Selection of Learning Media Mathematics for Junior School Students

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ABSTRACT
One of the factors that determine the success of mathematics learning is the learning media used. Learning media can help students to create mathematical abstract mathematics that is abstract. In addition to media, meaningful learning is a learning that is adapted to the students' cognitive development. According to Piaget, junior high school students are at the formal stage of thinking, but the reality in the field has not been entirely capable of formal thinking so that a learning media is needed that is able to serve students with different cognitive development. By using the principles of ASSURE and VISUALS, it is necessary to develop a medium tailored to the cognitive development of junior high school students. Semi-concrete media development can be used as an alternative to mathematics learning. Some concrete semi that can be used in learning such as number cards, number lines, and comics.
Keywords: learning media, mathematics, cognitive development

INTRODUCTION
Developments in science and technology are rapidly today, put the position of education as a determinant for the advancement of science and technology in the future. Although science and technology have grown rapidly, sometimes technological developments are not offset with good utilization. CELMI (Cellular Explorer Learning Movie Instruction) is a mobile-based learning media, where the development of this media is motivated by the misuse of the mobile telephone which is increasingly rampant done by students (Susanto, Dwijanto, & Siskandar, 2012).

Learning media is a tools or equipment to implement processes that enable educators and learners to carry out learning activities (Prasetyo, et al., 2011: 16), whereas according to Permendikbud. 65 The year 2013 on Standard Process of Primary and Secondary Education mentioned that the preparation of learning tools that is an integral part of learning planning is designed in the form of the syllabus, lesson plans, preparation of learning media and learning resources, assessment tools, and learning scenarios. This is what causes the learning media is one of the components needed for learning.

The current learning system requires students not only act as the recipient of the material but also act as a communicator or conveyor of the material resulting in two-way communication and even many-way communication (Nurseto, 2011). In learning communication, learning media is needed to improve the effectiveness of learning achievement goals. That is, the learning process will occur if there is communication between the recipient of the message with the source/channel message through the media. This is in line with the meaning of instructional media is a tool that serves to convey the message of learning (Ena, 2001; Sudrajat, 2008; Mediawati, 2011), So that the learning process using the media becomes more effective (Bulut, Akçakın, Kaya, & Akçakın, 2014; Wibowo, 2013; Ismail, Sugiman and Hendikawati, 2013; Yuniati, Purnama, and Nugroho, 2011; and Ali, 2009). This message is delivered by the teacher, accepted by students to stimulate the thoughts, feelings, attention or willingness of students so that will encourage the learning process. Messages or information brought by instructional media can be in the form of messages prepared to meet the learning needs and students' abilities so students can actively participate in the learning process.

In addition, the learning media is a component that is interconnected with other components in order to create expected learning situations, abstracts the abstract so as to reduce the occurrence of verbalism disease, increase student stimuli in learning activities, reduce misunderstandings of learners to the explanations given educators, The limited experience possessed by the learners, enabling direct interaction between learners with their

environment, generating uniform observation, and motivating and stimulating children to learn (Nurseto, 2011; Ali, 2009; Sudrajat, 2008).

In addition to good learning planning, the success of teaching and learning process is also influenced by the suitability between the subject matter and the level of students' thinking ability (Nuroso & Siswanto, 2010; Ojose, 2008). Thus, if the new students achieve concrete cognitive development, mathematics teachers are advised not to use formal mathematical learning, but mathematical formulas are brought toward the concrete. It is like reading a book for children that every stage of cognitive development of children have different book readings, for children who still think sensory motor child does not need to be given a reading book because it still uses a stronger hearing indeed, at the pre-operational stage and Concrete reading of books accompanied by images very helpful pattern of development and understanding of books, while in the formal stage of reading a novel book that is already abstract can be given to children (Nurgiyantoro, 2005).

