PROCEEDING ISBN : 978 – 979 – 16353 – 7 – 0

P – 3

Valsiner's Zone Theory As The Teachers' Zone Of Proximal Development

Rustanto Rahardi
Faculty of Science and Mathematics Malang University
Jl. Semarang 5 Malang, e-mail: rustanto_r@yahoo.com

Abstract

The research, develop and validate the theory and development of teacher educators of mathematics learning will lead to a better understanding of how expertise is developed in carrying out professional duties. In doing so, will provide evidence to inform discussions about what constitutes best practice in mathematics teacher education. The concept of Zone Proximal Development (ZPD) which was developed by the Soviet psychologist Lev Vygotsky and social constructivist (1896-1934) provides an interesting metaphor for designing teaching and learning to analyze, this poses a real challenge when it is practiced. Valsiner has broadened its interpretation of the concept of the ZPD Vygotsky to combine the social setting and the objectives and actions of participants. The theory proposes the existence of two additional zones, Zone of Free Movement (ZFM) and Zone of Promotion Action (ZPA). ZFM is a binding agent that is given by adults to limit access to its territory the child, object, or way of acting on those objects. While the ZPA is what adults are promoting, with no obligation for the child to receive what is being promoted. Further development of the zone when interpreting the ZPD of practitioner Valsiner found the presence of an Illusionary Zone (IZ). The presence or absence of IZ in practitioner provide insights for the development of potential teachers. Exploration in the field found a lack of connection to the conceptual understanding of procedural understanding, this situation makes IZ suspected.

Key Words: practitioner, ZPD, ZFM, ZPA, IZ

I. ITRODUCTION

Many have examined how a person's thought processes as they learn mathematics. However, still a few people who studied the potential that exists on teacher practice when he made the learning process in classroom. Such research is important because "teachers are required to have academic qualifications, competence, certified educators, physically and mentally healthy (spiritual and physical), and have the ability to realize the goal of national education". Another law's base is the purpose of Law of National Education (Law National Education System, 2003 Ps.3) about

> National Education's aim where the national education's function is to developing the ability and creates character and national's culture in term of educate national's live, for the potential development so they can be a faith and piety human to the God, noble, healthy (spiritual and physical), smart, creative, autonomous, and being a citizen of a democratic country and responsible.

Whereas Malang State University (UM) in catalogue (FMIPA UM's catalogue, 2010) has mathematic department with one of program study, that is Mathematic Education, with "a vision to make the department of mathematic education UM as the center of superiority and referral for education's implementation, research, and knowledge's

This paper has been presented atInternational Seminar and the Fourth National Conference on Mathematics Education 2011 "Building the Nation Character through Humanistic Mathematics Education". Department of Mathematics Education, Yogyakarta State University, Yogyakarta, July 21-23 2011

application and technology in mathematics' area and mathematics' education".

> Research that develops and validates a theory of mathematics teacher educator learning and development would lead to a better understanding of how expertise is developed in carrying out this professional task. In doing so, it would provide evidence to inform discussion about what constitutes best practice in mathematics teacher education. (Goos, 2009: 215)

Research related to teachers' teaching practices will strongly support the implementation of teacher education courses in college. Picture if the teacher can carry out the process of learning a "good" of course, the ability of learners (students) in terms of understanding the material will increase relative to their own learning, meaning teachers with students' abilities can be improved. Vygotsky in a learning perspective, Zone of proximal development, or ZPD, refers to the difference between what a learner can do unaided and what he can do to help. This is a concept developed by the Soviet psychologist Lev Vygotsky and social constructivist (1896-1934). "Though the concept of ZPD provides an attractive metaphor for designing instruction and analyzing learning, it poses a real challenge when put into practice" (Shabani, et al. 2010: 237). Combined the concept of teaching and the social setting is an extension of the concept has been developed by Vygotsky Valsiner.

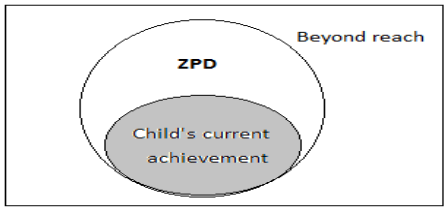


Figure 1: Current a chievement zone of children, ZPD, and zone out of range

II. INTERACTION ZONE AS A DEVELOPMENT MODEL

Goss (2009: 211), state that

> Valsiner's (1997) zone theory re-interprets and extends Vygotsky's concept of the Zone of Proximal Development (ZPD) to incorporate the social setting and the goals andactions of participants. Valsiner viewed the ZPD as a set of possibilities for development that are in the process of becoming realised as individuals negotiate their relationship with the learning environment and the people in it. His theory proposes the existence of two additional zones, the Zone of Free Movement (ZFM) and the Zone of Promoted Action (ZPA).

