

Research Article

Framework for Implementing e-Portfolio Assessment to Improve Student Habits of Mind and Mastery of Chemistry Studies Concepts

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ORCIDNahadi: <https://orcid.org/0000-0002-0975-7419>**Abstract.**

The COVID-19 pandemic emphasized the need for improving teachers' online teaching skills. One skill was using electronic portfolio assessment. Electronic portfolio assessment as an alternative assessment does not only focus on cognitive aspects but also is in line with the regulations of the Ministry of Education regarding the assessment of learning outcomes that focus not only on cognitive aspects but also on aspects of skills and attitudes. This study aimed to develop a framework for electronic portfolio assessment to improve students' habits of mind and mastery of chemical studies concepts. We conducted a literature review to identify, categorize, synthesize and develop a framework. This offers chemistry teachers a model for systematically designing and implementing an electronic portfolio of assessments and provides them with the instruments to conduct further research on assessment techniques. This framework guides chemistry teachers through important technical decisions, such as setting goals, identifying clear goals and establishing meaningful criteria for electronic portfolio assessment. Other issues discussed include defining the content of the electronic portfolio, managing the electronic portfolio, and monitoring and evaluating processes.

Keywords: electronic portfolio assessment, habits, chemical concepts

1. INTRODUCTION

The COVID-19 pandemic emphasizes the need to improve teachers' online teaching skills. Standardized tests were found to be most frequently used to assess students' abilities. However, because it is not suitable for online assessment, teachers should deepen their knowledge of alternative assessment methods [1]. This is in line with the 2013 curriculum in the regulation of the ministry of education and culture of the republic of Indonesia number 53 of 2015 concerning the assessment of learning outcomes by educators in primary and secondary education emphasizing that assessment does not only focus on cognitive aspects but also on aspects of skills, attitudes carried out for

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monitor the process, learning progress and improvement of learning outcomes through assignments and evaluation of learning outcomes.

The traditional assessment method used to assess student learning outcomes is claimed to be unable to reveal the complex intellectual abilities of students and the ability of real experiences in the field. At the same time, tests for minimum standards of competence have been widely rejected in order to reduce the burden on the curriculum, and the emphasis has been on content standards with high order thinking skills. As a result, educators are more involved in authentic assessments so that student competencies can be assessed as a whole [2]. Traditional assessment methods also encourage students to memorize every time a test or learning outcome test will be held, so that students are less able to interpret the learning process. Therefore, it is necessary to improve the narrow assessment context. One of them is by using a portfolio assessment [3], at the same time the implementation of the 2013 curriculum is oriented towards the use of authentic assessments.

In various documents it is stated that authentic assessment can take the form of various ways of collecting authentic data through portfolio assessment and performance assessment [4], but when compared to other forms of performance assessment, portfolio assessment has the privilege of providing a collection of documents as evidence of the process and student learning outcomes, so that in analyzing student work the teacher can find out the potential, scientific attitude, strengths and weaknesses of students [5]. Portfolio assessment is a procedure for collecting information about the development and abilities of students through their portfolios, where the information collection is carried out formally using certain criteria, for the purpose of making decisions on student status [4]. In his research, Lukitasari stated that the use of portfolio assessment in learning was considered effective and received good responses from students. Portfolio assessment also has a positive impact that can improve student learning outcomes in the learning process [6].

Today's use of portfolios has been widely integrated into online platforms. The use of online platforms is intended to facilitate collaboration between teachers and students that can be accessed both at school and outside school hours [7]. Electronic portfolios are now a platform that students can use to compose, organize, and formulate digital presentations across a variety of media types and can be updated and adapted from time to time for different purposes and audiences [8]. According to Bolliger, electronic portfolios are widely used to help students develop critical thinking and problem solving skills and prepare them to become lifelong learners [9], so this study was conducted

which aims to describe the framework for implementing e-portfolios in improving habits of mind and mastery of chemistry concepts student.

2. RESEARCH METHOD

Research on eportfolio implementation to improve habits of mind and mastery of chemical concepts is still in its early stages. Thus, qualitative research methods are approaches that are commonly used when important variables in research are not known [10]. This study uses the framework, theory and paradigm from previous studies on eportfolios. Data collection from literature reviews of written texts and online documents such as books, journals, articles, and newspapers is used to obtain information and develop a deeper understanding of the eportfolio process, features, elements, implementation related to habits of mind and mastery of students' chemical concepts. The process is divided into three steps. (1) Identification of knowledge required to develop an eportfolio assessment (2) Categorization of the initial body of literature according to the components of an electronic portfolio model (3) Synthesis and development of a framework for an electronic portfolio model.

3. RESULT AND DISCUSSION

The first step is to identify the knowledge needed to develop an eportfolio assessment. Research on eportfolios is categorized based on a literature review: Google Scholar, Routledge: Taylor and Francis, Ascilite, Sage Pub and Springer. Related research is searched based on keywords with variations of electronic portfolio, eportfolio, habits of mind and mastery concept of chemistry.

