Validity testing of a contextual approached with REACT components-based module on topic of salt hydrolysis for class XI senior high school students

Fauzana Gazali*, Eka Yusmaita and Nur Intan Feronika
Chemistry Departement Universitas Negeri Padang
Prof. Dr. Hamka Street, Air Tawar Barat, Padang, West Sumatera, Indonesia

*fauzana_gazali@fmipa.unp.ac.id

Abstract. A contextual approach-based module that consists of five components namely Relating, Experiencing, Applying, Cooperating, and Transferring (REACT) can help students find concepts. This research aims to develop a contextual approach-based module that contains critical thinking skills indicators on salt hydrolysis topics which have content validity and construct validity. Research instruments were construct validity questionnaires analyzed with Aiken V formula and a content validity questionnaire analyzed with CVR approach. The questionnaires were filled by 3 chemistry lecturers and 2 chemistry teachers at SMA 9 Padang. It was found that the average of V score for construct validity was 0.81 showing valid categories, while the CVR and CVI values of content validity were 0.98 and 1 respectively also showing valid categories. Therefore, it can be concluded that the salt hydrolysis module which is based on a contextual approach with REACT components for class XI learning is valid.

1. Introduction
Chemistry education as part of science education has an important role in human life. Chemistry education development is in line with the growth of science and technology in the 21st century. In this era, education requires the students to have ability to think, one of them is the ability to think critically, in order to hold on to the competition in the current era of globalization [1]. Therefore, chemistry learning must be applied by learning to stimulate the development of students' critical thinking skills. The ability to think critically can provide encouragement and enthusiasm for students to learn independently and be able to overcome problems that they encounter [2].

A preliminary research was conducted by interviewing teachers and distributing questionnaires to the students from some school in Padang. The results of this study were the teaching materials used by teachers in the learning process on salt hydrolysis have not been prepared based on a contextual approach that contains indicators of critical thinking, whereas In high school curriculum of 2013 demands the students to be able to think critically. Teaching materials are a set of systematically arranged tools that provide information related to the competencies and learning objectives that students want to achieve [3]. Compiling a teaching material is not an easy and simple activity. The preparation of teaching materials requires a selection process from various reliable sources and asks the panelists to review it[4].

Based on the teachers statement, a complete teaching material is needed for salt hydrolysis topic which can describe the process of salt hydrolysis, and contain the picture that can realize between salt hydrolysis topic and common events in our daily life. So that the students are motivated to find out their
own concepts about salt hydrolysis. The following things that need to be considered in developing students' critical thinking skills and increasing students' understanding of salt hydrolysis topic are the use of teaching materials in the form of modules that can reconstruct and reorganize the cognitive structures that already have by the students[5]. The module is a complete unit that consisting a series of learning activities that arranged to help students learn independently in achieving a number of specifically and clearly formulated goals[6]. Modules can develop students' critical thinking skills because the exercises in modules can help students comprehend the concept and they are be able to solve the question by themselves and they can do it repeatedly. Using module in learning allows students to increase their learning activities that suitable with the level of ability and progress that the students get during the learning process[7].

The modules developed in this study are compiled based on the REACT (Relating, Experiencing, Applying, Cooperating, Transferring) stages which are stages of learning that follow the basic principles of constructivist learning theory [8]. Relating is a stage where the students connect the prior knowledge with the new concept that will be obtained by the students in the classroom. This stage is also known as meaningful learning. According to Ausubel, meaningful learning is a learning process that the students can relate their prior knowledge with the new knowledge will get [9].

Next is experiencing, this is a stage that relates with discovering a new concept through exploration and finding out the new concept based on direct experience in the classroom. The direct experience can be obtained by students through manipulation activity, problem solving and simple experiment. The following stage is called Applying, it is an activity of applying the concept. The activity is the students solve the question by applying the concept that they got in the classroom. The question that is given is not too difficult and not too easy, because if the question is given too easily the students will get bored easily, on the other hand if the question is too difficult the student will think that they are not comprehend the concept very well. Next is cooperating, this is the stage in which the students sharing, responding, and communicating with others in solving the questions. The last is transferring, this is the learning process using the concepts that have been comprehended by the students into the new context or new situation which they never get in the classroom.

