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by Eli Rohaeti

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Sri Rejeki Dwi Astuti, Suyanta, Endang Widjajanti LFX, and Eli Rohaeti

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An Integrated Assessment Instrument: Developing and Validating Instrument for Facilitating Critical Thinking Abilities and Science Process Skills on Electrolyte and Nonelectrolyte Solution Matter

Sri Rejeki Dwi Astuti[1,a)], Suyanta[2,b)], Endang Widjajanti LFX[2], Eli Rohaeti[2]

[1]*Department of Chemistry Education, Graduate School Program, Universitas Negeri Yogyakarta, Indonesia*
[2]*Department of Chemistry Education, Faculty of Mathematics and Natural Science, Universitas Negeri Yogyakarta, Indonesia*

[a)]Corresponding author: srirejeki.dwiastuti@yahoo.com
[b)]suyanta@uny.ac.id

Abstract. The demanding of assessment in learning process was impact by policy changes. Nowadays, assessment is not only emphasizing knowledge, but also skills and attitudes. However, in reality there are many obstacles in measuring them. This paper aimed to describe how to develop integrated assessment instrument and to verify instruments' validity such as content validity and construct validity. This instrument development used test development model by McIntire. Development process data was acquired based on development test step. Initial product was observed by three peer reviewer and six expert judgments (two subject matter experts, two evaluation experts and two chemistry teachers) to acquire content validity. This research involved 376 first grade students of two Senior High Schools in Bantul Regency to acquire construct validity. Content validity was analyzed used Aiken's formula. The verifying of construct validity was analyzed by exploratory factor analysis using SPSS ver 16.0. The result show that all constructs in integrated assessment instrument are asserted valid according to content validity and construct validity. Therefore, the integrated assessment instrument is suitable for measuring critical thinking abilities and science process skills of senior high school students on electrolyte solution matter.

INTRODUCTION

Assessment is the process of gathering evidance of students' abilities for determining what they know, what they are able to do, and what thy still need to learn [1]. It is impact by policy changes. Assessment in education standard should covered three aspects i.e. knowledge, attitude and skill [2]. The three aspects are very important in chemistry education because the natures of chemistry are chemistry as a process and as a product. Therefore, assessment must cover all aspect in learning process.

Education products are consisting of declarative knowledge and procedural knowledge [3]. Declarative knowledge is cognitive knowledge including fact, principle, concept, theory and law. Whereas procedural knowledge is process skills oriented knowledge or called science experience [4]. Chemistry learning can't separate from the developing students 'cognitive and students' skills. Process skills are essential for understanding and applying chemistry concept. So, assessment in chemistry must covered knowledge and process skills too [5].

Chemistry is a branch of science that applying higher order thinking skills in each matter and holding important role in the development students' critical thinking skills [6]. It is easy fastened to daily life phenomena. Furthermore, it can be applied in society. One of chemistry matter in senior high school is electrolyte and nonelectrolyte solution matter. Electrolyte solution matter is contextual matter, so it can be easy fastened and applied in daily life. Many electrolyte solution phenomena can be found in daily life such as storage battery application and body requirement for electrolyte solution. It can develop students' critical thinking skills. Moreover, electrolyte solution matter is electrochemistry prerequisite matter.

Critical thinking is one of thinking skills in higher order thinking skills which become one of learning goal in 21th century [7]. Critical thinking abilities can help students for solve problem efficiently and way to self learning [8]. Critical thinking as thinking process is thinking ability to make personal evaluation about problem based on authenticity, accuracy, process, theory, method, background and then make reasonable decision [9]. Critical thinking is essential way on scientific investigation process, especially for analyzed and evaluated scientific evidences [10]. Critical thinking covered concrete and abstract thinking process to make conclusion about fact and problem which appropriate with scientific evidences [11]. Critical thinking abilities can emerge when students used higher order thinking abilities, so students' learning result enable to increase.

