Implementation of formative assessment portfolio check with feedback to improve mastery of concept and habits of mind students on acid-base material

R Burhanudin*, N Nahadi and H Firman
Departemen Pendidikan Kimia, Universitas Pendidikan Indonesia, Jl. Dr. Setiabudhi No. 229, Bandung 40154, Indonesia.

*ramlan1993@gmail.com

Abstract. This study aims to implement the formative assessment of checked portfolio with feedback to improve the mastery of concepts and habits of mind student on acid-base materials. The portfolio is a systematic collection of samples of learners' work resulting from the process of learning undertaken. Feedback is given in writing and verbally during the learning process takes a place. The method utilizes a quasi-experiment with pretest-posttest non-equivalent control group design. The instruments utilized to collect research datas are formative assessment of portfolio check formats with feedback, question of acid-base concept, questionnaire habits of mind, interview guides and student response questionnaires. The mastering test of acid-base concepts is validated by 5 chemist experts and forming CVR index (Content Validity Ratio) between 0.60-1.00. Reliability test of acid-base concept mastery was tested involving 60 respondents XI MIA 1 and MIA 2 class in Senior High School processed utilizable SPSS 24.0 argued coefficient alpha value of 0.76. Furthermore it will conduct a more experiment of formative portfolios with feedback that impacts on mastery of concepts and habits of mind.

1. Introduction
Learning is a process of interaction between learners and educators with learning resources and conditions that allow the learning process with the aim to achieve a predefined competence [1]. Assessment in learning is very important for the process of collecting and processing information in order to making decisions about what they have learned by learners and how the success rate of students in achieving the learning objectives that have been set. Learning effective, efficient and productive results from a good assessment [2].

Implementation of assessment in schools today as part of teacher education at various levels are still using the assessment of learning outcomes or summative assessment is still limited and that conducted an assessment of the learning process or formative assessment [3]. Formative assessment is an assessment of the learning process, learning objectives, learning objectives comparing the information obtained by the students and provide feedback to students to help achieve learning goals [4]. Research on formative assessment has been carried out by researchers in other countries, among the results of his research is the influence of formative assessment quiz at 124 chemistry teacher candidates improve achievement and activity of learning [5]. Formative assessment of student achievement positively affect and stimulate feedback between students and teachers on the lactic acid material [6]. Formative assessment can predict the success of the value of summative [7]. Formative assessment with feedback
can build students’ understanding of the concept [8]. Feedback effects in formative assessment improve student learning outcomes significantly [9].

Rate conventionally with a written test are generally only focused on theoretical knowledge of the content of textbooks, whilst ignoring the reality and its application in everyday life. Rate today's alternative government encouraged to apply in practice education is a portfolio assessment as a companion of the conventional assessment that relies on testing. The portfolio is a systematic collection of samples of learners' work resulting from the process of learning undertaken [10]. The portfolio is one form of formative assessment that can be assigned to the students, through a portfolio we can see the development, progress, improvement and achievement of student learning [11]. The use of portfolios as an assessment tool in secondary education is relatively new and the attention of education experts because of its great potential to reveal the students' competence in a comprehensive manner, which is not possible assessed effectively through testing [12]. Thus it is important to do research portfolio implementation formative assessment with feedback to improve the mastery of concepts and habits of mind students.

Habits of mind the dispositions (behavioral tendencies) that grows and develops in the person of someone as a result of involvement in teaching and research activities in the IPA. The dispositions include, among others: curiosity, honesty, integrity, openness, confidence in the IPA, cautious in concluding, respect for evidence of empirical data [13,14].

Formative assessment-related research and the habits of mind that has been done in the field of chemistry, namely the implementation of formative assessment strategies concept maps to improve mastery of concepts and habits of mind students on the material buffer solution [15]. Feedback effect on formative assessment to improve learning outcomes and the habits of mind of students on the material solubility and solubility product [16]. Effect of formative assessment quizzes to mastery of concepts and habits of mind students on the material salt hydrolysis [17]. Based on the advice of the results of previous research that needs to be done further research using different formative assessment on other chemical materials. The research objective is to implement formative assessment portfolio check with feedback to improve the mastery of concepts and habits of mind students on acid-base material.

2. Method

The research method that will be used in implementing formative assessment portfolio check with feedback to improve the mastery of concepts and habits of mind students on acid-base material is a quasi-experimental method with pretest-posttest design nonequivalent control group design [18]. In this design consists of two groups: the experimental group and the control group. The experimental group using formative assessment portfolio check with feedback during the learning process while the control group using the conventional formative assessment without feedback. In this case the feedback given is in writing and verbally during the learning process. The location and the subject of this research involved 60 students of class XI MIA 1 and 2 as the experimental group of 30 students and a control group of 30 students, one teacher and six observers in one Senior High School in Ciamis District semester of 2017/2018 academic year even. The instrument used to collect research data that formative assessment format portfolio check with feedback, mastery test of acid-base concept, habits of mind questionnaire, interview and questionnaire responses of students to the implementation of formative assessment are implemented.