Blanton, et al. (2005: 29), determine "Valsiner's zone theory as a way to understand better the ZPD of three mathematics and science teachers at novice points in their practice". It is clear that the actions being promoted (ZPA) and everything is allowed

(ZFM) practitioner can be used as a way of understanding the potential development of teaching skills. According Lightfoot (Blanton, et al., 2005: 6), "ZFM is a binding agency by which the adult restricts the child's access to areas, objects, or ways of acting on such objects". "The ZFM represents constraints that structure the ways in which an individual accesses and interacts with elements of the environment " (Goos and Bennison, 2008: 3). "The ZPA describes what the adult is promoting, with no obligation for the child to accept what is being promoted" (Blanton, et al., 2005: 7). Then Goos and Bennison (2008: 3), complete "the ZPA comprises activities, objects, or areas in the environment in respect of which the individual's actions are promoted". According Valsiner (Blanton, et al., 2005: 7), "further argues that only a portion of one's potential can be realized in a particular situation at a given time; hence the ZPD cannot be fully contained within the ZFM".

> Given the interdependence of these three zones, if we consider that the ZPD is ontogenetic, or within the learner, and the ZFM/ZPA complex is microgenetic, or between the learner and the environment and hence observable (see Lightfoot, 1988), then it seems reasonable to extend this theory to the exploration of a novice teacher's ZPD through investigating the ZFM/ZPA complex they establish for their students. (Blanton, et al., 2005: 9)

ZFM/ZPA itself is a product of the choice of teaching teachers. Thus, use of the ZFM/ ZPA Valsiner give purpose to observe how teachers understand their practices and provide information about their potential for development in the ZPD. In particular, is how teachers use the classroom environment to learn to describe what they allow and what they are promoting during the lesson, how to explore the interpretation of the ZFM /ZPA is complex to express their understanding based on his teaching practices. In particular, one can say what the teacher allowed ZFM or promoted ZPA in the class offered a glimpse into the practice of teacher development and phenomena can be observed that it is worthy to be the domain of research.

In order to describe the ZFM and ZPA are modeled by the teacher and how this zone is to inform our understanding of the ZPD teacher, has been found to coexist with zones ZFM and ZPA. Explained that this additional zone as illusionary' zone of promoted action (IZ) or zone promoted the illusion of action and defines it as a skill that teachers are putting out to build through the behaviors and routines that are used in teaching, but in reality, not realizing ZPD learners. All this illusion reflects the contradictions that exist in how the ZFM and ZPA are interconnected. That is, in theory,

should be included in the ZFM/ZPA while IZ represents what emerges from the response of learners based on the promotion of teachers but do not actually make the learners understand the problems that the teacher or the learner response is not met the teacher, so it remains to be an illusion for learners. In addition, the presence or absence in practice of a teacher, IZ eventually become important in the understanding of each

teacher's ZPD. Figure 3 below is a picture of the development zone to zone Valsiner Vygotsky developed by Valsiner and Blanton et al.

Figure 2: The development of Vygotsky's zone to Valsiner's zone that has been developed by Blanton et al

III. VALSINER'S ZONE AND THE DEVELOPMENT

Valsiner's theoretical framework includes three Zones: the ZPD from Vygotsky (1978), the ZFM, originating from Lewin (1933; 1939, in Valsiner, 1997), and the ZPA (Galigan, 2008: 212). Initially Vygotsky raise the theory of ZPD, then Valsiner interpret and expand as a development with two additional zones: ZFM and ZPA. Furthermore, Blanton et al. found an additional zone, the IZ.

Zone of Free Movement (ZFM)

ZFM is a restriction that the structure in a way where an individual access and interact with elements of the environment.

> The ZFM can be interpreted as constraints within the school environment, such as students (their behaviour, motivation, perceived abilities), access to resources and teaching materials, curriculum and assessment requirements, and organisational structures and cultures (Goos & Bennison, 2008: 3).

While freedom of action and thinking of students admitted, ZFM is a cognitive structure of the environmental constraints that limit freedom of action and thought. These environments are socially constructed by others (teachers, administrators, curriculum writers) and the system of cultural meanings that they bring to the environment, but ZFM itself can be regulated by the 'others', the students themselves or through joint action, but ultimately internalized. "Thus ZFM structures access to areas and objects such as technology, time, curriculum, and class rules as well as the teachers' and

students' expertise, experience, beliefs and values" (Galigan, 2008: 212).