Students, who have critical thinking abilities, will have high academic achievement. The result of Wenglinskys' research explained that students who was familiarized to think critically in learning process, be able to acquire high test score on learning evaluation [12]. Critical thinking abilities are not only necessary

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in school, but also in daily life. In fact, drawing conclusion very needed in all occupation section, so critical thinking abilities will raise person's success in work force [12]. Moreover, increasing job requirement for worker whose can analyze and apply information critically and give effective solution about problem in work force [13]. Therefore, critical thinking abilities are one of educations' goals in globalization era, so students have to familiarize used critical thinking abilities in chemistry learning.

Critical thinking covered three aspects i.e. to identify problem, to reconstruct argument and to evaluate argument [14]. Classification of critical thinking by Watson-Glaser consist of defining a problem, determining possible solution and strong argument, drawing valid conclusion based on regarding solution and evaluating conclusion [7]. Students' critical thinking abilities were seen from students' arguments toward problem and conclusion toward arguments. Therefore, critical thinking indicators that used on developing integrated assessment instrument include (1) identifying problem, (2) reconstructing arguments, (3) determining solution, (4) evaluating arguments, and (5) drawing conclusion.

Science process skills are important learning ways for reaching knowledge [15]. One of science educations' goals is to prepare students for accumulating knowledge and to discover scientific knowledge by self [16]. Science process skills are a way to produce and to apply scientific information on scientific research, and to solve problem [17-18]. Process skills were skills that scientist do to discover scientific knowledge and to investigate problem [1]. Science process skills are skills to discover knowledge, to define problem and to formulate problem [19]. Based on several different opinions about science process skills, it can be defined as skills that used to discover knowledge by identifying problem, solving problem, and answering question about nature. Science process skills are believed to ensure students' meaningful knowledge because it helps students to increase higher order thinking skills. Therefore, developing science process skills for students is important to be noted.

Based on science process skills' level, it consists of two level skills i.e. basic science process skills and integrated science process skills [1, 20]. Basic science process skills are fundamental skills that underlie scientific method. It consists of six process skills i.e. observing, communicating, classifying, measuring, inferring and predicting. Integrated science process skills are development of basic science process skills. It consists of eleven skills i.e. identifying variable, constructing a table of data, constructing a graph, describing relationship between variable, acquiring and processing data, analyzing investigation, constructing hypotheses, defining variables operationally, designing experiment and experimenting.

Based on science process skills' type, it consists of cognitive skills and sensorimotor skills [21]. Cognitive skills (soft skills) are process skills related to students' thinking process in learning process. It consist of classifying, predicting, inferring, communicating, constructing hypotheses, processing data, identifying variable, defining variables operationally, constructing a table of data, constructing a graph, analyzing investigation, describing relationship between variables, and designing experiment [22]. Sensoimotor skills (hard skills) are process skills related to body movement skills for discovering knowledge. It consists of observing, measuring, acquiring data and experimenting [22].

Science process skills indicators that used on developing integrated assessment instrument include (1) observing, (2) communicating, (3) classifying, (4) predicting, (5) inferring, (6) data analyzing, (7) constructing a table of data, and (8) designing experiment. Indicator selection was based on cognitive skills (science process skills that related to thinking process) in science process skills, so it can be measured using written test.

Now, learning process only emphasize to cognitive aspect, whereas process skills less get attention [23]. Based on interview result toward senior high school chemistry teachers in Bantul Regency indicate that comprehensive learning assessment haven't optimally done yet. Teachers still sets out assessment toward students' knowledge, whereas assessment toward science process skills only based teachers' subjective assumption. Furthermore, assessment toward students' critical thinking abilities on chemistry learning hasn't got attention yet from them. However, assessment of learning result must be work simultaneously. Students, who have good science process skills in learning process, will have better cognitive abilities [24]. Nowadays, cognitive assessment and skills assessment are carried out separately [20, 25-26] If it is carried out separately, so relationship between cognitive and skills can be acquired. Therefore, integrated assessment instrument is needed for measuring critical thinking abilities and science process skills in one instrument. The instrument development goals are to facilitate teacher for assessing the learning result effectively and efficiently and to develop valid instrument.

RESEARCH METHODS

In this study, instrument test development model by McIntire was adopted to develop integrated assessment instrument. The subjects in this study were 376 first grade studentst of two Senior High Schools in Bantul Regency that has enrolled electrolyte solution matter. Sample determining used purposive sampling technique based on school rank of Acceptance Student Data in Bantul Regency and school that has implemented 2013 curriculum in learning process.