3. Result and discussion

The results of this study only results the mastery test in acid-base concept of validity and reliability, as well as examples of research instruments to be used in the implementation of formative assessment portfolio check with feedback to improve the mastery of concepts and habits of mind students. The results are described as follows:
3.1. Formative assessment instruments sample portfolio check with feedback

Figure 1 shows the results of the preparation of instruments for assessing student portfolios. The format is based on the need for research that consists of student identity column, column portfolio quality indicators are divided into two: the mastery of concepts and habits of mind, column value range 1-10, columns feedback on the outcomes mastery of concepts and habits of mind, as well as student response column, Criteria mastery of concepts include: show the breadth of the concept, the accuracy of the concept, the depth of the concept, the concept of truth, clarity of concept, the ability to understand the concepts and the ability to explain the concept. While the criteria habits of mind are: show curiosity, honesty, integrity, openness, confidence in the IPA, cautious in concluding and respect for the evidence of the empirical data.

Portofolio check format with feedback for student

![Portofolio check format with feedback for student](image)

**Figure 1.** Sample portfolio check formats with feedback for students.

3.2. Portfolio that was assigned to the student

Table 1 shows the components of the portfolio assigned to the students include: a summary of acid-base theory, solving objective multiple choice, fill in the questionnaire habits of mind, make a report laboratory determination of acid-base properties, collecting lab photo collection and presentation. The portfolio is given feedback in written and verbal during the learning process takes place.
Table 1. Component student portfolio.

| No. | Task Portfolio                                      |
|-----|-----------------------------------------------------|
| 1   | Make a summary of the theory of acid-base            |
| 2   | Solving problems objective multiple-choice           |
| 3   | Fill out the questionnaire habits of mind            |
| 4   | Creating practical reports of acid-base              |
| 5   | photo collection practicum and presentation          |

3.3. Concept mastery test validity
The results of this new study results mastery tests in acid-base concept of validity and reliability. Values obtained based on the validity of the content validity of using CVR (Content Validity Ratio), CVR is a validation method is used to determine the contents of the item complies with the domain that is measured based on expert judgment [19]. This concept mastery tests validated by 5 experts in the field of chemistry and formed a CVR index of between 0.60 to 1.00, but there are three items that should be revised based on the advice given by the validator. CVR value is calculated based on the equation Lawshe [20]. CVR value for each item on the test mastery of the concept can be seen in Table 2.

Table 2. Item CVR value concept astery test.

| Number | Results Expert | CVR value | Category |
|--------|----------------|-----------|----------|
|        | Yes | No |             |           |
| 1      | 5   | 0 | 1           | Valid     |
| 2      | 4   | 1 | 0.60        | Invalid   |
| 3      | 5   | 0 | 1           | Valid     |
| 4      | 5   | 0 | 1           | Valid     |
| 5      | 5   | 0 | 1           | Valid     |
| 6      | 5   | 0 | 1           | Valid     |
| 7      | 5   | 0 | 1           | Valid     |
| 8      | 5   | 0 | 1           | Valid     |
| 9      | 4   | 1 | 0.60        | Invalid   |
| 10     | 4   | 1 | 0.60        | Invalid   |
| 11     | 5   | 0 | 1           | Valid     |
| 12     | 5   | 0 | 1           | Valid     |
| 13     | 5   | 0 | 1           | Valid     |
| 14     | 5   | 0 | 1           | Valid     |
| 15     | 5   | 0 | 1           | Valid     |
| 16     | 5   | 0 | 1           | Valid     |
| 17     | 5   | 0 | 1           | Valid     |
| 18     | 5   | 0 | 1           | Valid     |
| 19     | 5   | 0 | 1           | Valid     |
| 20     | 5   | 0 | 1           | Valid     |

Data in table 2 show that the items that have the CVR value equal to 1 as many as 17 questions, while the CVR has a value equal to 0.60 are as many as 3 problems. CVR value equal to the one obtained for five validator rate according whereas CVR value equal to 0.60 obtained as four validators assess compliance. Based on the minimum value of the CVR for validator amounted to 5 is 0.99. The results in Table 2 above there are 17 questions that are said to fulfill the criteria of validity in terms of both so that the reliability problem in the test as many as 17 questions.
3.4. Concept mastery test reliability
Reliability is a measure of the extent to which a measurement tool provides an overview truly trustworthy about the ability of a person (not false) [19]. After the matter was revised and then tested to determine the reliability of constancy matter. Reliability tests mastery of acid-base concept involving 60 respondents tested with MIA XI classes 1 and 2 in one of the Senior High School in Ciamis. The reliability calculation processed using SPSS 24.0 software to determine the value of coefficient alpha value of 0.76, including the high criteria.

