



# Plagiarism Checker X Originality Report

**Similarity Found: 28%**

Date: Saturday, August 11, 2018

Statistics: 1436 words Plagiarized / 5166 Total words

Remarks: Medium Plagiarism Detected - Your Document needs Selective Improvement.

---

Asian Social Science; Vol. 13, No. 12; 2017 ISSN 1911-2017 E-ISSN 1911-2025 Published by Canadian Center of Science and Education 167 Analyzing the Teaching and Learning of Mathematical Reasoning Skills in Secondary School E. Elvis Napitupulu<sup>1</sup> **1** Department of Mathematics, State University of Medan, Indonesia Correspondence: E. Elvis Napitupulu. E-mail: elvisnapit@gmail.com Received: October 5, 2017 Accepted: October 29, 2017 Online Published: November 28, 2017 doi:10.5539/ass.v13n12p167 URL: <https://doi.org/10.5539/ass.v13n12p167> Abstract The paper reports part of a study aimed at developing teaching materials in inculcating upper secondary students' mathematical reasoning skills (MRS).

To develop the materials, the researcher implemented the Four-D Model. The study took subjects from five public schools in Province of North Sumatera, Indonesia. The researcher designed and developed students' work sheet (SWS) and instrument to measure MRS. Along the teaching ran, which applied problem-based learning model, the researcher observed teachers' and students' activities while nurturing and applying MRS in the frame of solving mathematical problems.

Of the four indicators laid to measure the MRS, students lack most in use of pattern relationship to analyse situation, to make analogy, or to generalize. The ways support student's progress in achieving MRS are if (i) the problem faced is much mimicked the task solved in the classroom, (ii) more various problems given to solve under guidance, and (iii) intensive scaffolding is given. Keywords: Analyzing, Teaching and Learning, Mathematical reasoning skills (MRS) 1.

Introduction Appealing for making higher order thinking the ultimate goal as the outcome of mathematics education had been launched since eighties (Branca, 1980;

NCTM, 1989; National Research Council, 1989; Resnick, 1987; Schönfeld, 1985). On one side, schools should prepare students to live in the twenty first century, which predicted to be full of uncertainty and bounded natural resources.

To be survive, they should be smart, that is capable and competent in higher order thinking such as reasoning, logical, critical, and creative in the frame of problem solving. On the other side, they should have, to some extent, perseverance, self-regulated learning, self-efficacy, and positive attitude to doing mathematics. Being smart and having good character, they become productive citizens.

If students are to learn mathematics, it is far from enough just asking them to memorize formula and to apply procedures, but they should be also able to reason or to think critically and creatively ( Minarni & Napitupulu, 2017). Stein, Grover, and Henningsen (1996) emphasize that it should stress on students' full understanding of mathematics, which consists of more than knowledge of mathematical concepts, principles, and their structure.

The writers continued that mathematics educators and philosophers had convincingly argue that full understanding includes the capacity to engage in the processes of mathematical thinking, in essence doing what makers and users of mathematics do: framing and solving problems, looking for patterns, making conjectures, examining constraints, making inferences from data, abstracting, inventing, explaining, justifying, challenging, and so on.

In a similar manner, Romberg (1992) stated students should not view mathematics as a static, bounded system of facts, concepts, and procedures to be absorbed but, rather, as a dynamic process of "gathering, discovering and creating knowledge in the course of some activity having a purpose" (p. 61). To sum up, learning mathematics should push up to doing mathematics in which learners solve problems by applying their understanding and reasoning.

Reasoning is the primary and continuously tool one employs when trying to understand mathematics or to solve problems in mathematics. Since in reasoning, one attempts to relate facts, concepts, or principles one into another; looks for pattern emerged and makes effort to generalize or logical conclusion, and makes conjecture and simultaneously its proof (NCTM, 2000; O' Daffer & Thornquist as cited in Artzt & Yaloz-Femia, 1999).

By relating objects and/or draw logical conclusion, one builds his understanding on the problem posed. He then apply his understanding and reasoning to solve problem he

faces. To sum up, understanding triggers reasoning take place and in turn by reasoning, one improves his understanding. The process occurs cyclically.

