design research study. The shifting is showed from their improvement: from not able to speak their mind and explain their answer in front of the class become students who wants voluntarily give their opinion; from teasing friends for answering questions to awarding friends by giving an applause for their answer; and from whispering to himself about his disagreement of an answer to justifying their friends answer and explaining their disagreement.

Keywords: design research, realistic mathematics, classroom social norm.

431 Analysis of student mathematic representation to completing problems on relations and function materials

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Abstract. This research is a qualitative descriptive study that aims to determine the forms of mathematical representation of students who appear in working on problems related to material relations and functions and to know students' understanding of the concepts of relations and functions. This research was conducted in May 2018. The subjects in this study were VIIIA grade students of Kanisius Kalasan Middle School, Yogyakarta 2018/2019. Data collection methods used are written tests and interviews. The data analysis technique is data reduction, data presentation and conclusions and verification. Based on the results of analysis and interviews, it can be concluded that Student 1 (S1) has not understood the concept of relations and functions appropriately. In presenting relationships given S1 uses visual, verbal and symbolic representations. Student 2 (S2) has understood precisely the concepts of relations and functions and in presenting relationships using visual and symbolic representations. Whereas Student 3 (S3) presents relations with verbal and symbolic representations and S3 does not yet understand the concepts of relations and functions.

Keywords: understanding of concepts, mathematical representations, relation, functions.

434 Ethnomathematics: Design mathematics learning at secondary schools by using traditional game of Melayu Riau

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Abstract. Riau Province has been committed to become the center of Malay language and culture in 2020. Various efforts need to be made to introduce the Cultural Heritage both inside and outside the province. This research supports government commitment by designing mathematics learning using local culture. This research, design mathematics learning at the Secondary School using the traditional game namely Rimau, Ligu and Guli. The findings will be used in mathematics learning to introduce culture while bringing mathematics closer to student life. This study is a research and development with the Four-D approach. Game exploration is done at Define Stage, Instructional Design is done at the design stage, Learning material is created at the development stage. The Instructional design is disseminated into teachers and students of Secondary Schools. Data collection is done through documentation studies and interviews. The Game exploration resulted in the use of these games for various mathematical concepts of algebra, Geometry, and statistics for mathematics learning in secondary school. Based on FGD with the users can be concluded this Mathematics Learning Design help teachers in delivering relevant topics and recommended to be used by secondary schools teachers.

Keywords: ethnomatematics, secondary school, traditional game, Melayu Riau.

442 Learning design using PMRI to central tendency materialsA Meitriova¹ and R I I Putri¹¹Universitas Sriwijaya

Abstract. The aims of this study are to determine the role of activities in learning the central tendency materials (mean, median, and mode), which is expected to be able for helping students understand the concept of statistical learning in grade VIII. The method used in this study is Validation Studies type Design Research involving students of MTs Negeri 1 Palembang. There are three stages in the design research type of validation studies, namely Preparing for the experiment in the form of literature studies and the design of the Hypothetical Learning Trajectory; Design experiment in the form of a Preliminary Teaching Experiment (Pilot Experiment) and Teaching Experiment; and Retrospective analysis. In this study only that of preliminary teaching experiment (pilot experiment) is considered. The activity begins with questions about understanding the concept of the mean then the question of understanding the concepts of the median and mode, the question of associating the mean and median to determine the mode. The results of the learning experiment show that through the questions given can support students to understand the concept of the mean, median and mode and know the relevance.

Keywords: design research, LSLC, PMRI, statistics.

446 Designing reasoning problem of linear equations with two variables through compare and exchange activitiesA Agustina¹ and Zulkardi¹Universitas Sriwijaya

Abstract. This study aims to design reasoning problems of linear equations with two variables through comparing and exchange activities. This is focused on how students use the compare and exchange activities to find a way to solve linear equations with two variables with mathematics concepts in human's daily activities is chosen as a design underlies activities in the design based on a Realistic Mathematics Education (RME). RME based teaching has been adopted by countries including Indonesia with the so-called Pendidikan Matematika Realistik Indonesia (PMRI). This study was used to design research as an approach. We first develop hypothetical learning trajectories (HLT) of the learning we designed. Data collected in this study included students' written works, observation notes, and video-records. The data were analyzed by comparing the actual learning process and the hypothetical learning trajectories (HLT). The data also showed that the students' activities to be more flexible strategies to solve for equations.