ZFM is seen as a structure of individual access to different areas of environment, availability of different objects in an accessible area, and the way individuals are allowed or enabled to act with objects in accessible areas. Generally ZFM is any facility that allowed for learners to study with teachers.

Zone of Promoted Action (ZPA)

"While the ZFM suggests which teaching or student actions are possible, the Zone of Promoted Action (ZPA) represents the efforts of a teacher, or others to promote particular skills or approaches" (Galigan, 2008: 213). "The ZPA comprises activities, objects, or areas in the environment in respect of which the individual's actions are promoted" (Goos and Bennison, 2008: 3). Any teachers' action aimed to building knowledge (understanding) of learners, such as teachers' approaches to problem solving, teachers' stimulus, teachers' scaffold and other is all part of the ZPA. Part of the ZPA should exist in ZPD learners; this can happen if the promotion of teachers makes learners understand the material from the teacher.

Illusionary' Zone (IZ)

ZPA is not binding, in the sense that learners may actively participate in terms to respond the promotion of teachers but did not make the understanding of learners or learner responses are not permitted to be taken by the teacher so that the knowledge of which exists in the minds of learners be an illusion. For example, a nursing department promotes students to go to numeracy classes. However the ZPA is not binding; thus students may not wish to actively participate in this course (Galigan, 2008: 213). This possibility can occur, such as the learners who have very low math skills in the class as the basic skills of mathematics, unable to participate or learn. On the other hand, students who feel skilled (and may have knowledge) can not participate. This is, by Valsiner, called a construction illusion. This concept was further developed by Blanton et al. in 2005 as an illusion Zone (IZ).

IZ can be viewed as an additional zone of promoted action and the zone of permissibility that teachers are putting out to build through the behaviors and routines that are used in teaching, but did not realize the ZPD learners. That is, the IZ is learners responses to the promotion of teachers, but the responses do not render the learner understand the material that promoted by the teacher or arising out because of responses

did not receive teachers' reaction so it still be the learners' illusion. It is clear that part of the ZPA can be imagined and thus IZ is outside of the ZFM/ZPA. The presence or absence in practice of a teacher, IZ considered important in understanding each teacher's ZPD.

IV. USE ZFM/ZPA TO INTERPRET THE TEACHERS' ZPD

Environment of ZFM/ZPA is a product of the choice of teachers' teaching, so that Valsiner use ZFM/ZPA environment gives the intention that the teacher educator, examining how novice teachers understand their practice and provide information about their potential for development of ZPD. There are two objectives in this regard, first, identify the environmental ZFM/ZPA which is organized by the teachers practice. How teachers use the class environment to describe what they allow and what they promote during the lesson. Second, explore how environmental interpretation of ZFM/ZPA expresses their understanding of teaching practices as a better way to understand their capacity as professional development in ZPD its own.

Here in lies a subtle abstraction in this research approach, rather than examining how teachers manage the class learning environment as a way to understand students' ZPD, we propose to examine how teachers manage this environment as a tool for understanding their own development in their ZPD. In particular, observe what teachers allowed (ZFM) or promote (ZPA) in the class can provide a glimpse into the practice of teacher development. From this perspective, the goal is to understand the teachers' ZPD by making the conclusion of the free zone movement and actions that promoted by the teacher which is assigned to her students. In general, ZFM/ZPA environment that organized by teachers is a reflection of the choice of teaching and thus is a phenomenon that can be observed. Thus, we argue that teachers and actions choices in the class when organizing the ZFM and ZPA can information about how teachers understand the notion of practice and its potential for development. So, because the ZFM/ZPA environment that organized by the teacher is appear, identify what teachers promote (ZPA) or allowed (ZFM) in the class becomes a vehicle to understand teachers' ZPD. Ultimately, the ZPD comprehension of a teacher can help us, as teacher educators, teachers learning's scaffold.

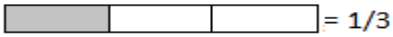
V. METHODS AND DISCUSSION OF EXPLORATION ZFM, ZPA, AND IZ

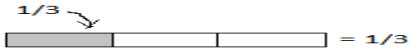
Data collection methods of exploration carried out by observing teachers as documented by video. Exploration is selected on the teachers who teach fractions, because in general the fraction is the hardest material in the primary level. "Division by fractions, however, is one of the difficult concepts for many children" (Yim, 2009: 105). "It is widely recognized that "Fractions" is a difficult topic for primary students as they comprise five interrelated subconstructs, namely part-whole, ratio, operator, quotient and measure" (Leung, 2009: 2).