To develop integrated assessment instrument, this study adopted test development model by McIntire that consist of 10 steps, i.e. defining the test universe, audience and purpose; developing a test plan; composing the test items; writing the administration instructions; conducting piloting test; conducting item analysis; revising the test; validation the test; developing norms; and complete test manual. In this study only used steps till conducting item analysis because only done till analysis of instruments' item.

Data were acquired in this research including development process data (comments from experts) and item validity data (content validity data and construct validity data). Content validity data were acquired by expert judgment whereas construct validity were acquired by instrument field testing. Collecting data instrument is content validity questionnaire and integrated assessment instrument. Content validity questionnaire is item content validity sheet for expert. It is used for verifying content validity on integrated assessment instrument. Integrated assessment instrument is instrument for instrument field testing. It is used for verifying construct validity on integrated assessment instrument.

Data analysis techniques are qualitative data analysis and quantitative data analysis. Qualitative data analysis was used for analyzing development process data. It was experts' suggestion for writing the final integrated assessment instrument. Quantitative data analysis was used for verifying content validity and construct validity. The content validity data was analyzed with Aikens' Formula for calculating content validity coefficient [27]. A coefficient content validity may be define as

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

Explanation:
s = r – lo
Io = rating scale in the lowest category (example: 1)
c = rating scale in the highest category (example: 4)
r = rating scale that be given by rater
n = amount of rater

The construct validity data was analyzed with SPSS software (ver. 16.0). Exploratory factor analysis (EFA) was used to verify construct validity of the integrated assessment instrument.

RESULT AND DISSCUSSION

The developing product of research is integrated assessment instrument for measuring critical thinking abilities and science process skills of senior high school students on electrolyte solution matter. The writing item was based on the definition of the grating electrolyte solution matter contained in basic competence in 2013 curriculum. There were 8 learning indicators of electrolyte and nonelectrolyte solution matter. Each constructs consists of learning indicator, critical thinking indicator, and science process skills indicator. The initial draft of integrated assessment instrument was essay test including 8 constructs with 28 items. Furthermore, the composing scoring manual was appropriated with difficulty item level and student thinking groove. Each item have different maximal score. The difference was caused each item has the different item quality to measure student ability and has the different steps to solve item. After that, initial product of integrated assessment instrument was reviewed by three peer reviewer and six experts (two subject matter experts, two learning evaluation experts, and two chemistry teachers).

Item reviewed was committed for validating initial product especially item content validity by expert. The verifying content validity was considered by suitability between learning indicators with critical thinking indicators and science process skills indicators. The initial product of integrated assessment was validated by two subject matter experts, two learning evaluation experts, and two chemistry teacher who are skilled in composing test. The validating initial product of integrated assessment instrument aimed to verify content validity. The results of validating data by expert were analyzed with Aikens' formula. It used to determine valid or invalid constructs based on content validity coefficients (Aikens' V).

Table 1. Content Validity Coefficient In Integrated Assessment Instruments

No	Construct	Aikens' V
1	1	0.83
2	2	0.94
3	3	0.83
4	4	1.00
5	5	0.83
6	6	0.94
7	7	0.89
8	8	0.89

To know content validity coefficient significance statistic, can be determine by correlating ratings category with amount of raters [28]. This research involved six raters and four ratings category. In 0.05 significance level, allowed minimum content validity coefficient (Aikens' V) was 0.78 [28]. As indicated on Table 1, all of constructs have Aikens' V more than 0.78. So, it can be explained that with significance level 0.05, all of constructs in integrated assessment instrument were asserted valid. Therefore, all of constructs in integrated assessment instrument be able to measure critical thinking abilities and science process skills of senior high school students on electrolyte solution matter.

The results of validating initial product of integrated assessment product by experts are not only acquired validating data, but also qualitative data i.e. experts' suggestion. Experts' suggestion was linguistic aspect suggestion especially word selection. It was used to make product of integrated assessment instrument perfectly. The involvement of lecturers as expert in validating product was aimed to gain suggestion about depth of matter and suitability between scoring manual with test instrument. The involvement of chemistry teachers in validating product was aimed to gain suggestion about visibility and effectiveness implementation product in learning process such as time allocation, amount of ideal item in essay test, and product readability. Moreover, teacher was considered having experience in composing test. Therefore, teacher can give some suggestion about language using, words and composing good sentences.