This shows mathematical reasoning is essential and at the heart of understanding and problem solving processes. Researchers have paid much attention to reveal students' mathematical reasoning and proving proficiency in different countries and they found that students face serious difficulties when working in this domain (Stylianides, 2009). TIMSS reported similar result for fourth and eighth grade students (Mullis, et. al, 2012).

In the same report, Indonesian eighth graders only achieved 17%, which is equivalent to score 388; meanwhile international average was 30% equivalent to score 465. For upper secondary school, Napitupulu, Suryadi, & Kusumah (2016) reported students' MRS in PBL classroom was 39% while in the conventional one was 33%. Students lack most at give explanation on model, fact, properties, relationship, or pattern exists.

The low achievement indicates that treatment should take place to overcome the problem. Despite the low achievement, Bieda (2010) found it still know very little about how skills related to justifying and proving are taught in school mathematics - particularly in mathematics courses outside of high school geometry.

She further asserted: Research has not examined students' opportunities to develop deductive reasoning and to learn skills for evaluating the validity of others' mathematical arguments. Without such opportunities, students are inadequately prepared to participate in meaningful discussions about mathematical proofs and to explore the variety of roles a proof can play in doing mathematics... To understand how to change the ways in which students learn to prove in school mathematics communities, we need to understand how teachers, students, and the curricula they use - elements existing at the nexus of school mathematics communities - interact in classroom settings when students are discussing and developing justifications and proof.

Concerning to the statement Bieda posed, this study attempted to nurture and facilitate students to develop their mathematical reasoning skills by means of solving problems. Doing so, they have chances discussing the validity of arguments they construct and relating knowledge and experiences to gain deep understanding. 1.1 Mathematical Reasoning Skills As asserted earlier, to understand or to solve problem in mathematics, the primary and main tool one make use is reasoning.

It is important to note, Lithner (2000) emphasizes that reasoning is the foundation of

mathematics (p. 165). He continues arguing that if reasoning ability is not developed in the student then mathematics simply becomes a matter of following a set of procedures and mimicking examples without thought as to why they make sense.

If this is the case, it would certainly lead students considering mathematics as a boring subject and something nothing to do with and the ultimate goal of learning mathematics would be put aside accordingly. The study referred to Lithner definition on reasoning i.e. as the line of thought, the way of thinking, adopted to produce assertions and reach conclusions.

The reasoning concerns the transfer of properties from one familiar situation to another (task solving) situation that has at least superficial resemblance to the familiar situation (p.167). Whereas argumentation is the substantiation, the part of the reasoning that aims at convincing oneself, or someone else, that the reasoning is appropriate (p.166).

The study grounded its framework on the work of Lithner (2003). The author classifies reasoning into plausible reasoning (PR), established experience (EE), and identification of similarity (IS). This classification based on three parts, which he called reasoning structure, components and properties, and reasoning characteristics (p.31).

According to Lithner, one way to structure the reasoning is: 1. A problematic situation is met where it is not obvious how to proceed. 2. Strategy choice: Try to choose (in a wide sense: choose, recall, construct, discover, etc.) a strategy that can solve the difficulty. This choice can be supported by predictive argumentation: Will the strategy solve the difficulty? 3.

Strategy implementation: This can be supported by verificative argumentation: Did the strategy solve the difficulty? 4. Conclusion: A result is obtained, (p.31-32). A sequence of mathematical reasoning is classified as PR if strategy choice and strategy implementation: (i) is founded on intrinsic mathematical properties of the components involved in the reasoning, and (ii) is meant to guide towards what probably is the truth, without necessarily having to be complete or correct.

Meanwhile, the reasoning is classified as EE if the argumentation (i) is founded on notions and procedures established on the basis of the individual's previous experiences from the learning environment, and (ii) is meant to guide towards what probably is the truth, without necessarily having to be complete or correct. Last, the reasoning is classified as IS if it fulfils (i) the strategy choice is founded on identifying similar surface properties in an example, theorem, rule, or some other situation described earlier in the text. (ii) The strategy implementation is carried through by mimicking the procedure

from the identified situation.