Good learning planning, well-designed learning strategies, and learning materials adapted to the level of cognitive understanding to be meaningless in learning if the media used is not appropriate. The success of learning is determined by two main components namely teaching methods and learning media (Ali, 2009). These two components are interrelated and inseparable, the use and selection of any particular teaching method have consequences on the appropriate use of the type of instructional medium. Eyler and Giles added that the effectiveness of learning is strongly influenced by the media teachers use (Muhson, 2010). So children who are at the stage of concrete operational development (age 7 to 11 years) teachers should not use formal operations in learning. This is because formal operations are given to children after the age of 12 years.

According to Piaget, individuals will experience levels of cognitive development of sensory-motor, preoperative, concrete and formal operational operations. The increasing age of a person, the more complex the arrangement of nerve cells and the increased ability. As the individual progresses to his or her adulthood, he will experience biological adaptation to his environment so that there are qualitative changes in his cognitive structure. To achieve a stage of cognitive development one to another stage of cognitive development can be achieved at various ages, the child will not skip the stages of cognitive development and the child will not retreat the stage of cognitive development (Ojose, 2008).

Students of junior high school (SMP) in Indonesia averaged over 11 years, where at that age children can use concrete operations to form more complex operations or in other words students can think abstract (Nuroso & Siswanto, 2010; Widodo, 2010). So that junior high school students are informal development, but junior high school teachers still need to consider the level of operation before formal because junior high school students sometimes have not reached the stage of formal or abstract thinking.

Piaget sees that the process of thinking is a gradual activity of the intellectual function, that is, from thinking concretely to the abstract thinking at a formal operational stage. The development of mental capacity provides new capabilities that have not previously existed or even existed. So that junior high school children who have not reached the process of abstract thinking, they are still in a concrete operational stage. Encountering this problem teachers have an obligation to pay attention to students who are already in the abstract thinking stage and students who are still at the concrete stage of thinking. This is done by the teacher until the last stage of cognitive development has been achieved by the child.

This is the background of the importance of media selection for students should be considered by the teacher before implementing the lesson. Because by using the right media can help teachers in the learning process and students can Make it concrete concepts of learning materials that are still abstract (Muhson, 2012). So the purpose of this paper is to describe the selection of effective math learning media used for junior high school students.

DISCUSSION
Learning Media
Tools that can be used as an intermediary between the sender of the message to the recipient of the message called the media, if the media that brings messages or information that aims instructional or contain the purposes of teaching then the media is called media learning (Mediatati, 2011). Learning media is a tool that serves to convey the message of learning (Ena, 2001). Learning media can channel the message, can stimulate the mind, feelings, and willingness of learners so as to encourage the creation of learning processes in students (Sudrajat, 2008). Based on it can be concluded that the learning media is a tool that can be used as educators to send messages to students.

The function of learning media such as aids to create a more effective learning situation, one of the components that are interconnected with other components in order to create expected learning situation, abstracts the abstract so as to reduce the occurrence of verbalism disease, improve the stimulation of learners in learning activities, Reduce the misunderstanding of learners to the explanation given by educators, overcome the limited experience possessed by the learners, allowing direct interaction between learners with the environment, generate uniform observations, and generate motivation and stimulate children to learn (Nurseto, 2011; Ali, 2009; Sudrajat, 2008)

One of the most widely used descriptions of the theoretical basis of media use in teaching and learning is Dale's Cone of Experience (Ali, 2009). Edgar Dale made the classification according to the level from the most concrete to the most abstract (Nurseto, 2011). Dale draws that a person's learning outcomes are derived from direct experience (concrete), the reality that exists in one's life environment than through artificial objects, to the verbal (abstract) symbol.

Learning media are grouped into two groups based on technological developments, namely traditional media and advanced technology media (Ali, 2009). Audio recording media and print media are part of traditional media, while the latest media technology among them is telecommunication-based media, microprocessor-based media. In contrast to the Nurseto (2011) which classifies the learning media into seven groups based on (1) Graphic, print materials, and still images, (2) Silent media projection, (3) Audio media, (4) Silent audio media, (5)) Live audio / movie media, (6) Television media, and (7) Multimedia.

Cognitive Development
Each individual is born with unique characteristics. Although a person is born a twin even though the individual still has characteristics that can distinguish between the person with the twin. Human classification based on certain criteria is very difficult. The obstacles lie in the heterogeneity and uniqueness of human nature. The classification of each individual can only be done by the approach based on somewhat similar traits to be grouped into several groups of personalities.

