Development virtual test of reaction rate based visual perceptual skills to measure students’ mastery concept

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Abstract. This study aims to obtain a valid and reliable virtual test of reaction rate based visual perceptual skills to measure students’ mastery concept. The test has been developed has the form of virtual test, consists of texts, drawings, graphs, animations, videos, sounds, and images. The method of this study was development and validation method. Data obtained from the result of validation, testing of virtual test, and interview of students which include content validity, reliability, level of difficulty, distinguishing ability, and the transcription of interview students. The results showed that the virtual test is valid from 33 items developed are 32 items that have a CVR value between 0.6 to 1.0 which indicating items both in terms of content validity. Thirty-two items that have been declared valid tested on 177 students of Eleventh-Grade to calculate the reliability of the test, and Cronbach alpha values obtained for the entire items of 0.734 which indicates a high level of consistency of measurement is acceptable. Virtual test of rate reaction based visual perceptual items has distinguishing ability of 0.35, that is indicated good sufficiency category and level of difficulty of 0.45, that is indicated medium category. After being evaluated of distinguishing ability from 32 items of virtual test, three items were rejected. From result of interviews, the students responded positively to the virtual test based visual perceptual on the concept of rate reaction which is developed viewed from sides of performance, grammar of items, feasibility of access and operation, advantages and time of doing.

1. INTRODUCTION
In these ‘21\(^{st}\) century’, the assessment as an essential component and affect the learning process, assessment should be changed from the traditional to technology assessment. The use of computer technology to conduct assessments to students in schools has managed successfully to drive a high measure of validity in the result, more interactive and wishes in accordance with the measurement objectives to be achieved, in other words more contextual measurement[1]. Recently, information and communication technology has been used in assessment. Computer-based systems’ specific value can be seen in their efficiency while automatically marking responses, in providing immediate learner feedback on any potential weaknesses, and in being available upon demand and, in the case of larger learning groups, simultaneously accessible by all pupils[2]. The computer is a medium of instruction to visualize different facts, skills, concepts and computer also displays images that move in
accordance with its requirements[3]. So that teachers as educators with computer based test can measure the competence of more established than paper and pencil test.

Van Merrienboer[4], one of the leading educational researchers in problem solving, emphasizing the importance of using a computers as an assessment and instructional tool, since the tool can simulate real-world problems, which are ill-structured and complex in nature. Besides assessment by Computer Based Test, has advantages which the tests can explore the computer so that the test form with multimedia can be images, text, graphics, animation, video and others. One of the computer based test that has been and should be developed further is a virtual test. Virtual test is a test form using software that can be carried out both online and offline[5]. From the above definition, it can be concluded that the virtual test is a form of testing by using multimedia computer such as images, text, graphics, diagrams, animations, and video. Mushonev states that the use of visual forms in the test questions will help evaluators to measure students' cognitive abilities were higher compared to just use a statement or just questions and can train simultaneously measuring the ability of the students' science process[6]. The use of media such as text, images, audio, animation, and video better than the media[7]. Multimedia effects provide sufficient retention great for students. video can display a phenomenon which is difficult to be seen directly. This is so that students better understand the statement items are delivered.

Virtual test is developed by eight visual perceptual skills are developed Rocford and archer[8] with the aim to measure the level of student mastery concepts on the reaction rate material. There are several research of virtual tests have been developed, but the virtual development of visual perceptual skills test based on specific chemical content has never been developed. Research that have been developed include Firman and Rusyati (2014) develop a virtual test used to measure critical thinking skills of junior high school students on the theme of human diseases, Saukani (2015) in his research to develop a virtual test used to measure the ability of decision-making high school students on the material solution acid-base, Anggarjati (2015) in his research to develop a virtual test used to measure critical thinking skills of high school students on the material Chemical Equilibrium, and Christian (2009) has developed VSCs (Visual Spatial Chemistry Specific). VSCs are assessment tools developed to assess visual perceptual skills of the students, where these skills are involved in the formation of a mental image of visual objects. Christian VSCs focuses on the representation of the molecule, and have not focused on a specific chemical content.