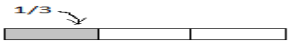
Initial Assessment Results of Mathematics Teachers' Practices in Elementary Fourth Grade Students on Modify Two Fractions with Different Denominator to be The Same Denominator $\frac{1}{3}$ and $\frac{2}{5}$

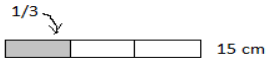
1. U : If a stick divided into 12 equal parts, what is one part called as?
2. S : One-twelfth.
3. U : One-twelfth. If one part of a stick is one-fiftieth, so Ustad a divided into how many parts of the stick?
4. S : 50.
5. U : 50 parts.
6. S : It's so difficult, Ma'am.
7. U : It's difficult, right? It's a very long stick.
8. S : Easy.
9. U : 6 meters of scout rope, how long it would be if it is changed into centimeters?
10. S : 600 cm.
11. U : So, from the 6 meters, what is 1 meter part of the rope called as?
12. S1 : 6; 1/6
13. U : So if I divide 6 meters into 6 parts, then one part is…
14. S : 1/6
15. U : So if I have 6 meters rope, ups, 12 meters, then one-third is…
16. S : One-third?
17. U : Yes, 12 meters, so the one-third is how long?
18. S : 4
19. U : 4 parts, ups sorry, 4 meters. So if I have 12 meters rope then how long is one-third? It's 4 meters, so what is 1 meter from 6 meters rope called as?
20. S : 1/6
21. U : What about 2 meters from 6 meters rope?
22. S : 2/6
23. U : If it's 5 meters?
24. S : 5/6
25. U : 5/6 part. So, now I ask again, if I have 1/3 and 2/5 part of a rope, and I find another rope so it can be divided by 1/3 and 2/5, how long another rope would be?
26. S : 6; 15; 30; 45; 60; 35
27. U : Rio, why did you answer 6?

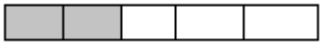
28. Rio : I don't know.
29. U : Remember, the answer should have a reason. Okay, there was 15?
30. Yu : Cause it can be divided by 3 and 5.
31. U : Okay, then Fachri answers 60, right?
32. Fachri : 30
33. U : Why 30?
34. Fachri : Cause it can be divided by 3 and 5.
35. U : Okay, if 15 we usually… If I have 3 and 5, we find the multiple fellowships (KPK) of 3 and 5. 3 times 1?
36. S : 3
37. U : 3 x 2?
38. S : 6
39. U : 3 x 3?
40. S : 9
41. U : 3 x 4?
42. S : 12
43. U : 3 x 5?
44. S : 15
45. U : 3 x 6, 18 etc. So, 5…
46. S : 5; 10; 15; 20; 25; 30; 35; 40; 50…
47. U : Okay, in this case, what is the multiple fellowships (KPK)?
48. S : 15
49. U : 15, so Ayu's answer can be inferred from where?
50. S : The multiple fellowships (KPK).
51. U : The multiple fellowships of 3 and 5, so how long another rope would be?
52. S : 15
53. U : Yes, 15. Now I ask you to draw. How is 1/3 part from 15 and 2/5 from 15? Is there anyone brave to draw it?
54. S : Pardon, Ma'am?
55. U : How is 1/3 part from 15 and 2/5 from 15?
56. S : Pardon, is it allowed to divide it into two groups?
57. U : Sure. Don't appoint your friends, just yourself, okay? Then, the group will get a point, and each of you will get a point from me.
58. Rian : (raise his hand and draw in front of class)
59. U : 1/3 from 15
60. Rian : (nod and draw) 
61. U : How many is 15 meters? 
62. Rian : (erase the initial drawing)
63. U : Or maybe you can use number line. So draw a 15 meters stick or rope.
64. Rian : (erase whole his drawing) 15 meter from 6 meter is so long
65. U : It's an imaginary drawing, isn't it? Just be serious, Rian!
66. S : Imaginary.
67. Rian : (redrawing) Just help me, friend! (his friends said that they can't answer and confused). 
68. U : Okay, what is it? A stick?