Because personality has characteristics, characteristics, styles or traits that are typically associated with the individual self. So it can be said that the personality comes from the formations we receive from the environment, such as the formation of the family in our childhood and also the innate-brought luggage. Contrary to the fact that human personality varies widely, perhaps even as much as many people, a group of experts tries to categorize people into certain types, because they argue that it is the most effective way to know human beings well.

David Keirsey distinguishes individuals based on his preference temperatures (Keirsey and Bates, 1984, Keirsey, 1998), Myers-Briggs also distinguishes individuals based on temperament or preference (Seahorse, 2010). The difference between the two experts lies in the division of individuals, if David Keirsey divides into 4 personality types namely Artisan, Guardian, Idealist and Rationals (Keirsey and Bates, 1984; Keirsey, 1998) while Myers-Briggs divides it into 16 categories, they are *Introverted sensing with thinking*, *introverted sensing with feeling*, *Introverted Intuition with feeling*, *Introverted intuition with thinking*, *Introverted thinking with sensing*, *Introverted feeling with sensing*, *Introverted feeling with intuition*, *Introverted thinking with intuition*, *Extraverted sensing with thinking*, *Extraverted sensing with feeling*, *Extraverted intuition with feeling*, *Extraverted intuition with thinking*, *Extraverted thinking with sensing*, *Extraverted feeling with sensing*, *Extraverted feeling with intuition*, dan *Extraverted Thinking with Intuition* (Seahorses, 2010)

Based on cognitive development, Piaget divides the cognitive development of children into four stages: sensory-motor that occurs from birth to age about 2 years, preoperational that occurs at the age of about 2 years to about 7 years, concrete operations that occur at the age of about 7 years to 12 Years, and the last stage of formal operations that occurred at the age of about 12 years until adulthood (Alhaddad, 2012; Widodo, 2010; Ojose, 2008).

In general, the cognitive development of high school students is at the formal operational stage (Widodo, 2010). This is because high school students are at least 11 years of age. The formal phase of operation is the last stage of Piaget's cognitive development (Alhaddad, 2012), where at this stage students have been able to think logically, thinking with formal theoretical thinking based on propositions and hypotheses, can draw conclusions from what can be observed then, And the abstract way of thinking starts to be understood.

An important characteristic of the formal development stage is that children are able to think "scientifically", to think theoretically, to argue and to test hypotheses that prioritize thinking, children are able to solve problems

logically by involving various related problems (Nurgiantoro, 2005). Flavell points out some of the characteristics of this formal operational thinking, ie, hypothesis-deductive adolescence thinking, this period is characterized by proportional thinking, a combinatorial thinking adolescent, a formal operational child of reflexive thinking (Syahbana, 2011).

The cognitive development of junior-aged children is at the formal operational stage so that they have abstractive thinking abilities, abstract thinking ability can be seen from classification reasoning, conservation reasoning, theoretical reasoning, combination reasoning, proportional reasoning, functional reasoning, variable control, analogical reasoning, propositional reasoning, Correlational reasoning, probable reasoning (Nuroso & Siwanto, 2010). As a result of students who have had the ability to think formal or abstract students can be invited to use their minds in solving problems that require high-level thinking such as linking, weighing, testing, deciding, abstract thinking, understanding, analyzing and solving problems (Syahbana, 2012).

Despite the age, the cognitive development of junior high school children is at the formal operational stage but they are not yet fully able to think formally. Junior high school students can not yet fully think abstractly, in the learning of things or concrete events are still needed (Syahbana, 2012)). Based on this, junior high school students are sometimes still in concrete operations, in other words, a formal operational stage has not been reached. This is in accordance with Masganti (2012) which states that every individual will pass a series of qualitative changes that are invariant (stable), always fixed, not jumping or retreating.