Based on the work of Napitupulu, Suryadi, & Kusumah (2016), the study laid four indicators to measure students' MRS, that is to say: (a) Draw logical conclusion; (b) Give explanation on model, fact, properties, relationship, or pattern exists; (c) Make conjecture and proof; and (d) Use of relationship pattern to analyse situation, to make analogy, or to generalize. 1.2

**Problem-Based Learning** One of model of teaching that promote students engagement in building new knowledge based on previous knowledge and experiences is problem-based learning (PBL). PBL is an instructional method in which students learn through solving problems and reflecting on their experiences (Barrows & Tamblyn, 1980). According to Barrows (1996), there are six characteristics of PBL, i.e.

(i) Learning is student-centered, (ii) learning occurs in small group, (iii) teacher is facilitator or guider, (iv) problem forms the organizing focus and stimulus for learning, (v) problem is a vehicle for the development of problem solving skill, (vi) new information is acquired through self-directed learning. Considering the characteristics, it is obvious that PBL demand the learners to be active and self-directed with enough previous [ass.ccsenet.org](http://ass.ccsenet.org) Asian Social Science Vol. 13, No.

12 2017 169 knowledge and experience to doing mathematics, especially solving problems by exploiting and exploring their reasoning skills. Hmelo-Silver and Barrows (2006) emphasize, in PBL, students have the opportunity to develop skills in reasoning and self-directed learning. PBL requires students to become responsible for their own learning.

The PBL teacher is a facilitator of student learning, and his interventions diminish as students progressively take on responsibility for their own learning processes. (p.24). Consequently, students who are not accustomed to learning collaboratively, self-directed, solving problem, and do not have perseverance usually feel inconvenient and refuse learning in such a way.

In this case, to assure PBL run as it should be teacher-facilitator should take role more to motivate, scaffold, direct, and control students learning. This is also stressed in Collins, Brown, & Newman (1989), "the facilitator guides students in the learning process, pushing them to think deeply, and models the kinds of questions that students need to be asking themselves, thus forming a cognitive apprenticeship".

For students new to PBL, role of teacher-facilitator is key and critical. Students, who are



stuck in effort to solving problem, should immediately addressed for helping. Hmelo-Silver and Barrows (2006) argued: Facilitators make key aspects of expertise visible through questions that scaffold student learning through modelling, coaching, and eventually fading back some of their support.

In PBL, the facilitator is an expert learner, able to model good strategies for learning and thinking, rather than providing expertise in specific content. This role is critical, as the facilitator must continually monitor the discussion, selecting and implementing appropriate strategies as needed. As students become more experienced with PBL, facilitators can fade their scaffolding until finally the learners adopt much of their questioning role. 1.3

Research Questions The study intended to answer these subsequent questions: (Q1) In what task did students most fail and in what task did they succeed? How did the learning process predict that phenomenon? (Q2) In what ways did the learning process support students' progress in achieving the MRS? 2. Methodology The research is developmental in nature. Subjects were students from five A-rank public upper secondary schools from each one classroom is taken.

Five regular teachers in each classrooms taught during the research and the researcher and one other teacher observed while the teaching and learning processes proceed. The researcher administered pretest and posttest, which consisted of four problems for each, derived from four indicators mentioned earlier to measure students' MRS. The researcher applied the holistic rubric scoring to assess students' work on MRS (Table 1). Table 1.

Holistic Rubric for Scoring Students' MRS Criteria Score Solution is correct and complete. Reasoning in solving problem and its communication are complete. Adequate explanation on the solution, contain a little defect. 4 Solution is correct. Good reasoning in solving problems and its communication. Explanation on the solution exists though contain some defect. 3 Complete solution does not emerge. Adequate reasoning in solving problems and its communication.

Defect reasoning emerge clearly. Inaccurate conclusion. Limited understanding on mathematical concept. 2 Problem emerges while imitating mathematical idea and unable to develop. Lack of reasoning and its communication. A lot of incorrect calculation emerge. 1 No solution exist. No reasoning in solving problem. Neither mathematical understanding nor response on possibilities emerges. Just guessing.

0 The teachers conducted lessons for four meetings. SWS 1 contains nine problems and

needed two meetings to complete. At the first lesson, the teacher oriented each group to work on problems in the previous part or SWS 1. The problems in SWS 1 were intended to inculcate the ability in drawing logical conclusion and give explanation on model, fact, properties, relationship, or pattern exists, and use of relationship pattern to analyse situation, to make analogy, or to generalize.