Based on the result of validating product, it was acquired amount of proper item that used in learning process as many 8 construct with 21 items, whereas 7 items was dropped. It was committed because of teachers' consideration that amount of item question more than 25 items is too many for examining during 2 hour lesson (90 minutes). The other words, this dropped items have similarity meaning with other items. The drooped items choose based on teachers' suggestion. The good time for students to finish the test is the range of 1.5 hour to 2.5 hour. If it more than 2.5 hour will cause declining students' thinking endurance [29]. If it happens, it will cause declining tests' reliability. Grating of the integrated assessment instrument shown in Table 2.

Table 2. Grating of The Integrated Assessment Instrument

No	Learning Indicator	Item before reviewed	Item after reviewed
1	Identifying the caracteristic of electrolyte and nonelectrolyte solution.	1a; 1b; 1c	1a; 1b; 1c
2	Clasifying the solution in strong electrolyte, weak elctrolyte or nonelectrolyte based on electrical conductivity characteristic of solution.	4a; 4b; 4c; 4d	4a; 4b
3	Explaining why electrolyte solution can conduct electricity current.	2a; 2b; 2c; 2d	2a; 2b; 2c
4	Explaining why electrolyte solution consist of ionic compound and polar covalent compound.	5a; 5b; 5c	5a; 5b; 5c
5	Explaining the meaning of degree of ionization and the relationship between degree of ionization and electrical conductivity.	6a; 6b; 6c	6a; 6b; 6c
6	Observing and drawing the changes that occured when electrodes are dipped into a solution.	3a; 3b; 3c	3a; 3b
7	Defining dependent and independent variable in electrolyte experiment.	7a; 7b; 7c; 7d	7a; 7b; 7c
8	Designing experiment for investigating electrical conductivity	8a; 8b; 8c	8a; 8b
	Amount of item	28 items	21 items

The emendation of instrument was committed on property if concept, writing technique, and selection words. Sentence is early step to comprehend question, so it was very influential for students' comprehension toward question in the test [30]. Though there were dropped items, but 8 constructs have covered all learning indicators because each construct lade one of learning indicators. Furthermore, all of item in integrated assessment instrument was ordered and was arranged again become valid instrument according to content validity.

The valid instrument according to content validity was used in field testing. It aimed to verify construct validity. Construct validity was called unidimension testing too. Its' purpose was to know the instrument only measure one factor or dimension. The results of field testing data were analyzed with exploratory factor analysis using SPSS software (ver. 16.0).

The exploratory factor analysis output covers Kaiser-Mayer-Olkin Measure of Sampling Adequacy testing KMO-MSA), Bartlett testing, variance-covariance matrix and scree plot. Before interpreting the result of exploratory factor analysis, the data used must satisfy the assumption required of exploratory factor analysis, including sample size adequacy. Sample size adequacy was analyzed using Kaiser-Mayer-Olkin Measure of Sampling Adequacy testing (KMO-MSA) and Bartlett testing KMO-MSA testing was used to know what sample has adequate for factor analysis. Bartlett testing was used to determine presence correlation between variables.

Table 3. The Result of KMO-MSA Testing and Bartlett Testing

Kaiser-Mayer-Olkin Measure of Sampling Adequacy		0.605
Bartlett's Test of Sphericity	**Approx. Chi-Square**	134.964
	Df	28
	Sig.	0.000

To commit factor analysis, the value of KMO-MSA must be more than 0.5 and the significance of Bartlett testing must be less than 0.05 [31]. As indicated on Table 3, the value of KMO-MSA was more than 0.5 and the significance of Bartlett testing must be less than 0.05. So, it can be explained that sample has adequate for factor analysis. Therefore, the interpretation result can be continued with construct validity analysis or unidimensionality assumption. Furthermore, factor analysis was continued with interpreting Eigen value from correlation variance-covariance matrix.