Many studies discuss different e-portfolios including; portfolio of learning management system [11-14], portfolio assessment [15] task-oriented portfolio assessment [16] portfolio as guidance [17]. Table 1 shows research related to the portfolio assessment model in the last ten years.

In sum, each study has a different portfolio model because each has a different background and context. The key points highlighted are not exactly the same.

The second step is the categorization of how the ideas can be applied to each component of the e-portfolio assessment. The literature review in table 1 shows that each model developed by the portfolio is different. However, each portfolio model mentions that each portfolio has a clear planning [18] assignments that show students' abilities clarity of assessment criteria [16], choosing a good portfolio platform [11, 19]

TABLE 1: Research portfolio models.

Source	Portfolio process	Portfolio type
Mohd Bekri et al. (2013)	E-portfolio learning management system (analysis, design system, development database, development application, evaluation of system)	e-portfolio
Ashikin et al. (2015)	Portfolio professional practice (identify the needs, determination of expenditures, planning and selection, development and implementation)	e-portfolio
Mazlan et al. (2015)	Portfolio assessment (planning, selecting, reflecting and sharing portfolio evidence)	e-portfolio
Clarke and David (2016)	E-portfolio assessment (planning framework, feedback planning processes, curating portfolio collections, curating for feedback)	e-portfolio
Lam (2016)	Portfolio assessment (planning, composing, revising and editing)	Paper based portfolio
Wyk (2017)	Eportfolio learning (collecting, compiling, and reflecting on authentic evidence)	e-portfolio
Cain (2018)	Task-oriented portfolio assessment (Planning teaching and learning activities, determining learning outcomes and assessment criteria, developing teaching and learning activities, providing feedback, and assessing portfolios)	Paper base portfolio
Pospisilova (2018)	Eportfolio assessment (Choice of learning processes and outcomes, evidence presentation, final self assessment, assessment and feedback)	e-portfolio

evaluates the portfolio process [20] in an effort to find out the improvement of habits of mind and mastery of portfolio chemistry concepts, also equipped with Marzano's habits of mind questionnaire [21] and tests of mastery of chemical concepts.

The third step is to synthesize how portfolio elements are useful in each electronic portfolio model and propose new components of electronic portfolio assessment. Based on the first and second steps, the new eportfolio framework has been designed and adapted from several previous studies by adding elements of habits of mind and mastery of chemical concepts, the assessment portfolio implementation framework uses five elements, namely: 1) planning the assessment purpose, 2) identify instructional objective 3) open source moodle 4) assessment e-portfolio model 5) evaluate the portfolio process as shown in Figure 1.

Based on the literature review process carried out, the points of framework for implementing e-portfolio assessment to improve students' habits of mind and mastery of chemical concepts are as follows.

1. Planning The Assessment Purpose,

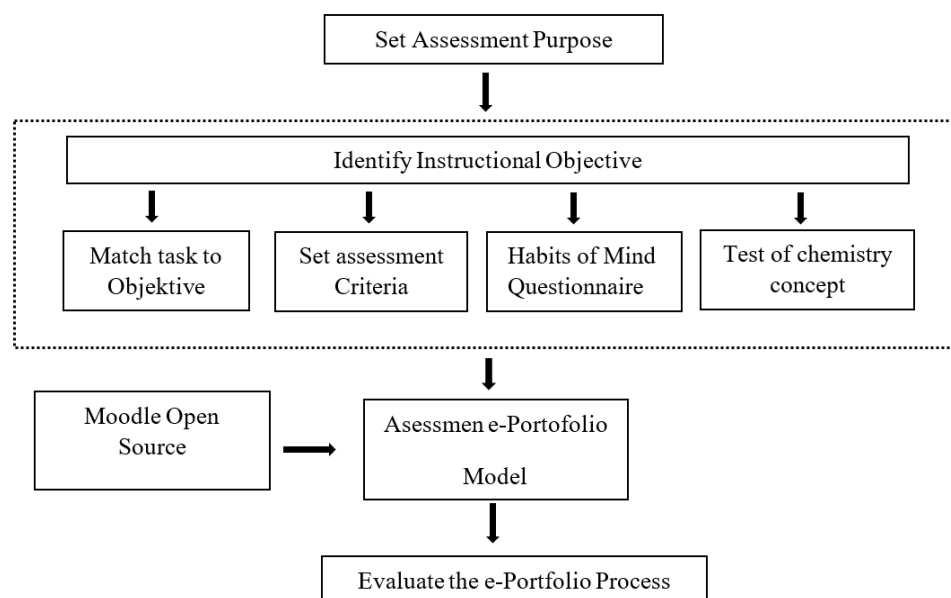


Figure 1: Framework for e-portfolio assessment.

Objectives are an important element of portfolio implementation. Setting clear goals can help teachers, students, parents, and administrators know why they use portfolios. So that in the end it allows the portfolio to show the development of each student's skills during learning [17].