Tasks in SWS 1 constitute establishing trigonometric comparison in the four quadrants of Cartesian plane and related angles and apply it to solve related problems. SWS 2 contains six problems, which is intended to inculcate students' skill in all the four indicators mentioned earlier. The last SWS contained five problems. Similar to SWS 2, all of the problems in SWS 3 pursue the four indicators mentioned above. All tasks are based on sine rule. SWS 2 and 3 each needed one meeting.

The tasks were adopted from Sinaga, et al (2014) textbook and book of Thong and Hiong (2006). While conducting lesson, the teachers gave scaffolding and nurtured students, either classically or in-group, to solve problems. The collected data then were analysed quantitatively and qualitatively. 3. Results and Discussion 3.1

Students' Performance on MRS Test There were four problems posed to measure students' performance on MRS either pre-test or post-test. Pretest problems are about exponent, basic trigonometry, matrix, and system of linear equation of two variables. The students [ass.ccsenet.org](http://ass.ccsenet.org) Asian Social Science Vol. 13, No. 12 2017 170 have already learned all of the materials before tested.

Meanwhile, the posttest problems are about trigonometric comparison of related angles, trigonometric identity, and cosine rule. Table 2 showed the distribution of pre and posttest problems into each RMS indicator. Table 3 showed each indicator with its related problem. Since problem number 1 and 2 simultaneously measure both indicator 1 and 2, they are put in the same box.

Table 4 presents percentage of students' achievement on the both tests refer to holistic rubric of scoring for each problem. Score zero up to two means underperformed and score three or four means performed. To say differently, score zero up to fifty means underperformed and more than fifty up to one hundred means performed in 100-scale. Table 2.

Blue Print of RMS Indicators and Related Pre and Posttest Problems

Indicator	Problem number	Pre test	Post test
Draw logical conclusion	(I1)	1	1 and 2
Use of pattern relationship to analyse situation, to make analogy, or to generalize	(I 2)	2	1 and 2
Make conjecture and proof	(I3)	4	3
Give explanation on model, fact, properties, relationship, or			

pattern exists (I4) 3 4 Table 3. RMS Indicators and Its Related Problem Indicator Problem  
1. Draw logical conclusion. 2.

Use of pattern relations **hip to analyse situation, to make analogy, or to generalize.** 1. Let and . Determine si and in and . Then establish relationship between and . 2. Look at ? below. Explain why si? , and si? tan ? B C A 3. Make conjecture and proof. 3. Look at below. is one of its height. By using sine for ? , determine **the area of the** triangle. What is the formula if you use ? ? What if ? ? Prove your answer. B C ab A c D 4.

Give explanation on model, fact, properties, relationship, or pattern exists. 4. Verify that tan . Table 4, for posttest, tells us that the students were most succeed in task "Make conjecture and proof" (problem 3). They were less succeed in task "Give **explanation on model, fact,** properties, relationship, or pattern exists "(problem 4).

On the contrary, for pretest, they exactly were worst in those tasks. At the other side, for pretest, nearly half of them succeed on tasks 1 and 2 but for posttest, they were totally failed. This is undoubtedly contradictory. Actually, some tasks in SWS 1 and 2 had facilitated students to establish **a relationship between two variables** when a pair of equations given.

While working on the tasks, their teachers helped by giving scaffolding at many occasions. It was hard for them to discover the way to connect terms contained in the equations. Furthermore, they failed to recognize what algebraic operation should take place to make it closer to the goal.

The result the students achieved in this case was predicted by their work on problems of the SWS. The discrepancy between their achievement in the pretest and the posttest looked due to not only the mathematical content but also the lack of experiences in handling such problems.

From Figure 1, it is readily seen, the student make use his establish experience in handling **system of linear equation** and applying the substitution method and it works. Therefore, it is an EE category. Unfortunately, he was unable to continue working to establish the relationship between and . Most of the students did similar work. ass.ccsenet . Table 4. St u Problem 1 2 3 4 One work strategy h e lead him t o he actually (EE).

He c a The stude n work, tho u triangle. T h unaware t h . org u dents' Perfor m Performed Pr 44/2 46/5 2/64 0/30 on problem 2 e chose and im p o the solution. H y should take a d a n then combi n n ts were most s u gh not compl e h is procedure h eir



work was n mance in Perce n e/Post Un d Fig u is shown in F i p lemented base H e even then w d vantage of th e n e the definitio n Fig u s successful at ta e tely.