The next thing that has to be considered in order to make the students more understand about the concept of salt hydrolysis is the students are led to find out the new concepts based on their own opinions, the application of the concepts in daily life, and the experiment is carried out to prove the concept [10]. Based on the problem above, it is important to design a salt hydrolysis module that can help students understand the topic and relate it to their daily life. This module should be validated, whether the content and the construct.

2. Methods
This was descriptive qualitative research, it means the study was trying to describe the phenomena and what happened in the recent time. This study described the worthiness of salt hydrolysis modules as teaching material in the learning process. The technique of the data collection was using construct validity questionnaire and content validity questionnaire. These questionnaires were validated by five Subject Matter Experts (SME) or validators which get used to evaluate learning product. The SME consists of five which were 3 chemistry lecturers in science and mathematics faculty of Universitas Negeri Padang and two chemistry teachers of SMAN 9 Padang.

Validity testing consists of content and construct validity. Content validity is a kind of validity that measures the components of the content that have to be included in teaching material [11]. On the other hand construct validity shows a teaching material construction from the composition, layout and language and etc [12].

The technique of data analysis for content validity testing used a technique developed by lawshe (1975) that called content validity ratio technique (CVR). According to lawshe every SME or validator answers the question for each item with three optional answers, the options are: essential, useful but not essential, and not essential. The questionnaire to collect the content validity data in this research has two
categories “Yes” or “No”. The answer “yes” is given 1 and “No.” is given 0. The answer that is given by SME will be analyzed by this equation.

\[ CVR = \frac{n_e - N}{\frac{N}{2}} \]  

where:
- \( n_e \) = the number of validators who answer yes
- \( N \) = the number of validators

The items in the module are accepted if the CVR value is equal to or greater than the critical value, while the items will be rejected if the CVR value of the item is less than the critical value based on the number of validators, as shown in Table 1 below [13].

| Number of validator | Critical value of CVR |
|---------------------|-----------------------|
| 5                   | 0.736                 |
| 6                   | 0.672                 |
| 7                   | 0.622                 |
| 8                   | 0.582                 |

Based on CVR value, we can calculate the value of the content validity index (CVI) using the formulation below

\[ CVI = \frac{\sum CVR \text{ yang diterima}}{\text{Jumlah item yang diterima}} \]  

The validation sheet that has been identified based on the questions using CVR and then we can calculate CVI. Simply, CVI is CVR's average for each question which answered “Yes”. The CVI shows that each item consisting of modules has good content validity. To evaluate the construct validity of the module, the researcher used questionnaire by using likert scale. The validators were given a questionnaire, and in the end, they will give assessment to the questionnaire.

The technique of data analysis construct validity is based on expert agreement. To find out this agreement, a validity index can be used, including the index proposed by Aiken (1980; 1985; Kumaidi, 2014). In this categorical judgement the validators were given a statement and then the validators will assess each of these statements. The validator's assessment of each analysis was analyzed using the Aiken V formula, which at the end of processing the V permit. The formula that used as follow:

\[ V = \frac{\sum s}{n(c-1)} \]  

where:
- \( V \) = index of validator agreement regarding the validity of items
- \( n \) = The lowest number of validity assessments (in this case=1)
- \( c \) = the highest number of validity assessments (in this case = 5).
- \( r \) = the score that is given by validator[14].