Chemistry requires the users, can visualize a world picture macroscopic, microscopic and symbolic. Visual perceptual skills is an integral part of three of the world picture. Visual perceptual skills are fundamental premise that students in learning chemistry is always exposed to view objects in space, where students have formed a mental image of the object[8]. In other words, three level representation of the chemical can be developed in a virtual instrument test. Because the conceptual understanding of chemistry requires the ability to represent and interpret the problems of chemicals in the form of representation macroscopic, microscopic, and symbolic simultaneously[9].

Visual perceptual capabilities need to be developed on any material, but any material in chemistry has the characteristics of a particular concept. There are several materials that can accommodate the needs of evaluation in measuring students' mastery of concepts in which the material terms with the concepts of real, symbolic and abstract visual perceptual skills require students to understand it, one of which is the rate of reaction. Judging from the characteristics of the concept, the reaction rate has kind of a concept based on the principle of the critical attributes of the abstract but concrete examples. Under these conditions, the reaction rate of
the material requires a level of understanding and visualizing high enough, so that it can be used in developing the items that can encourage students to develop visualization. This study aims to produce a virtual test of visual perceptual skills based on the material reaction rate is valid and reliable to measure students’ mastery of concepts. Based on previous research, virtual test based visual perceptual on specific chemical content has never been studied. Though virtual test based visual perceptual is needed to help students understand the statement items that contain high enough understanding and visualization, so that needs to be developed virtual test based visual perceptual test on the chemical content that requires understanding and visualizing them is the concept of a high enough rate of chemical reactions.

2. RESEARCH METHODOLOGY
In general, the research method is defined as a scientific way to obtain valid data with the purpose and usefulness. The method used in this research is Development and Validation Method. Development and validation method is used to assess test developed whether it is feasible to use and can measure the aspects measured[10].

This study seeks to develop and validate a virtual visual-perceptual-based test to measure the level of student mastery of concepts related to the rate of reaction material. Rochfor and Archer theoretical framework consisting of the eight visual-perceptual skills as a basis or foundation (framework) to develop the indicators items. Analysis of the chemical reaction rate of material from the standpoint of visual-perceptual skills done to develop this assessment tool. Where visual-perceptual characteristics of eight visual-perceptual framework Rochford and the Archer, each revealed to be indicator items that collaborated with the indicator reaction rate material. The character of the skills identified clearly delineated, and it is suitable to use in developing the assessment tool to measure the level of mastery of concepts rather overlooked in educational assessment is the process of high-level thinking skills (High order thinking skills-HOTS). With a virtual visual-perceptual-based test can be developed an assessment tool to measure the level of student mastery of concepts included high-level thinking skills consisting of C4 levels, C5 levels, and C6 levels.

Stages of implementation of this study were divided into four main phases namely planning studies (including analysis of competency standard, basic competence, analysis of the concept, representation reaction rate, material analysis reaction rate from the point of view of the skills of visual perceptual), stage of development (including the preparation of the grating and analysis of items virtual test), the validation phase (includes validation and analysis of CVR), and the last stage is the pilot phase of virtual test rate of reaction.

The method used to measure the validity of the content is a method developed by Lawshe[11]. Mechanical CVR (content validity ratio) is used CVR proposed by Lawshe as interpreted by Wilson[12]. Reliability for determining the level of consistency in this study using internal consistency reliability. Reliability index is done for this sort of test, where scoring is done if it is true "1" and if one of "0". This study using coefficient Cronbach alpha developed by using SPSS 16.

3. RESULTS AND DISCUSSION
Virtual test the reaction rate based visual perceptual developed is thirty-three items in the form of simple multiple choice. Based on the assessment validator which consists of 10 people validator (7 lecturers and 3 chemistry teacher), thirty two (32) are valid (accepted) by the CVR value of 0.600 to 1 and one (1) is invalid (rejected) of CVR value (0.400) below
CVR critical value (0.520). Of the 33 items based virtual test of reaction rate based visual perceptual that is validated by 10 expert judgment there are 32 items that valid (acceptable). There is one problem that is invalid (rejected), which is about the number 32 by the value of the CVR (CVR = 0.44) below the critical value of the CVR (CVR = 0.520). CVR analysis results for each item on the virtual test based visual perceptual are shown in Figure 1.