It is cle a then combine d n ot finished yet Fig u Asia n n tage on MRS d e r performed P r 56/98 54/95 98/36 100/70 u re 1. Student S i gure 2. This w d on intrinsic m w rote somethin g e familiar situ a n of sine, tan, a u re 2. Student S sk "make conj e a r from Figure d with trigono m . This is an EE u re 3.

Student S n Social Science 171 for Both Pre a n r e/Post 4 44 30 2 0 S ample Work o r k tells us t h m mathematical p r g nonsense an d a tion (right tria n a nd Pythagoras S ample Work o e ctore and pro o 3, they face a m etric compari reasoning. S ample Work o n d Posttest Pretest Score ( % 321 0 132 7 16 2 4 3 007 004 o n Problem 1 h e type of reas o r operties of th e d remained in a n gle) and esta b to solve the pr o o n Problem 2 o f".

Problem 3 a familiar situ a son to finish t h o n Problem 3 % ) P 0 4 7 16 0 3 9 5 91 23 96 30 o ning the stud e e component in v pro b lematic si t b lish the trigo n o blem. facilitated the m a tion, that is f i h e work. Unf o Vol. 13, No. 1 2 osttest Score ( % 3 2 1 2 23 21 0 53 9 41 34 0 0 23 3 e nt used is P R v olved but it d i tuation.

In this n ometric comp a m to accompli s i nding t he are a o rtunately they 2017 % ) 0 54 33 2 44 . The i d not case, a rison s h the a of a were ass.ccsenet . For the la However, procedure and could n Along the SWS 2 pr o equivalent them was a task comp l Problem 3 while han d support in d problems w a familiar fourth of t number 3, 4 these SWS Albeit littl e MRS. Dur i optimal.

S o they very r example, t h In additio n Moreover, algebraic understand to the dee p Similar re proof-relat e developin g circumsta n multiple o p proof at th e middle sc h routine pa r 4. Conclu s Of the fou r make ana l successful n Moreover, task solve d is given. Acknowle d This resea r Indonesia. Mathemati . org st task, the st u it is not suff i in effort to ma k n ot reach the s o learning proce s o blem number 1 in difficulty t o a ble to accom p l etely was pred i of the pos t -te s d ling the tasks d irectly to acc w as better than situation in h a t he maximum 4 , and 6, and S W problem reall y e , overall the i n i ng conducting o me of them h r arely use it in t h e scaffolding t n , observation r students' lack operation, an d d ing on trigono m p er and challen g sult also obta i e d tasks in t h g an understand n ces - teacher s p portunities fo r e middle scho o h ool teacher pr e r t of middle sc h s ion r indicators lai d l ogy, or to g e n ess or failure o The ways sup p d in the classro o dg ments r ch was supp o The author is cs and Natural Fig u u dents emplo y i ce.

The fault k e the situatio n o lution. s ses, students w 1 and 5 trained o problem 4 in p lish the task i n i cted from thei r s t is exactly a r in the teache r omplish probl e it was on the p a nd, made the m score and it w W S 3 problem n y illustrated w h n tervention, w h the lessons, te a ave followed t r t heir classroom t hey gave was r e vealed too m of understand i d algebraic p r m etric compar i g task such a i ned in a stu d h e classroom.

d ing of what c o s with ample e r justification a o l level is quite e paration, prof e h ool students' o p d to measu r e th e e neralize. On t o f the students p ort student's p o m, (ii) more v o rted by the M thankful to Re Sciences for p r Asia n u re 4. Student S y ed IS. They m committed al g n simpler towa r w orked to solv e them to achie v the pos t -test i n n the SWS nor r work on this i r epetition.

It w a r and learning e m 2 of the p o p os t -test. Alth o m go unintenti o w as classified u n umber 4 supp h at they would d h ich took four a chers have pl a r aining how to m s. Consequent l inappropriate t m any groups i n i ng on b asic k n r operties beca i son is not fir m a s posed in the d y of Bieda.

She found th a o nstitutes valid e xperience an d a nd proof - inst r superficial. S h e ssional devel o p portunities to e MRS, studen t t he other han d in accomplishi n p rogress in ac h v arious proble m M inistry of Re s ctor of Univer s r oviding neces s n Social Science 172 S ample Work o m imicked pro c g ebraically (d i r d solution.