Keywords: design research, compare and exchange activities, linear equations, PMRI.

451 The data package context in mean study using LSLC and PMRIP T Rahayu¹ and R I I Putri¹¹Universitas Sriwijaya

Abstract. This study aims to produce statistical learning designs in the introduction of the concept of average values and knowing student learning outcomes in learning average values by previously learning about the presentation of data consisting of tables and diagrams through learning trajectories and what happens during the learning process. This learning is based on Lesson Study for Learning Community (LSLC), the approach of Indonesian Realistic Mathematics Education (PMRI). This study uses a type of Design Research method research design type of validation study, which involves in MTs 1 in Palembang. There are three stages in design research type validation studies namely Preparing for the experiment in the form of literature study and the design of the Hypothetical Learning Trajectory (HLT); Design experiment in the form of a Preliminary Teaching Experiment (Pilot Experiment) and Teaching Experiment; and Restrospective analysis. The instruments used were written test, video and field notes. The results of learning experiments show that the design of learning provided has helped students understand the concept of Mean.

Keywords: Design Research, Mean, LSLC, PMRI.

454 Crochet Crafts As A Context Using LSLC in Number Pattern

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Abstract. This study aims to determine students' understanding of number pattern learning by using the context of crochet crafts in 8th grade students. This research was conducted at SMP Negeri 1 Palembang. This research method using design research . The stages of the research carried out consisted of preparation for the experiment, design experiments, and retrospective analysis. Data collection is done through question answers, interviews, video recordings, and photos. In this study, learning was designed and developed based on alleged learning, PMRI, and LSLC. The results of this study indicate that learning pattern numbers using the context of crochet crafts can help students understand numerical patterns and find equations that can be used to find patterns of numbers to n.

Keywords: Design Research, PMRI, LSLC, Number Patterns, Crochet Crafts.

455 “Gerpak Tuyul” as a context in learning addition integer using LSLC system

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Abstract. This study aims to determine students' understanding of integer addition , which is designed to use the game of gerpak tuyul. The sample of this study was students of class VIII of SMP Negeri 1 Palembang. The research method used is design research (*design research*). this study was designed through integer integer material learning using the context of the game of gerpak tuyul. Data collection is done through video recordings, photos and interviews. The stages of this study consisted of experimental preparation, design experiments and retrospective analysis. This research was only conducted in stage 1, namely preliminary preparation. The results of this study indicate that by using the tuyul gerpak game as a context in learning it can help students to understand the concept of integer addition operations.

Keywords: Design Research, Whole Number Summing Operations, Game of Gerpak Tuyul.

457 Design division mixed fractions materials using PMRI and lesson study

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Abstract. One of the problem in modern mathematical learning proses is the mathematics concept presented by the teacher to students such as machines. So, the concepts are used by students as finished product without knowing the origin and how to reconstruct them. The effort that can be done by the teacher to overcome this problem by designing learning wherever possible starting with presenting realistic problems to drive and support students understanding abstract idea in mathematics. In this article we will discuss the design mixed fraction division based on PMRI, which is a type of design research. Design research has three cycles, namely preliminary design, classroom experiment, and retrospective analysis. This Design is aimed for supporting students understanding the concept division mixed fraction then use it into problem solving. In this article only the preliminary study phase will be discussed, which includes literature study activities, curriculum analysis, and the design of the initial prototype based on non-formal trials conducted at the SMP Srijaya Negara Palembang. An HLT (Hypotetical Learning Trajectory) has been produced regarding division of mixed fraction using image representation. This material not only designed using PMRI but also Lesson Study as learning system. So the design contain three activities, which are two activities about sharing task and one activity about jumping task.

Keywords: Design Mixed Fraction Division, PMRI, Lesson Study, Design Research.