The criteria for assessing validity based on Aiken V scale can be seen in Table 2[15].
Table 2. Validity base on Aiken V scale (V)

| Aiken V score (V) | Category |
|------------------|----------|
| V≤ 0,4           | Low      |
| 0,4<V≤0,80       | Medium   |
| 0,8 <V           | Valid    |

3. Result and Discussion

3.1 Content Validity

The results of content validity data for salt hydrolysis module based on contextual approach can be seen from the assessment of suitability the content of the module with REACTs’ component, the suitability of the module’s content with indicator of critical thinking and the suitability with chemistries’ knowledge of the field. The value of CVR and CVI salt hydrolysis module based on contextual approach with REACT component that given by five validators were shown in the table below.

Table 3. Analysis of Content Validity

| No | Evaluated Aspects                                                                 | CVR  | CVI  | Validity |
|----|------------------------------------------------------------------------------------|------|------|----------|
| 1  | The suitability of the content of the module with REACTs’ component                | 1    | 1    | Valid    |
| 2  | the suitability of the module’s content with indicator of critical thinking        | 0,98 | 1    | Valid    |
| 3  | the suitability with chemistries’ knowledge of field                               | 0,98 | 1    | Valid    |
|    | Average                                                                            | 0,98 | 1    | Valid    |

Based on validity content analysis on the table above, the comparison of all evaluated aspects can be seen on the following chart

Figure 1. The result of content validity salt hydrolysis module with contextual approach.

Concerning the result from the data above, module that have been designed already have content validity. This module was appropriate with REACTs’ components, critical thinkings’ indicators and chemistry’s concepts. The REACT learning steps that were presented in the module can help students understand the concepts and relate it with the events in their everyday life[16].

This salt hydrolysis module is arranged based on the critical thinking sub-indicators according to Ennis (1985). The dominant indicators and sub-indicators of critical thinking in the module can be seen in Table 4 below [17]
### Table 4. Indicator and sub indicator critical thinking in salt hydrolysis module

| Indicators                          | Sub indicators                                      |
|-------------------------------------|-----------------------------------------------------|
| Focusing on question                | Identifying and formulating the criteria for possible answer |
|                                     | Keep thinking situation                              |
| Analyzing argument                  | Identifying the conclusion                           |
|                                     | Seeing the similarities and the differences          |
| Assessing the trustworthiness of the source | Using the appropriate procedure                     |
| Interacting with others             | Using the argument                                   |
| Questioning and answering the question | Giving simple explanation                           |
| Deciding temporary action           | Giving simple explanation                            |

It can be concluded that the modules’ content was valid. The average of CVR and CVI values given by the validator was 0.98 and 1.

#### 3.2 Construct Validity

The result of construct validity is used to evaluate the content, the component of layout, linguistic, and graphic in the salt hydrolysis module based on contextual approaches that developed. The result of data analysis from all evaluated aspect that assessed by five validators in short shown in table 5

### Table 5. Construct validity data analysis

| Evaluated Aspects | V Categories of Validity |
|-------------------|--------------------------|
| Content           | 0.82 valid               |
| Component of layout | 0.84 valid             |
| Linguistic Component | 0.86 medium            |
| Component of graphic | 0.82 valid              |
| k construct validity | 0.81 valid               |

V = validity

Regarded to the result of construct validity in the table above, all of the aspects that are evaluated can be seen in the chart below.

![Figure 2](image_url)

**Figure 2.** The result of construct validity module based on contextual approach.

### 4. Conclusion

Based on the research that has been done, it can be concluded that the module that has been designed is valid both in terms of content and in terms of its construct. In terms of content validity, the CVR value is 0.98 and the CVI value is 1. This illustrates that the module produced is in accordance with the
REACT component, according to the critical thinking indicator and is in accordance with the chemical scientific context.