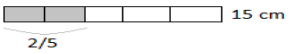
69. Rian : 
70. U : What is it called?
71. Rian : 3 parts.
72. U : Now what is you have shaded in the stick called?
73. Rian : 1
74. U : What 1?
75. Rian : 1/3
76. U : 1/3 give mark to each part.
77. Rian : 

78. U : Which one is 1/3? Then, where it should be?
79. S : In the top, Yan (a student help Rian) 

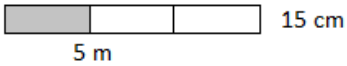
80. Rian : Ooo
81. U : Which one is that? It should be erased (point at 1/3 in the right side)
82. Rian : 

83. U : How long is the stick?
84. Rian : 15 meters 

85. U : Write it there (point at right side of the drawing)
86. Rian : (one of Rian's friends said "hoh" and laugh)
87. U : 15 cm or 15 m?
88. Rian : 15 m
89. U : We agreed that it is 15 m. Okay, Rian sit down, pelase. Rian said that the drawing is 1/3 from 15 meters. Now, the next case. I ask…
90. S : (a student go to in front of class and draw) 
91. U : So, which one is 2/5?
92. S : (draw) 

93. U : Then, how long is the stick?
94. S : 

(draw)
95. U : Pay attention, the first case, the stick is 15 meters, then 1/3 from 15 meters from the Rian's drawing is…
96. S : 3
97. U : So, what is each part called? (point at the drawing)
98. S : 1/3
99. U : 1/3. Then for the second stick, the length is 15 meters, and I take the 2/5 part. And what is 2/5 part called if it's in here?
100. S : 5 parts
101. U : Now if I want these drawing to be in meters unit, how long is the 1/3 part? 

102. S : 4 meters
103. U : 4 meters or 5 meters?
104. S : 5 meters
105. U : How come it be 5 meters?
106. S : 15 divided by 3.
107. U : (point at the drawing) Then, 2/5 by point at this drawing. 

108. S : 10 meters

109.U : 10 meters?
110.S : 6 meters
111.U : How many meters?
112.S : 6 meters
113.U : 6 or 10?
114.S : 6
115.U : How come?
116.S : 15 : 3 = 3, 3 + 3 = 6
117.U : How? How?
118.S : 15
119.U : Please explain.
120.Fachri : (go to in front of class and write 15 : 3 =)
121.U : Why does it divide by 3, Fachri?
122.Fachri : (erase 3 from 15 : 3, and change into 15 : 5 = 3 x 2 = 6)
123.U : 15 : 5 =3, 3 x 2 = 6. Okay, so 15 from 2/5 is same with 15 : 3, right Fachri?
124.Fachri : Wrong, Ma'am.
125.U : Yes, 15 : 5 then it times with 3.
126.S : Right
127.U : 2 times 3 is 6. And what is it? 6 meters. So, it will be 1/3… 1/3 and how is it? 2/5. If 1/3 is 5 meters and 2/5 is same with 6 meters, so…. (stop talking because the students are noisy). Okay, look at Ilham's drawing, I asked you for 15 meters stick, 1/3 part has been drawn by Rian, then what is 1/3 part?
128.S : 5 meters..
129.U : 5 meters. Do you still remember when I had a 6 meters rope, then what is 1 part called?
130.S : 1/6
131.U : Then, what part, what is 1/3 part?
132.S : What?
133.U : 1/3 from 6 meters?
134.S : 3 meters?
135.U : How come?
136.S : 2 meters.
137.U : How come? So it can be known that 1/3 is same with five-… what?
138.S : 5/15
139.U : 5/15, and here I have 6 meters, so it is the same with 6-…
140.S : 6/15
141.U : Then 2/5 is same with 6-…?
142.S : 6/15
143.U : Yes, now from here the denominator is same, then 1/3 is same with…
144.S : 5/15 m
145.U : 5/15 m, then 2/5 is same with…
146.S : 6/15 m
147.U : 6/15 m, okay, so 1/3 and 2/5 can be changed into the same denominator, by using what way? We can use multiple fellow ships (KPK) or by using a way like this. So we can use number line or what have we used for?
148.S : Stick.

149.U : And what is the length of the sticks?
150.S : The same length.
151.U : The same length sticks, by using the multiple fellowships (KPK). Okay, is there any questions? No.