458 Development of the complexity measurement instruments of the mathematical contextual problem of trigonometry topicM M Melissa¹ and V Y Komalasari²¹Universitas Sanata Dharma and ²St Fransiskus Asisi Jakarta Junior High School

Abstract. The complexity of mathematical contextual problems need to be measured so that they are appropriate for use, such as estimating the time to work and knowing achieve competence. This study aims to produce the instrument for measuring the complexity of mathematical contextual problem of trigonometry topic. This research and development used the combination of Plomp and Cennamo & Kalk models. The phase are: (1) preliminary study, (2) development, and (3) presentation. The subjects of this study were 1 mathematics teacher, 4 prospective mathematics teachers, and 2 mathematics lecturers. Data collection techniques used questionnaire, test, and interview. Questionnaire validation is used to determine the validation of the developed instrument. The complexity measurement instrument filled by the test subjects to determine the reliability of the developed instrument. Trigonometric test is used to classify students into groups according to their level of ability. Interview is used to determine the practicality of the instruments developed. The results of the study showed that the complexity measurement instrument of mathematical contextual problem that being developed had good quality, it is fulfilling valid, practical, and reliable criteria. The instrument has been declared valid by the expert and eligible to be tested with minor revisions. This instrument also reaches practical criteria based on the results of interviews with respondents. This instrument has fulfilled the reliable criteria based on the calculation of the reliability coefficient which is obtained that each component has fulfilled a minimum "sufficient category" of reliability. There are 4 components that have high reliability and 2 components have sufficient reliability.

Keywords: Instrument Development, Complexity Problem, Contextual Problem, Trigonometry.

460 Development of sharing task and jumping task scale material using LSLC and PBL

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Abstract. This research has purpose to get problem points to scale topics learning and analyze students answer in solving problems which already arranged through implementation of lesson study for learning community (LSLC) and PMRI approach using problem based learning. Research subject are students of VII grade of Junior High School 1 Palembang. From this research focused on LKPD questions about scale which focused on 3 problems, such as calculating scale (sharing task), determine ratio of area and scale (jumping task) and counting pempek volume with determine scale first (jumping task). Based on analysis result from student answers in small group, shown that in first problems (sharing task), 87,5 % of them can solve the question and result of this research on second and third problem shown that 25% of students can solve the question correctly.

Keywords: Scale, PMRI, LSLC, PBL.

461 Analysis of representation forms on SPLDV materials for class VIII SMP

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Abstract. This qualitative research aims to find out the representation forms of material Linear Equations System Two Variables. Data collection methods are interviews and written tests. The subjects of this study were two class VIIIA students as representatives chosen based on two large groups of the same answer. The results showed that from the two groups had different forms of representation, the subjects of one group used visual representation, while the other group used symbolic representation.

Keywords: Representation, Linear Equations System Two Variables, Visual, Symbolic.

463 Using comics to captivate primary school pupils in solving mathematics word problems

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Abstract. This study explores the use of comics in teaching primary school pupils on solving Mathematics Word Problems. A total of 13 Year 2 pupils from a primary school in Brunei Darussalam were chosen to participate in the study. A series of comics were created and some exercises included characters that were adapted from a local popular culture for utilisation in teaching the pupils in order to engage their learning. The method chosen to conduct the research is of mix method adapted through usage of the action research model. A pre-test was conducted before the lesson intervention to assess the pupils' prior knowledge of the content on the terms used in mathematics word problems. Subsequently a post-test was administered right after the intervention lessons were completed in order to discern if there were any significant improvements. Based on a classroom observation that was video recorded when the intervention was carried out, the children were highly motivated and very much interested in the content of the comics. Furthermore, the findings from the interviews revealed two major themes, which are 'Enjoyment' that detailed the pupils enjoying and had fun with the usage of the comics in the classroom, whereas 'Interest' tied in with the pupils' enjoyment that resulted from their interest in the comic books. It is recommended that educators use comics in classroom due to its potential, especially in mathematics, where certain concepts can be quite challenging for some pupils to grasp.

Keywords: Primary Mathematics, Action Research, Comics, Word Problems.

467 Students' ability to simplify the concept of function through realistic mathematics learning with the ethnomathematics approach

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Abstract. The concept of function was a basic concept that students must understand in mathematics learning. This concept needs to be implicated through realistic mathematical learning with the ethnomathematics approach. The purpose of this study is to describe students' ability to simplify the concept of function through realistic mathematical learning with the ethnomathematics approach. This was part of the research development. This stage was the prototype phase. We apply realistic mathematics learning with the ethnomathematics approach. The instrument of this research is the assignment sheet and the in-depth interview sheet by the researcher. Data was collected through task-based interviews. It is analyzed qualitatively. The results of this study are that students are able to simplify the concept of function through realistic problems based on "Andun dance" culture. He simplifies the concept of mapping. For example, f is a function from set A to B , students are able to simplify the concept of function f with $D_f = A$ (domain function f is A). Also, being able to explain with various real examples and being able to show the position of the concept of function in a deductive structure of mathematics. The conclusion of this study was that realistic mathematics learning with ethnomathematics approach can be a vehicle for students to simplify the concept of function to be more meaningful.