Table 4. The Result of Initial Eigen value from Correlation Variance-Covariance Matrix

Construct	**Initial Eigen Values**		
	Total	**% of variance**	**Cumulative %**
1	1.697	21.207	21.207
2	1.283	16.031	37.238
3	1.067	13.337	50.576
4	0.896	11.195	61.771
5	0.859	10.739	72.510
6	0.798	9.970	82.480
7	0.756	9.452	91.932
8	0.645	8.068	100.00

Factor analysis was used to analyze relationship inter variable using correlation testing, so it was obtained a new variable named factor. As indicated on Table 4, students' respond data towards the instrument lade three Eigen value (Eigen value > 1). Three factor can explain 50.576% from total variance. It means the integrated assessment instrument can explain 50.576% students' ability. According to Kaiser Criteria that the instrument lade three factors, but there was a dominant factor [31]. The dominant factor should be chemistry knowledge because the instrument was developed based on the definition of the grating item contained in basic competence in chemistry especially electrolyte and nonelectrolyte solution matter. Chemistry knowledge test consist of mathematics abilities and non mathematics abilities or language abilities [32]. Whereas two factors were measured by the instrument include personality factor and administrative factor during the test such as anxiousness and students' motivation [33].

The result of factor analysis was presented in scree plot for Eigen value visualization. As indicated on Figure 1, Eigen value began slightly on third Eigen value. So, there was a dominant factor which was measured by integrated assessment instrument and two another factors also gave contribution towards instrument responses

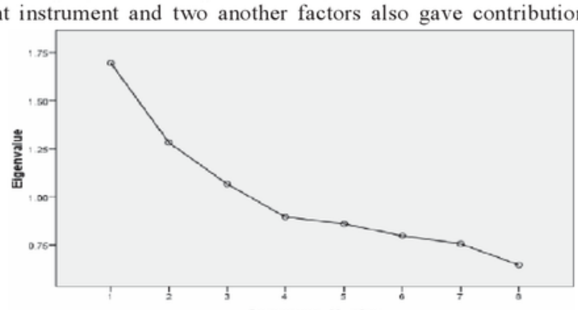

Figure 1. Scree *Plot*

Unidimensionality assumption was very difficult to fulfilled ideally [34]. However, unidimensionality assumption can be considered to fulfill if test contained one dominant factor [35-36]. Moreover, if the result of factor analysis referred that first factor has cumulative percentage more than 20%, unidimensionality assumption has fulfilled [37-39]. As indicated on Table 3, cumulative percentage of first factor was 21.207%, so it can be stated that unidimensionality assumption has fulfilled. If unidimensionality assumption has fulfilled, construct validity has fulfilled too. Therefore, the integrated assessment instrument has proven to be valid according construct validity, because it only measure one dimension i.e. chemistry knowledge.

CONCLUSION

According to the findings of this research, the integrated assessment instrument has been developed based on learning indicator of electolyte and nonelectrolyte solution matter, critical thinking indicator, and science process skills indicator. The integrated assessment instrument is valid according content and construct. So, it can be used for measuring critical thinking abilities and science process skills on electrolyte and nonelectrolyte solution matter.