One of the characteristics that emerged during the concrete operational stage is that at this stage the child has begun to understand the concept of eternity, the student can understand the operation (logical) with the help of concrete objects although sometimes there are students do not need the help of concrete objects When performing surgery, it is possible students have difficulty making verbal generalizations of similar examples (Alhadad, 2012). At the concrete operational stage, learning should not be glued to learning concepts but students must engage in activities that directly interact with the object being studied (Fauziah, 2011).

At this stage, the child begins to understand logically stable. Characteristics of children at this stage include (a) a child can make a simple classification, classify objects based on common traits, such as color classification, certain character classification, (b) the child can make a sequence of things accordingly, according to the object, numbers, Small, and so on, (c) The child may begin to develop his or her imagination into the past and the future; The development of egocentric patterns of thinking becomes easier to identify with different points of view, and (d) the child begins to think of arguments and solve simple problems, there is a tendency to acquire ideas as adults do, yet can not think about Something abstract because the way of thinking is still limited to a concrete situation.

Selecting Appropriate Learning Media mathematics Junior High School Students With Cognitive Development
Learning media is a component that is interconnected with other components in order to create learning situations that are expected, abstracts the abstract so as to reduce the occurrence of verbalism disease, improve student stimuli in learning activities, reduce misunderstanding of learners to the explanations given educators, overcome the limited experience Owned by learners, enabling direct interaction between learners and their environment, generating uniform observation, and motivating and stimulating children to learn (Nurseto, 2011; Ali, 2009; Sudrajat, 2008).

To be effective in learning mathematics, in the learning required a good and careful planning. One of the things that should be carefully planned in addition to the use of models, strategies, and approaches used in learning are learning tools such as syllabus, lesson plan, learning media and learning resources, assessment tools, and learning scenarios. In order to utilize learning media properly and effectively, it is necessary to consider several aspects such as Analyze Learner Characteristics, State Objectives, Select and Modify or Design Materials, utilize materials, require learner response, and evaluate (Mukminan & Saliman, 2008).

The use of media in the teaching and learning process is very important. Some criteria in the selection of materials to achieve effective results include (1). Interesting, meaning the media used should appeal to students, (2). Motivate, meaning the media used can motivate students to read, (3). Relevant/appropriate, meaning that the media used must be relevant or in accordance with the topic discussed and in accordance with the age of students (Johana & Widayanti, 2007). In addition, for the media to be used appropriately and effectively in learning can consider aspects of visible, interesting, simple, useful, accurate, legitimate, and structured (Mukminan & Saliman, 2008).

The use of media in the learning process needs to consider that (1) none of the media is best for all learning objectives, (2) media is an integral part of the learning process, (3) media selection should be objective based on learning objectives, Some media at the same time will be confusing learners, and (4) the goodness and lack of media is not dependent on the concreteness and abilities alone (Sungkono, 2014).

Because the learning media is a communication tool to convey a message to the learner to stimulate learners to learn for the achievement of learning objectives, then choose the media need to consider the learning objectives to be delivered, tailored to the level of development of learners, the media should be tailored to the ability of teachers, and the media should adapt to the situation and conditions or at appropriate times, places and situations (Sumantri, 2001); in addition, media selection should also take into account the characteristics of the materials to be provided to students, the characteristics of learners or individual differences in learners, and learning support facilities Susilana and Riyana, 2009).

At least teachers are able to select instructional media tailored to the characteristics of learners or materials to be provided to students (Reiser and Gagné, 1982; Igoe, et al, tt; Mukminan & Saliman, 2008; Susilana and Riyana, 2009), needs such as the abilities, skills and attitudes of students that we want to be mastered by students (Nursetyo, 2011). By using learning media tailored to the characteristics of learners or student learning outcomes expected to be more leverage.

Effective learning activities require careful planning, as well as in media use. To use effective learning media can use the 6 steps proposed by Heinich, Molenda, and Russell namely (1) Analyze Learner Characteristics, (2) State Objectives, (3) Select, Modify Or Design Materials, (4) utilize materials, (5) require learner response, and (6) evaluate. The six steps are better known as ASSURE (Mukminan and Saliman, 2008). In addition to obtaining the right media used in mathematics learning, the principle known as VISUALS is visible, interesting, simple, useful, accurate, legitimate, and structured (Mukminan & Saliman, 2008).