Virtual test developed has CVI (Content Validity Index) of 0.897, it means that there is a match between the virtual test items based visual perceptual skills developed indicators to measure the level about students' mastery of concepts. Virtual test of reaction rate based visual perceptual that are 32 questions and has been revised subsequently tested ready to pitch. Items that have been validated indicate that the items developed are in accordance with the indicators to measure the level of students’ concepts mastery.

In this study, the reliability is used internally consistent reliability. Formulation to determine the reliability index is done to sort of test where scoring is done if it is true "1" and if either "0" by using Cronbach's alpha coefficient developed by Cronbach. Determination of reliability were performed using SPSS 16 by determining the value of Cronbach 's alpha. Cronbach 's alpha value of virtual test visual perceptual reaction rate based on the can at 0.734. Based on Table 1 were developed Jacobs and Chase, this means that this instrument is acceptable and are included in the category of "high".

| Correlation coefficient | Specification    |
|------------------------|-----------------|
| 0.00 – 0.19            | very low        |
| 0.20 – 0.39            | Low             |
| 0.40 – 0.59            | Sufficient      |
| 0.60 – 0.79            | High            |
| 0.80 – 1.00            | very high       |
Distribution characteristics of matter obtained 35% items with the characteristics of the visual skills of association, 10% items with characteristic visual skills constancy, 14% items with characteristic visual skills discrimination, 7% items with the skill characteristics of visual figure ground, 17% items with characteristics of visual memory skills, 7% items with characteristic visual skills orientation, and 10% items with characteristic visual sequencing skills.

The advantages of virtual test of reaction rate based visual perceptual is a measurement tool that can be used in the measurement and improvement of skills including visual perceptual skills, and aligned with 21st century learning where feedback is timely, meaningful to learners and teachers. Virtual test of reaction rate based visual perceptual skills displays those items that can visualize various facts related to the concept of reaction rate, and the statement displays a matter involving dynamic images. Virtual test of reaction rate based visual perceptual involves multimedia such as text/picture/video/animation is a visualization of the fact concepts of reaction rate. The concept of the macroscopic to the concept of reaction rate as formation of deposits is a concrete concept, then the stem of item it directly demonstrated with video. Such visualization can stimulate more students to achieve a high level of understanding of the concept of chemistry. Figure 2 shows an example of virtual items based visual association test.

Figure 2. The items were developed based on visual association

Association visual skills are skills that involve abilities related to the concept represented in the image and the written word[13]. Items shown in Figure 1 based visual association, namely the statement items (stem) question about based on the concept that is represented in the image and the written word. While visual sequencing skills reflect the student's ability to remember a sequence of object shape. Examples of items that are developed by visual sequencing is shown in Figure 3.

Figure 3. The items were developed based on visual sequencing
Based on the interview can be concluded that the information in the form of video, images, graphics, animation or experimental data contained in items very help students in understanding the statement items. Based on interviews with students, use of multimedia on the virtual test of reaction rate based visual perceptual such as video, images, graphics, animations or interactive experiment data easier for students to understand the items. The use of virtual test can be said to be almost 0 %, for items in the virtual test is made by means of randomized, where each student will get a different order of questions. The use of virtual tests help teachers in the effectiveness and efficiency of test examination time for virtual test software is already equipped with a slide to the results of the evaluation in the form of scores acquisition and analysis results from each answer items.

4. CONCLUSION

The results showed that virtual test of rate reaction based visual perceptual (VTVP) a measure that is valid and reliable. VTVP so it can be used to measure students' mastery of concepts on the concept of rate of reaction. Use of multimedia on the virtual test of reaction rate based visual perceptual such as video, images, graphics, animations or interactive experiment data easier for students to understand the items.

5. REFERENCES

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