The Making of E-Portfolios for Performance Assessment in Chemical Practicum

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Abstract. This research aims to create a media that can facilitate the assessment of chemical practicum following the development of information technology. Through the Design-Based Research method, an e-portfolio has been made for performance evaluation on chemical practicum that can assess the work of student practicum in the form of documents, photos, and videos online. E-portfolios can be used to assess aspects of planning, implementation, and reporting on digital-based chemical labs. The validation results show that the product is declared valid by the acquisition of an average value of 0.85. The results of a limited trial conducted on chemistry education students indicate that the product is declared suitable for use with an average percentage value of 86.87%.

1. Introduction

Assessment is one of the activities that cannot be separated from chemical learning activities, including practicum activities in the laboratory. Assessment plays a significant role in the learning process to find out the achievements in learning [1] and is useful for measuring the level of achievement of competencies and improving the learning process [2]. The function of assessment in the learning process is as part of learning and serves to advance students in learning [3]. To measure the achievement of necessary competencies whose indicators are in the form of observed student work can use performance assessment[4].

Student performance can be known for its development and monitored by using portfolio assessments. A portfolio assessment puts pressure on student activities and gives a full space for each individual to respond to an assignment in his own way [5]. So that portfolio assessment can assess student learning as a whole, both cognitive, affective, and psychomotor aspects [6] as the development of information and communication technology has a high impact on life, so too in education [7], [8]. One of the advances in information and communication technology that can be used in education or learning is e-portfolio [9]. E-portfolio or electronic portfolio is one of the utilization of website-based technological advances in the implementation of learning activities that use the Learning Management System (LMS)[10].

Research on the use of e-portfolios needs to be carried out to determine the benefits provided by e-portfolios for the learning process, especially in assessing performance in chemical practicum or chemical learning and as an adjustment to the development of information and communication technology[11]. The use of e-portfolios can improve the quality of learning because students can more quickly evaluate their learning outcomes, and their development can be monitored directly [12]. The use of e-portfolios makes the assessment process done online or digitally to reduce the use of paper in the appraisal process [13].
In the previous research conducted by [14], researchers used a website-based performance appraisal instrument in basic chemistry courses were in this study only assessed student performance in the form of reports, journals, pretests, and posttests. The instrument that was made could only be used in one course and used as retrieval of fixed value data using conventional methods or using journals and reports in paper form. In other studies conducted by [15], researchers used e-portfolios to improve students' generic science skills in inorganic chemistry. The e-portfolio used is a commercial platform, moodle, which can only receive performance results in the form of documents and limited use because it requires installation on a computer first. Whereas in this study, the E-portfolio that was created had several advantages including being able to store document files, photos, and videos, its use was not limited because it did not need to be purchased and installed in advance and could be accessed on various devices, be it smartphones or computers. Also, e-portfolios made can be used for various subjects and student performance results in the form of practical journals, practical reports, and documentation uploaded to e-portfolios and assessed online. However, this e-portfolio does not have facilities that can ensure that the practitioner sends a report that is truly the result of their work and also the practicum assistant who assesses for one practicum title, not for the group. Therefore, e-portfolio needs to be developed so that the benefits can be maximized.

2. Experimental Method

Design-Based Research (DBR) is a research method used in this study. This Design-Based Research (DBR) method is related to research that makes the manufacture or development of products that support the learning process [16]. There are five stages in this method proposed by Barab & Squire [17], which are abbreviated with ADDIE (Analysis, Design, Development, Implement, and Evaluations). However, this study only carried out until the Development stage, namely by knowing the response or assessment of the chemical material experts and the media in the validity test and the responses of respondents in the feasibility test. In the analysis and design phase, mapping and designing an e-portfolio will be made so that the function is right. At the design development stage, a feasibility test was conducted on chemical education students at Sunan Gunung Djati State Islamic University in Bandung. The research procedure can be seen in the following figure.

![Figure 1. Research Procedure](image-url)
3. Result and Discussion

The e-portfolio display created is divided into two parts, namely the external display and the content display. Outward appearance in the form of a login page and display contents according to e-portfolio web users. There are four users on the e-portfolio web, namely admin, lecturer, assistant, and student.