Keywords: ability to simplify, realistic mathematics, ethnomathematics.

468 The cognitive process of extended trans students in understanding the real number system

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Abstract. There are seven levels of student schema development in learning real analysis. Extended trans is the highest cognitive level. The purpose of this study is to describe the cognitive process of students in understanding the real number system. This is the initial part of development research. We want to know the highest initial ability students have about real number systems. The subjects of this study were 12 students of Real Analysis at the Bachelor of Mathematics Education Program. Students are interviewed based on assignments. Data were analyzed using fixed comparison techniques. The results of this study are that students can build linkages between actions, processes, objects, and other schemes (performing retrieval of the previous schema) by using and selecting procedures or operations in real number systems. He was able to apply the concept of the properties of bounded set to problem solving so that a mature scheme was formed. The scheme can be used to solve related problems. Also, can build new structures based on mature schemes that they already have. The conclusion of this study is that students can interiorize, encapsulate and thematize schemes that mature into a deductive structure.

Keywords: Cognitive process, understanding, real number system.

470 Students of the extended abstract level in proving Lobachevsky's parallel lines theorem

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Abstract. The highest quality of the students in proving the theorem is extended abstract. One of the theorems that is difficult to determine is Lobachevsky's parallel lines. The purpose of this study was to describe the characteristics of extended abstract level students in proving the Lobachevsky parallel lines theorem. This is was part of research development. This stage is the student analysis phase. The subjects of this study were 21 Mathematics Education students who were taking Geometry courses. The instrument of this study was the researchers themselves with the help of task sheets and interview guides. Data was collected through task-based interviews. Qualitative data analysis techniques with fixed comparison techniques. The results of this study are that students are able to understand the axiom "through a point outside the line g , there are at least two lines parallel to g ". This axiom was used to prove the Nonmetrical Theorem. Also, students are able to prove that through point T which is not located at line g , there are not so many lines parallel to g . Students are able to compare the deductive structure of Lobachevsky's Geometry with Euclid's Geometry. The conclusion of this study is that extended abstract students are able to present several elements and pass interdependence between one another, so that it becomes an integrated entity. He can generalize to new structures.

Keywords: the extended abstract, parallel lines, Lobachevsky's theorem.

471 The mathematization process of students to understand the concept of vectors through learning realistic mathematics and ethnomathematics

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Abstract. The concept of vector is one that is difficult for students to understand. Realistic mathematics learning with ethnomathematics approach makes it easy for students to learn mathematics. The purpose of this study is to describe the mathematical process of students in understanding vector concepts through learning realistic mathematics and ethnomathematics. This research is the prototype stage of development research. The subjects of this study were 38 high school students in Bengkulu. Observation sheets, anecdotes and interview guides are the instruments of this research. Data was collected during the realistic mathematics learning process using the ethnomathematics approach. Data is analyzed qualitatively. The results of this study are the mathematical process of students in understanding the concept of vector by using selfie culture. Camera drones can stop in space. This is one of the multiplication properties of two perpendicular vectors. Multiplication of points is zero. The conclusion of this study is that the mathematical process of students using realistic selfie culture can achieve the multiplication of two vectors which form right angles.

Keywords: Mathematical processes, vector concepts, ethnomathematics.

473 Applying an alternative teaching aid in the learning of fractions, decimals and percentages

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Abstract. An implication on the use of comics in converting between fractions, decimals and percentages as part of the teaching material allows students to experience learning as well as to instil their interest towards the Mathematics subject. The study investigated the performance (scores) of Year 9 students in one of the secondary schools in Brunei Darussalam. The aim is to explore the strength in using comic as a teaching aid for students to learn and achieve the objectives of the lesson. The use of comic as one of the teaching tools proved that there is positive improvement after having the intervention lesson. The findings before the intervention lesson revealed that the mean score is 4.62 from two classes where this indicated there is low progress in understanding the concept and the procedural in converting between fractions, decimals and percentages. However, after conducting the intervention lesson, the students showed progressive improvement from their post-test scores where the mean score is 6.82. At this stage, there is positive impact that shows that the use of comic really helped the students in understanding the concept and the procedures in converting between fractions, decimals and percentages. In addition, the paired sample t-test is another successful analysis where it shows an improvement on the significant difference in mean scores which is $p < 0.05$ level. From the students' interviews, they mentioned that they enjoyed learning with the use of comics because they get to experience a new style of learning that is better suited in achieving the objectives of the lesson.