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REFERENCES

1. R.J. Rezba, C.R. Sprague, J.T. McDonnough and J.J. Matkins, *Learning & Assessing Science Process Skills Fifth Edition.* (Kendal/Hunt Publishing Company, Dubuque, 2007).
2. Kemendikbud, Permendikbud Nomor 66 tahun 2013 tentang Standar Penilaian Pendidikan (4 June 2013).
3. R.J. Marzano, *The Art of Science Teaching* (ASCD, Alexandria, 2007), p.59.
4. Z. H. Ismail and I.Jusoh, Journal of Science and Mathematics Education in S.E Asia **xxiv**, 67-77 (2001).
5. A.C. Marasigan and A.A.Espinosa, International Journal of Learning, Teaching and Educational Research **1**, 35-72, (2014).
6. Q. Zhou, Q.Huang and H. Tian, Crative Education **4**, 40-45 (2013).
7. M. Duran and S. Sendag, Creative Education **3**, 241-250 (2012).
8. N. Mahapoonyanont, R. Krahomwong, D. Kochakornjarupong, and W. Rachasong, Procedia Social and Behavioral Science **3**, 434-438 (2010).
9. Z. Qing, S. Ni, and T. Hong, Procedia Social and Behavioral Science **2**, 4561-4570 (2010).
10. B. White, M. Stains, M. Escriu-Sune, E. Medaglia and L. Rostamnjad, Journal of College Science Teaching **40**, 102-107 (2011).
11. Arslan, The Malaysian Online Journal of Educational Science **3**, 1-10 (2015).
12. B. Moore and T. Stanley,.*Critical Thinking and Formative Assessment* (Eye on Education Inc, New York, 2010), pp.16-21.
13. N.S. Stephenson and N.P. Sadler-McKnight, Chemistry Education Research and Practice **17**, 72-79 (2016).
14. T. Bowel and G. Kemp, *Critical thinking: A concise guide* (Routledge, London, 2002), p.6.
15. R.A. Rauf, M.S. Rasul, A.N. Mansor, Z. Othman and N. Lyndon, Asian Social Science **9**, 47-57 (2013).
16. J. Li and D. Klahr, "The psychology of scientific thinking: Implications for science teaching and learning,"in *Teaching Science in the 21st Century*, edited by J. Rhoton, & P. Shane (NSTA Press, Arlington, 2006), p.2.
17. W. Harlen, Assessment in Education **6**, 129-140 (1999).
18. J. Huppert, S.M. Lomask and R. Lazarorcitz, Journal of Science Education **24**, 803-821 (2002).
19. A. Aydin, International Journal of Education and Practice **1**, 5 1-63 (2013).
20. C. Keil, J. Haneyand J. Zoffel, Electronic Journal of Science Education **13**, 1-18 (2009).
21. B. Subali, Cakrawala Pendidikan **xxx**, 130-144 (2011).
22. M.M. Sheeba, Educationia Confab **2**, 108-123 (2013).
23. U. Zoller, Chemistry Education Research and Practice in Europe **2**, 9-17 (2001).
24. A.C. Austin, H. Ben-Daat, M. Zhu, R. Atkinson, N. Barrows and I.R. Gould, Chemistry Education Research and Practice **1**, 168-178 (2015).
25. D. Saribaz and H. Bayram, Procedia Social and Behavioral Sciences **1**, 61-72 (2009).
26. C. Tosun and Y.Taskesenligil, Chemistry Education Research and Practice **14**, 36-50 (2013).
27. L.R. Aiken, Educational and Psychological Measurement **40**, 955-959 (1980).
28. L.R. Aiken, Educational and Psychological Measurement **45**, 131-142 (1985).
29. T. Utomo and K. Ruijter,. *Peningkatan dan pengembangan Pendidikan* (Gramedia Pustaka Utama, Jakarta, 1994), p.60.
30. K.V. Beek and L. Louters, Journal of Chemical Education **68**, 389-392 (1991).
31. A.S. Beavers, J.W. Lounsbury and J.K. Richards, Practical Assessment, Research & Evaluation **18**, 1-13 (2013).
32. F. Lord, *Application of Item Response Theory to Practical Testing Problems* (Lawrence Erlbaum Associates, Inc Publisher, Mahwah, 1980), p.20.
33. H. Retnawati, *Teori Respon Butir Dan Penerapannya* (Parama Publishing, Yogyakarta, 2014, p.1.
34. R,K, Hambleton and H. Swaminathan, *Item Response Theory* (Kluwer Inc, Boston, 1985), p.16.
35. R.K. Hambleton, H. Swaminathan and H.J. Rogers, *Fundamentals of Item Response Theory* (Sage Publications Inc, California, 1991), p.56.
36. M. Wiberg, *Classical Test Theory vs Item Response Theory* (Umea University Press, Umea, 2004), p.5.
37. M.D. Reckase, Journal of Educational Statistics **4**, 207-230 (1979).
38. N. Smits, P. Cuijpers and A. van Straten, Psychiatry Research **188**, 147-155 (2011).
39. Q. Wu, Z. Zhang, Y. Song, Y. Zang, Y. Zhang, and F. Zhang, International Journal of Advancements in Computing Technology **5**, 209-216 (2013).

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