![E-Portfolio Web Login Page](image)

Figure 2 is an e-portfolio web interface in the form of an entrance page that functions as an entrance into an e-portfolio. To enter e-portfolios, users must complete the required data, namely user names, passwords and choose entry access that is appropriate for their role. Each user has a username to enter into a different e-portfolio. Lecturers use employee ID numbers (NIP) as user names and practicum assistants, and students use student ID numbers as user names to enter e-portfolios.

On the e-portfolio web login page, it uses a user verification system, where if the user enters incorrect or unregistered data, then when clicking the enter button, a message will fail to appear. Use of this verification as a security so that not just anyone can enter this e-portfolio website. When the user enters the correct and registered data and the selection of the appropriate access, then when clicking on the enter button, the user will enter the e-portfolio web content display according to the access.

After entering into the e-portfolio web, each user has a different display content. The difference in appearance for each user aims to have each user have different access rights and functions. E-portfolio web display for admin users, there are several menus including facility menu, lecturer menu, student menu, course menu, user management menu, and e-portfolio usage guide menu. In the facilities menu, the admin can add facility data available in the laboratory in the form of tools and materials. The data entered is the name of the tool or material, the amount of availability and specifications. The next menu is the lecturer menu; on this menu, the admin can add lecturer data that teaches practicum courses. Lecturers who are added by the admin in certain subjects can only access courses and students who are registered in the course. Students can be added by the admin on the student menu by selecting the courses that are followed by the student. The course data that can be chosen is added by
the admin by completing the course information in the form of lecturers, semesters, and academic years.

E-portfolio web display for lecturer users, there are several menus, namely facility menu, schedule menu, assistant menu, assessment, and guidance menu. In the facilities menu, the lecturer can only see what facilities are available in the laboratory. In the schedule menu, lecturers can add a schedule of practicum activities by including a practicum module which is a reference for students to carry out practicum so that the material provided on this e-portfolio website is following the practicum to be carried out [18]. This is following the results of the feasibility test to students on the indicators of the relevance of e-portfolios with learning through practicum, which gets 66 points with a percentage of 82.50%. This value indicates that the portfolio is suitable for use in evaluating performance in chemical practicum.

Lecturers can add practicum assistants to assist practicum activities on the assistant menu by filling in assistant data in the form of NIM, name, the title of the experiment, gender, contact, which group and photo assistant. The added assistant can only access the practicum subject, the trial title, and the group determined by the lecturer supporting the course. So the assistant can only access students in the group the assistant is holding to assess student performance results. Lecturers can access student performance results on the assessment menu.

Figure 3. Menu Page Display

Figure 3 is a display of the portfolio sub-menu on the assessment menu. Lecturers can see and assess the student portfolio as a whole. Portfolios sent by students are in the form of document files and photos or videos. This is a portfolio function that can store a variety of student data in the form of documents or photos or videos digitally [19]. As for assistant users, the portfolio shown is only from student group members mentored by the practicum assistant.

Portfolios that have been given an assessment will be displayed on the value menu, which is automatically accepted by each student in a different group. Lecturers can see the grades that have been given or assessments made by the assistant on the student portfolio on the assessment menu.
Figure 4. Display pages for all students’ grades

Figure 4 is a display of sub-menu values for lecturer users who display the value of all students. Whereas for assistant users, the grades shown are only grades for student members of the group they guide. Lecturers and assistants are distinguished in their scope so that the assessment process is faster and more thorough because the assistant only evaluates a few students [20]. Also, a website-based e-portfolio makes the assessment process can be done anywhere, and students can see feedback quickly so that the assessment process is more effective and efficient. This is in accordance with the results of the feasibility test to students on the efficiency indicators of the use of e-portfolio products in terms of time that gets 106 points with a percentage of 88.33% and indicators of the effectiveness of e-portfolios in the practicum assessment process that gets points 74 with a percentage of 92.50%. This shows that e-portfolio is feasible to use because it makes the valuation process more efficient and very feasible to use because the valuation process can be more productive.

In the e-portfolio web interface for student users, several menus can be used by students. The available menus are facility menu, schedule menu, portfolio menu, and guidance menu. On the schedule menu, students can see the time of practicum and experiment modules as a reference for carrying out the practicum. In the portfolio menu, students can add a portfolio of practical results to be assessed by a practicum assistant or lecturer. Where the portfolio has been assessed, can be seen in the Value menu. In addition to grades, students can also see comments made by assistants or lecturers on portfolios so that students can reflect on their learning outcomes more quickly [21]. This shows that the use of e-portfolios in practicums has a positive impact on improving student learning. In accordance with the results of the feasibility test to students on the indicators of the use of e-portfolios for assessments that earn 104 points with a percentage of 86.66%.