T h e various prob l v e sepecially s k n establishing in the posttes t i ndicator. a s a problem i n process. SWS o s t -test to gra s o ough at the beg i o nally. Therefo r u nderperforme p ort problem 1 o d o on the post- t courses time t a yed their role a o implemente a l y, they could n t o the situation n the classroo m n owledge relat i me other ba r m ed yet. As co n study.

She investiga t a t students' e x mathematical j d professional r uction that su p h e continued w i o pment, and cu learn. t s lack most in d , they most n g the post-tes t h ieving MRS a r m s given to sol v s earch, Techn o s itas Negeri M s ary facilities t o o n Problem 4 c edure from t h i stributive) m a h erefore, they r e l ems on trigon o k ill in l 4 . Probl e a relationship b t . Therefore, st u n SWS 3.

The 1 problem n u s p l 1 and l 2 c o i nning they sta r r e, at this task d. SWS 1 pr o o f the pos t -test t est. t o accomplish, a s facilitato r -g u a ching model b n ot conduct the emerged or th e m made teache r ing to the tas k r iers to acco m n sequence, the y t ed the proce s x periences wit j ustification.

Development supports students' with suggestion to encourage support use of pattern to succeed in mathematics was illustrated by (i) the problem over guidance and High Median, Research conducted to re-identify the same theme more remained in a problem-solving number 4 in between students' inability result was an indicator 9, SWS competencies.

That well, but the, most of the problem number to achieve level 1 and has successful understanding in much of based on constructivist lesson fluently scaffolding it is difficult to grasp, such as Pythagoras' theorem the tasks were not easy and outcomes of such tasks he even showed using a curriculum understanding that greater effort to make just a relationship to a key conjecture of their work on problem faced is a matter, and (iii) in her Education Director, and research. Vol. 13, No.

12 situation (Figure difficult to a problematic situation and function SWS 3 is related. Neither of them to accomplish the 3 problem 2. Their work on failure to recommend only achieved 8, SWS 2 problem 2. Their work only improve situation, though activism. How by as it should be itself did not emerge help optimize program proposals.

Besides, speed and fast movement of implementation are insufficient that in the curriculum that program of justification emphasis is needed in defining and providing analysis situation and proof. Eklon SWS problem much mimicked intensive scaffold of the Republic Dean of Faculty 2017 (re 4). application of these work and 3 these generalized one problem work on students' not ever, etc. For merge. finally.

Results, their involvement in the test of video and evidence for a one, to either items. Evidence of the role of literacy of [ass.ccsenet.org](http://ass.ccsenet.org) Asian Social Science Vol. 13, No. 12 2017 173 References Artzt, A. F. & Yaloz-Femia, S. (1999). Mathematical Reasoning during Small-Group Problem Solving. In L.V. Stiff (Ed). *Developing Mathematical Reasoning in Grade K-12*. Reston, VA: NCTM. Barrows, H. S. (1996). Problem-Based Learning in Medicine and Beyond: A Brief Overview.

*Character Building*  
New Directions for Teaching and Learning, No. 68, Winter. Barrows, H. S. and Tamblyn, R. (1980). Problem-based learning: An approach to medical education. New York: Springer. Bieda, K. N. (2010). Enacting Proof-Related Tasks in Middle School Mathematics: Challenges and Opportunities. *Journal for Research in Mathematics Education*, 41(4), 351-382. DOI: 10.2307/41103880. Branca, N.A. (1980). Problem Solving as a Goal, Process, and Basic Skill.

In S. Krulik (Ed). *Problem Solving in School Mathematics*. 1980 Yearbook. Reston, VA:

NCTM. Collins, A., Brown, J. S., & Newman, S. E. (1989). Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In L. B. Resnick (Ed.). *Knowing, learning, and instruction: Essays in honor of Robert Glaser* (pp. 453-494). Hillsdale NJ: Erlbaum. (<http://creativecommons.org/licenses/by/4.0/>).