We have depicted the zones a teacher (*Ustada*) established in her early classroom practice in Figure 3.**Students' responses to teacher's questions**: can be seen at even numbered line. **Teacher's approach to solving a problem**: show by using illusion media. **Students participation**: it shows that there is some students who are active and some students are not, so here I describe that ZPA is out of ZFM, line 2, 4, 6, . . . , 66, 67, 69, ..., 79, 80, 82, 84, . . ., 150.
Active contribution of students' ideas: lines 56, 58, 60, 62, 67, 69, 77, 82, 90. **Students' engagement in more complex mathematical processes**: line 30, 34, 124. **Sense making**: still in the illusion, hasn't been clear if it needs an interview so it can be ascertainable the conceptual knowledge or the procedure. **Conjecturing and argumentation**: lines 6, 26, 32, 56, 124.

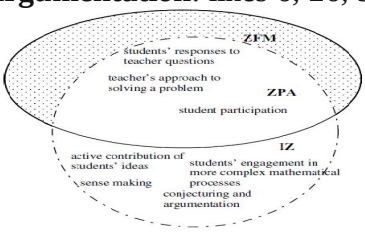


Figure 3: The ZFM, ZPA, and IZ by a teacher in her practice

VI. CONCLUTION AND SUGGESTION

Conclution Inferred from the conversation above, it is an active student, but was limited to answering questions directed at the teacher but rather to understand the issues of teacher. Teachers are active early in order to use the media stick to change the two fractions into same denominator, it looks like this will lead to conceptual understanding, but in fact in line 35 teachers turn the bow to start using a procedural approach, teachers use a procedure explicitly KPK. Teacher-centered learning rather than on students' thinking and provide evidence that the actions of teachers from the conceptual to procedural not connected.

Suggestion Under these circumstances there is to know how the process of learning the use of conceptual and procedural rather than a separate connected away so it can create the illusion. Interview instrument for teachers and students need to be arranged so that it can be seen in exactly the presence or absence of IZ in students. These facts are very interesting for us would look at how the potential of teachers as their role in delivering the material fractions, surely each of them has a unique way. The main is when the teacher can transition IZ into the ZFM/ZPA of like what so there is no conflict in the minds of students.

VII. BIBLIOGRAPHY

Blanton, M. L., Westbrook, S., & Carter, G. (2005). Using Valsiner's Zone Theory to Interpret Teaching Practices in Mathematics and Science Classroom. *Journal of Mathematics Teacher Education*, Springer 8, 5–33.

Galigan, L. (2008). Using Valsiner. *Proceeding of the 31st Annual Conference of the*

Mathematics Education Research Group of Australasia M. Goos, R. Brown, & K. Makar, @MERGA Inc., 211-218

Goos, M & Bennison, A. (2008). *Teacher Professional Identities and the Integration of Technology into Secondary School Mathematics*. Paper presented at the annual conference of the Australian Association for Research in Education, Brisbane.

Goos, M. (2009). Investigating the Professional Learning and Development of Mathematics Teacher Educators: A Theoretical Discussion and Research Agenda. In R. Hunter, B. Bicknell, & T. Burgess (Eds.), *Crossing divides: Proceedings of the 32nd annual conference of the Mathematics Education Research Group of Australasia* (Vol. 1 pp. 209-216). Palmerston North, NZ: MERGA Inc.

Katalog. (2010). Katalog FMIPA UM Jurusan Matematka.

Leung, Chi-Keung. (2009). *A Preliminary Study on Hongkong Students' Understanding of Fraction.* Paper presented at the 3rd Redesigning Pedagogy International Conference June 2009, Singapore.

Shabani, K., Khatib, M., & Ebadi, S. (2010). *Vygotsky's Zone of Proximal Development: Instructional Implications and Teachers' Professional Development. Published by Canadian Center of Science and Educatio*n Vol. 3, No. 4. Canadian Center of Science and Education. Diakses 28 Januari 2011, dari http://ccsenet.org/journal/index.php/elt/article/view/8396

Undang-Undang. (2005). *Undang-undang No. 14, Tahun 2005, tentang Sistem Pendidikan Nasional Guru dan Dosen*. Diakses 8 Februari 2011, dari http://www.slideshare.net/srijadi/uu-no-14-2005-guru-dan-dosen.

Undang-Undang.(2003). *Undang-undang Republik Indonesia, No. 20,Tahun 2003, tentangSistemPendidikanNasional*. diakses 11 Mei 2011, dari http://downloads.ziddu.com/downloadfile/10745711/UU Sisdiknas no20 tahun 2003.pdf.htm,.

Yim, J. (2009). Children's strategies for division by fractions in the context of the area of a rectangle. *Educational Studies in Mathematics*, 73:105–120. DOI 10.1007/s10649-009-9206-0