Keywords: Teaching Aid, Secondary Mathematics, Intervention Lessons, Improvements.

474 The characteristics of relational students in understanding the concepts of normal subgroups

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Abstract. The quality of students' responses in understanding the normal subgroup concept can be analyzed through SOLO Taxonomy. One level is relational. The purpose of this study is to describe the characteristics of relational students in understanding the concept of a normal subgroup. This is part of research development. This stage is a needs analysis. The research subjects were 29 undergraduate students of Mathematics Education at the University of Bengkulu. The instrument of this research is the researchers themselves with interview guides. Data collection is done through task-based interviews. Data were analyzed qualitatively through fixed comparison techniques. The results of this study are that the concept of normal subgroup is understood through the relationships between objects in a group. Like the right coset and left coset. The relationship between these objects becomes an integrated entity. The conclusion of this study is that relational students can represent all elements and conduct interdependence with one another, so that it becomes an integrated entity.

Keywords: Relational level, concept understanding, normal subgroup.

475 Task design for inquiry-based learning to train middle school students' mathematics problem-solving ability

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Abstract. The aim of this study is to design a set of inquiry-based tasks on quadratic equation in order to help students improve their problem solving ability. In designing the tasks, firstly we analyze students' common problems occurred during learning quadratic equation and design some learning tasks on quadratic equation-related problem solving. The tasks are designed to support students in an inquiry-based learning which requires teacher as a facilitator. There are two designed inquiry-based tasks. The first task is focused on solving a quadratic equation related to a quadratic function having maximum value while the second one is related to a quadratic function having minimum value. Real contexts are used for the tasks to guide students learn how mathematics embedded in real life. These designed tasks have later on been implemented in one ninth grade class of a private junior high school.

Keywords: inquiry-based task, problem solving.

476 The thinking process of students in understanding the concept of graphs during ethnomathematics learning

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Abstract. Understanding of concepts is one of the goals of learning graph theory. The concept of graph can be achieved through learning ethnomathematics. The purpose of this study was to describe students' thinking processes in understanding the concept of graphs during ethnomathematics learning. This research is part of development research. This is the prototype stage. The subjects of this study were 26 students in the University of Bengkulu. The instrument of this study was the researchers themselves plus interview guides, anecdotes and observation sheets. Data collection is done during ethnomathematics learning. Data were analyzed qualitatively with a fixed comparison technique. The results of this study are students begin learning with a culture of communication using mobile phones. Students think about the definition of graph by corresponding to a cellphone with a vertex. The edge of a graph is corresponded to the existence of a relationship between mobile phones. Students can define graph as a system that is built by a set of non-empty vertices, and a set of edges which are pairs of non-sequential vertices. The conclusion of this study is that students' thinking process in understanding the concept of graph begins with the culture of communication using mobile phones.

Keywords: Process thinking, understanding concepts, ethnomathematics.

477 Overcoming difficulty understanding the system of linear equations through ethnomathematics learning

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Abstract. Middle school students experience difficulties in understanding systems of linear equations. Ethnomathematics learning was one alternative to overcome it. The purpose of this study was to describe ethnomathematics learning techniques to overcome students' difficulties in understanding systems of linear equations. This research was part of development research. This is part of student analysis. The subjects of this study were 38 junior high school students in the Kota Bengkulu. The application of ethnomathematics learning was given to the subject. The instrument of this study was the researchers themselves with interview guides and observation sheets. Data were analyzed qualitatively with fixed comparison techniques. The results of this study are the difficulty of students understanding the system of linear equations can be overcome through learning ethnomathematics. This horizontal mathematician used the culture of the fishermen of Bengkulu people "*bundled fish, rice as small, relaxed*". This culture makes it easy for students to recall prerequisite concepts, making it easier for students to do interconnection between concepts. This makes it easy for students to achieve the principles of elimination, substitution and mixtures. The conclusion of this study is that Bengkulu fishermen culture can overcome students' difficulties in understanding the system of linear equations.

Keywords: Difficulties, understanding, ethnomathematics.