4. Conclusion
This study is an example of a formative assessment instrument portfolio check with feedback, as well as the components of the portfolio assigned to the students. Acid-base concept mastery tests validated by 5 experts in the field of chemistry and formed a CVR index (Content Validity Ratio) between 0.60 to 1.00 were calculated using equation Lawshe. Reliability tests mastery of acid-base concept produces coefficient alpha value of 0.76, including the high criteria.

Furthermore, the examples instruments and acid-base concept mastery tests will be used in the implementation of the research portfolio formative assessment with feedback to improve the mastery of concepts and habits of mind students.

Acknowledgments
Researchers would like to thank the lecturers who have helped and directed in writing this paper, the validators who have helped in the process of validating a matter of mastery of concepts, the head of Senior High School in Ciamis who have given permission to carry out trials about the mastery of concepts in MIA XI classes 1 and 2.

References
[1] Anderson L W and Krathwohl D R 2001 A Taxonomy for Learning, Teaching and Assessing, a revision of Bloom’s taxonomy of educational objectives (USA: Addison Wesley Longman)
[2] Stiggins R J 1994 Student-Centered Classroom Assessment (New York: Macmillan College Publishing Company)
[3] Sriyati S, Rustaman N Y dan Zainul A 2011 Kontribusi Asesmen Formatif terhadap Habits of Mind Mahasiswa Biologi Jurnal Pengajaran MIPA 15 (2) 77-86
[4] Furtak E M 2009 Formative Assessment (Corwin: USA)
[5] Yalaki Y and Bayram Z 2015 Effect of Formative Quizzes on Teacher Candidates Learning in General Chemistry Journal of Research in Education and Science (IJRES) 1 (2) 151-156
[6] Vogelzang J and Admiral W F 2017 Classroom action research on formative assessment in a context-based chemistry course Educational Action Research 25 (1) 155-166
[7] Siweya H J and Letsolo P 2014 Formative assessment by first-year chemistry students as predictor of success in summative assessment at a South African university Chemistry Education Research and Practice 10.1039/c4rp00032c
[8] Lawrie G et al 2013 Using Formative feedback to identify and support first year chemistry student with missing or misconception The International Journal of the First Year in Higher Education 4 (2) 111-116
[9] Aydeniz M and Pabuccu A 2011 Understanding the Impact of Formative Assessment Strategies on First Year University Student Conceptual Understanding of Chemical Concepts Necatibey Faculty of Education Electronic Journal of Science and Mathematics Educations 5(2) 18-41
[10] Supranata S and Hatta M 2004 Penilaian Portofolio (Bandung: Remaja Rosdakarya)
[11] Klenowski V 2002 Developing Portfolio for Learning and Assessment Processes and Principles (London: Routledge Falmer)
[12] Mui SO W 2004 Formative and Summative Assessment Different Strategies for the Assessment of Science Learning The Important Quality Meaningful Assessment Asia-Pacific Forum on Science Learning and Teaching 5(2) Article 8
[13] Campbell J 2006 Theorising Habits of Mind as a Framework for Learning [Online] Tersedia: http://www.aare.edu.au/06pap/cam06102.pdf.
[14] Hammerman E and Musial D 2008 Integrating science with mathematics and literacy: New visions for learning and assessment (New York. NY: Skyhorse Publishing)
[15] Windani D H 2016 Implementasi Strategi Penilaian Formatif untuk Meningkatkan Penguasaan Konsep dan Habits of Mind Siswa pada Materi Larutan Penyangga Tesis Pascasarjana UPI Bandung tidak diterbitkan
[16] Nahadi, Firman H and Farina J 2015 Effect of Feedback in Formative Assessment in the Student Learning Activities on Chemical Course to the Formation of Habits of Mind Indonesian Journal of Science Education JPII 4 (1) 2015 36-42
[17] Solihat R N 2016 Implementasi Strategi Penilaian Formatif untuk Meningkatkan Penguasaan Konsep dan Habits of Mind Siswa pada Materi Hidrolisis Garam Tesis Pascasarjana UPI Bandung tidak diterbitkan
[18] Wiersma W and Stephens G J 2009 Research Methods in Education an Introduction 9th (Boston: Pearson)
[19] Frankel J R and Wallen N E 2006 How to Design and Evaluate Research in Education (New York, NY: McGraw-Hill)
[20] Lawshe C H 1975 A Quantitative Approach to Content Validity Personnel Psychology 28 (16) 563-575