#### INTERNET SOURCES:

---

- 26% - [www.ccsenet.org/journal/index.php/ass/article/download/...](http://www.ccsenet.org/journal/index.php/ass/article/download/...)
- <1% - [kristen-bieda.squarespace.com/s/JRME-July-2010...](http://kristen-bieda.squarespace.com/s/JRME-July-2010...)
- <1% - [www.ascd.org/.../Knowing-Our-Students-as-Learners.aspx](http://www.ascd.org/.../Knowing-Our-Students-as-Learners.aspx)
- <1% - [uu.diva-portal.org/smash/get/diva2:417492/FULLTEXT02](http://uu.diva-portal.org/smash/get/diva2:417492/FULLTEXT02)
- <1% - [www.scribd.com/document/338329334/Creativity-1](http://www.scribd.com/document/338329334/Creativity-1)
- <1% - [www.researchgate.net/publication/270509024...](http://www.researchgate.net/publication/270509024...)
- <1% - [files.eric.ed.gov/fulltext/EJ744018.pdf](http://files.eric.ed.gov/fulltext/EJ744018.pdf)
- <1% - [www.slideshare.net/soharashed/problem-based...](http://www.slideshare.net/soharashed/problem-based...)
- <1% - [iosrjournals.org/iosr-jrme/papers/Vol-7 Issue-3/Version-3...](http://iosrjournals.org/iosr-jrme/papers/Vol-7 Issue-3/Version-3...)
- <1% - [www.researchgate.net/publication/305658010...](http://www.researchgate.net/publication/305658010...)
- <1% - [www.ccsenet.org/journal/index.php/ass/issue/view/1821](http://www.ccsenet.org/journal/index.php/ass/issue/view/1821)
- <1% - [www.apa.org](http://www.apa.org)
- <1% - [www.researchgate.net/publication/27234907\\_Goals...](http://www.researchgate.net/publication/27234907_Goals...)
- <1% - [www.slate.com/articles/news\\_and\\_politics/view\\_from...](http://www.slate.com/articles/news_and_politics/view_from...)
- <1% - [docs.lib.purdue.edu/cgi/viewcontent.cgi?article=...](http://docs.lib.purdue.edu/cgi/viewcontent.cgi?article=...)
- <1% - [files.eric.ed.gov/fulltext/EJ1097641.pdf](http://files.eric.ed.gov/fulltext/EJ1097641.pdf)
- <1% - [www.researchgate.net/publication/274028057\\_The...](http://www.researchgate.net/publication/274028057_The...)
- <1% - [www.au.af.mil/au/awc/awcgate/army/rotc\\_dm\\_ps.pdf](http://www.au.af.mil/au/awc/awcgate/army/rotc_dm_ps.pdf)
- <1% - [softmath.com/.../factoring-of-cubic-equation.html](http://softmath.com/.../factoring-of-cubic-equation.html)
- <1% - [www.mathcentre.ac.uk/.../mc-ty-triangleformulae-2009-1.pdf](http://www.mathcentre.ac.uk/.../mc-ty-triangleformulae-2009-1.pdf)
- <1% - [quizlet.com/115853979/aswb-study-materials-flash...](http://quizlet.com/115853979/aswb-study-materials-flash...)
- <1% - [www.aes.org/e-lib/browse.cfm?elib=19165](http://www.aes.org/e-lib/browse.cfm?elib=19165)
- <1% - [www.scribd.com/document/61700763/Public-Affairs...](http://www.scribd.com/document/61700763/Public-Affairs...)
- <1% - result was an i number 9, sws competencies.
- <1% - [www.wseas.org/multimedia/journals/education/2017/a225810...](http://www.wseas.org/multimedia/journals/education/2017/a225810...)
- <1% - [www.scribd.com/document/378590850/references-docx](http://www.scribd.com/document/378590850/references-docx)
- <1% - [www.learntechlib.org](http://www.learntechlib.org)
- <1% - [www.ilkogretim-online.org.tr/index.php/io/article/view/2854](http://www.ilkogretim-online.org.tr/index.php/io/article/view/2854)
- <1% - [www.ernweb.com/browse-topic/math-education-articles](http://www.ernweb.com/browse-topic/math-education-articles)
- <1% - [ponce.inter.edu/cai/tesis/bfeliciano/Bibliografia.htm](http://ponce.inter.edu/cai/tesis/bfeliciano/Bibliografia.htm)
- 1% - [dixieching.wordpress.com/2009/10/18/cognitive...](http://dixieching.wordpress.com/2009/10/18/cognitive...)