The e-portfolio web interface is simple and easy to use, making this e-portfolio attractive to use. This is supported by the results of the due diligence on the e-portfolio display indicators which get 71 points with a percentage of 88.75%. In addition to the display, digitalization of the valuation process is an attraction for using e-portfolios. So that the use of e-portfolios can increase student motivation, in line with Nazmi [22] which states that an attractive display of media will be able to provide stimulation of thoughts, feelings, attention, and interest in the information, so students will be encouraged to learn further, this is supported by the acquisition of a feasibility test result score on the indicator of 33 with a percentage of 82.50%.
In this study, the object under study is the primary element of chemical practicum. The main element of chemistry is a branch of chemistry that discusses the properties and reactivity of element compounds in the leading group [23]. The selection of the primary element chemical practicum as the object of research is based on the ease in carrying out the practicum and requires not too much time, so that observations on student performance will be more productive and because it can be in the form of photos, videos or documents. One of the experiments carried out was the synthesis and identification of hydrogen gas. By using e-portfolio, the practicum assessment is done digitally by sending reports, journals, and practicum documentation to the e-portfolio so that the assistant can directly examine the results of the student practicum. Therefore the practical assessment process is more efficient, and students can more quickly improve their learning. For practicum performance appraisal, the assessment is done manually by the assistant during the practicum. This is a drawback of this e-portfolio website because the assessment rubric is still in the form of hard files so it cannot directly assess student performance in e-portfolios. Also, this e-portfolio cannot print the students’ overall grades with automatic grade processing.

The results of the validation of the validator as a whole are obtained from the r-count value of 0.80 to 0.93 (Table 1.) where an instrument is declared valid if it has an r-count higher than r-critical, which is 0.30.

Table 1. E-portfolio Validation Results for Performance Assessment

| Assessment Aspects | r-count | r-critical | Conclusion |
|--------------------|---------|------------|------------|
| Learning aspects   | 0.82    | 0.30       | Valid      |
| The material substance aspect | 0.80 | 0.30 | Valid |
| Visual communication aspects | 0.93 | 0.30 | Valid |
| Software engineering aspects | 0.86 | 0.30 | Valid |
| **Average**        | 0.85    | -          | -          |

Table 1 shows that all four aspects assessed were valid. Therefore e-portfolio products that have been made can be continued for feasibility testing [24].

Table 2. E-portfolio Feasibility Test Results for Performance Assessment

| Indicator | Question Number | Score | criteria | Percentage |
|-----------|-----------------|-------|----------|------------|
| The relevance of e-portfolios to learning through the practicum. | 1 and 8 | 66 | 80 | 82.50 % |
| Efficient use of e-portfolio products in terms of time | 2, 4 and 11 | 106 | 120 | 88.33 % |
| The effectiveness of e-portfolios in the practicum assessment process | 6 and 7 | 74 | 80 | 92.50 % |
| Displayed-portfolio | 3 and 10 | 71 | 80 | 88.75 % |
| Increase student motivation in learning | 5 | 33 | 40 | 82.50 % |
| Use of e-portfolios for valuation | 9, 12 and 13 | 104 | 120 | 86.66 % |
| **Average:** | | | | **86.87 %** |
Table 2 shows that the highest score obtained is an indicator of the effectiveness of e-portfolio in the practicum assessment process, namely obtaining a score of 74 with a percentage of 92.50% with very decent qualifications. Based on the results of the feasibility test obtained an average value of 86.87%, it can be concluded that the e-portfolio can be used to assess performance in chemical practicum.

**Conclusion**

The results of the e-portfolio validation test for performance appraisal in chemical practicums by expert validators on four aspects, namely aspects of learning, aspects of material substance, aspects of visual communication and aspects of software engineering showed valid results with a count of 0.80 to 0.93. This shows that e-portfolio for performance appraisal can be used for due diligence. The results of the e-portfolio feasibility test for performance appraisal at the chemical practicum obtained results with a feasibility percentage of 82.50-92.50%. This shows that e-portfolio for performance appraisal is suitable to be used as an instrument of performance appraisal in chemical practicum.

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