While the construct validity includes 4 aspects of assessment, namely: 1) the content component obtained the aiken V score of 0.82; 2) the layout component obtained the aiken V score of 0.86; 3) the linguistic component obtained the aiken V score of 0.76; and 4) for the graphic component, the Aiken V score is 0.82. Thus, the average aiken V score for all aspects is 0.81

Acknowledgments
The researchers deepest and sincere gratitude goes to LP2M Universitas Negeri Padang for funding this research. They also thanks to the Headmaster and the chemistry teachers of SMAN 9 Padang for facilitating the research and giving permission to conduct this research

References
[1] Partnership for 21st Century Skills. (2008). 21st Century Skills, Education & Competitiveness: A Resource and Policy Guide. Partnership for 21st Century Skills
[2] Maridi, Ervan Setya Bakti Nugroho, Baskoro Adi Prayitno. (2018). Pengembangan Modul Berbasis Relating, Experiencing, Applying, Cooperating And Transferring (REACT) Pada Materi Jamur Untuk Meningkatkan Kemampuan Berpikir Kritis Siswa Kelas X SMA JURNAL INKUIR, Vol. 7, No. 1, 2018 (hal 61-70).
[3] Prastowo, A. 2013. Panduan Kreatif Membuat Bahan Ajar Inovatif. Yogyakarta: Diva Press
[4] Yusmaita, E., Mudzakir, A., & Hernani, H. (2017). Pengembangan Model Rekonstruksi Pendidikan pada Bahan Ajar Sel Elektrokimia Berbasis Green Chemistry. JURNAL EKSAKTA PENDIDIKAN (JEP), 1(1), 71-78.
[5] Gazali, F., Yusmaita, E., & Ningsih, N. R. (2019). Pengembangan Modul Kimia Berbasis REACT untuk Meningkatkan Keterampilan Berpikir Kritis Siswa Kelas XI IPA SMA/MA. JURNAL EKSAKTA PENDIDIKAN (JEP), 3(2), 142-151.
[6] Susilana, Rudi dan Riyana, Cepi. 2009. Media Pembelajaran. Bandung : CV Wacana Prima.
[7] Lunenburg, F.C. (2011). Critical Thinking and Constructivism Techniques for Improving Student Achievement. National Forum Teacher Education Journal. 21(3) 1-9.
[8] Crawford, M.L. 2001. Teaching Contextually: Research, rationale, and techniques for improving students motivations and achievement in mathematics and science. Texas: CCI Publishing Online.
[9] Slameto. 2010. Belajar Dan Faktor-Faktor Yang Mempengaruhiya. Jakarta: Rineka Cipta.
[10] Supriyono, Agus. (2010). Cooperative Learning Teori & Aplikasi PAI KEM. Yogyakarta: Pustaka Pelajar.
[11] Muljono, P. (2007). Kegiatan penilaian buku teks pelajaran pendidikan dasar dan menengah. Buletin BSNP, 2(1), 21.
[12] Latisma, DJ. 2011. Evaluasi Pendidikan. Padang: UNP Press.
[13] Wilson, F.R., Wei, P., Donald, A.S. 2012. “Recalculation of the Critical Values for Lawshe’s Content Validity Ratio”. Measurement and Evaluation in Counseling and Development. 45(3):197-210
[14] Azwar, Saifuddin. 2012. Reliabilitas dan Validitas. Yogyakarta: Pustaka Pelajar
[15] Nugroho & Ruwanto. 2017. Pengembangan Media Pembelajaran Fisika Berbasis Media Sosial Instagram Sebagai Sumber Belajar Mandiri Untuk Meningkatkan Motivasi Dan Prestasi Belajar Fisika Siswa Kelas XI SMA. Jurnal Pendidikan Fisika , 6(6).
[16] Ningsih, N. R., Yusmaita, E., & Gazali, F. (2019). Evaluasi validitas konten dan konstruk bahan ajar asam basa berbasis REACT. EduKimia, 1(1), 1-10.
[17] Ennis, R.H. 1985. Practical Strategies for the Direct Teaching of Thinking Skill. In A.L. Costa (ed) Developing Mind: A Resource Book for Teaching Thinking. Alexandria: ASCD.