The use of instructional media should be tailored to the characteristics of students such as age, a level of intelligence, cultural factors, socioeconomic, and related characteristics and directly affect the content of the lesson (Mukminan and Saliman, 2008). In addition, media planning is based on the need, One indicator of the needs of skills, skills, and attitudes of students that we want to be mastered students (Nurseto, 2011).

Cognitive development is one of the characteristics of learners that are rarely noticed by teachers or educators. Teachers are expected to pay attention to the cognitive development of students in learning, meaning that if students are still at the operational stage of concrete teachers should not use abstract concepts in learning. This is because the success of teaching and learning process, among others, is influenced by the suitability between the subject matter and the level of cognitive development of learners (Nuroso and Siswanto, 2010; Ojose, 2008). Thus, if the new students achieve concrete cognitive development, mathematics teachers are advised not to use formal mathematical learning, but mathematical formulas are brought toward the concrete. It is like reading a book for children that every stage of cognitive development of children have different book readings, for children who still think sensory motor child does not need to be given reading books because it still uses a stronger hearing indeed, at the pre-operational stage and Concrete reading of books accompanied by images very helpful pattern of development and understanding of books, while in the formal stage of reading a novel book that is already abstract can be given to children (Nurgiyantoro, 2005).

The age of junior high school students according to Piaget states that they are at a formal development stage because they are over the age of 11 years (Widodo, 2010), but the age limit of children to differentiate the Piaget's cognitive developmental stages varies widely (Ojose, 2008). Based on this matter, it is possible for junior high school students still at the stage of concrete development yet formal or still concrete. This is what needs to be studied more detail on the cognitive development of students in junior high school. Whether junior high school students are in the formal age or are still at a concrete age. This is consistent with the previous opinion which states that learning mathematics will be meaningful if adapted to the child's cognitive development (Ojose, 2008) so that the teacher is expected to provide adjust the child's cognitive development in learning.

Although the cognitive development of junior high school students already in the formal stage is no longer concrete, sometimes still found students are still at the stage of concrete development because the stage of formal thinking has not been achieved (Syahbana, 2012). Because students have not reached the formal stage of thinking then in mathematics learning the presence of concrete objects is still needed, it aims to concrete abstract mathematical material. Yet educators should begin to introduce semi-concrete objects in mathematics learning.

The junior high school students should have begun to introduce semi-concrete objects so that their thinking patterns can be used to understand and solve problems (Syahbana, 2012). In addition, the use of semi-concrete learning media aims to reduce the dependence of students on events or concrete objects and to help students to the concrete phase of thinking immediately passed. Ismail, Sugiman & Hendikawati (2013) explains that To teach math so that learners can think abstractly starting from the concrete, semi-concrete, and finally able to think abstractly.

Adi, Meter & Kristiantari (2014), the number line is one example of a concrete semi-media. Indriyani (2013), media card number that is used as a learning medium that is used to provide the understanding of the concept of numbers to students with intellectual challenges is also a media example semi-concrete. Artini, Sujana, & Wiyasa (20 114) explains that the media semi-concrete is half real props in the form of two-dimensional graphics media to distribute messages and information through visual symbols such as pictures, posters, cartoons, caricatures, and so on. Based on the semi-concrete media that can be used in teaching mathematics in secondary schools in addition to the number line and card number is comic, such as comic learning mathematics on material geometry for SMP students (Widodo, Pardimin, & Purwaningsih, 2016; Pardimin & Widodo, 2017)

CONCLUSION
Learning media is a tool that can be used to convey the message to the students for the purpose of learning can be achieved. Each learning medium used has unique characteristics, so it needs careful planning in using the media in learning. Planning the use of mathematics learning media can use the principles of ASSURE and VISUALS. In mathematics learning in high school, the media used in addition to using these two principles, the teacher should also pay attention to student cognitive development. Because math learning will be more meaningful if adapted to the cognitive development of students. High school students can not be entirely formal thinking so it is still needed semi-concrete learning media to bridge students who have not been able to think formally.

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