Each teacher has own goals when setting portfolio assessment goals, the following points can help teachers in managing portfolio assessment objectives: 1) Portfolio audience, students and teachers are always the main part of the audience. However, parents, administrators, and other stakeholders can also be involved. By identifying audiences, teachers can plan content and criteria so that those viewing portfolios can interpret and use assessment portfolio information appropriately. 2) Identify assignments that can use the portfolio. 3) Recognize student needs that cannot be addressed by other assessments, but can be measured by portfolios such as self-assessment, motivation or use of learning strategies. Teachers can use portfolios to help students monitor their progress [22].

2. Identify instructional Objective

After agreeing on the objectives, the next step is to determine the portfolio results. These results provide a focus for the portfolio by describing what knowledge or skills students can demonstrate. For example, the purpose of the portfolio is to assess the improvement of students' habits of mind and mastery of chemical concepts. Determining portfolio results involves considering class assignments that must be in accordance with the competence of chemistry lessons. When

planning a portfolio, teachers need to take an inventory of assignments in chemistry competencies to ensure that there are chemistry assignments to choose from and show progress on each outcome [23]. Chemistry assignments lead to products that become entries in the student's portfolio. Students need to make sufficient products during chemistry lessons, so that they have control in selecting entries and for their portfolios to show progress by including multiple samples for each outcome. For example, a portfolio assessment carried out in class XI MIA on the material of buffer solutions, acid-base titrations and colloids, students can produce products in the form of short articles, practicum reports and projects. Students can use different entries to show progress on the same result.

Portfolios in an effort to improve students' habits of mind chemistry can be done by giving a questionnaire adapted from the Marzano habits of mind questionnaire [21]. The habits of mind questionnaire consists of three aspects, namely: self-regulation, critical thinking, and creative thinking with each having its own item. Meanwhile, portfolio in an effort to improve concept mastery is carried out by giving a concept mastery test on the cognitive aspect using a revised bloom taxonomy [24]. The concept mastery test is in the form of multiple choice in class XI chemistry, especially on the topic of buffer solutions, acid-base titrations and colloids, each of which is made based on chemical competence and indicators.

Once materials and resources are defined, teachers can make decisions regarding artifact organization and endorsement in the portfolio. Although the criteria for submitting entries will vary between classes, there are some points that are relevant for teachers when planning this organization, namely:

1. The portfolio should be organized systematically so that the audience understands why each section was chosen and can evaluate the portfolio as a whole. One way to organize an assessment portfolio while giving students choices is to have a consistent, predetermined table of contents.
2. The teacher should allocate time for students to select and arrange items during chemistry class. For example, teachers need to decide whether students submit their work to a portfolio every week or once a month. The teacher can create a timeline made before the lesson starts for the purpose of the chemistry portfolio. The schedule can be written on the syllabus. Regular opportunities for students to contribute to their portfolios ensure that there is plenty of evidence of student progress.

3. Students need to understand that the purpose of a portfolio is to demonstrate progress towards results, not necessarily mastering results. Therefore, not all parts have to be perfect. Critical drafts and reflections can be completely revised and provide better insight into the progress of a set of tasks that need to be put in the right place.

Portfolios measure progress towards results using a consistent scoring system. The use of rubrics in portfolio assessment is beneficial for students, rubrics help students to understand the assessment well to realize the skills they need to develop [25]. Rubrics which are detailed criteria combined with a rating scale, provide consistency. Before starting the portfolio process, teachers should work with students or others involved in the process to develop the criteria used to evaluate portfolio entries. Teachers and students also need to develop criteria for assessing the entire portfolio.

3. Moodle Open Source

Moodle is an open source LMS software that can be copied, downloaded, and modified to create an internet-based course. Moodle is an acronym for Modular Object - Oriented Dynamic Learning Environment [26]. Moodle as a learning tool, provides a medium where students can improve their knowledge as a result of active and collaborative support from teachers [27]. Moodle facilitates conceptual assessment, which helps students decide what to consider in learning and guides them to key concepts [28]. Moodle strongly supports electronic learning that can be used in various formats of learning materials, namely in the form of text, portfolio, animation, audio and video and others [29].

Courses designed at Moodle can use different methodological approaches, from simply uploading information that students can then download from the network to creating collaborative communities. From a pedagogical perspective, the Moodle platform facilitates the use of multimedia tools to create interesting activities and make the learning process more student-friendly [30]. The electronic platform used is a portfolio solution to be more widely used in assessing comprehensive standards, lean content and become more flexible [31].

4. Assessment E-Portfolio Model

After the platform is determined, the next step is to develop a portfolio model, an electronic portfolio is developed according to the needs of educational competencies [25]. The student portfolio model [32], portfolio assessment [15] task-oriented portfolio assessment [16] the assessment portfolio model [33] and the e-portfolio

model [34] were adopted and adapted into the portfolio development process to improve habits of mind and mastery of chemical concepts where the elements elements were verified by expert using the formulation of a questionnaire. The activities in the portfolio model include setting learning objectives, reflective writing, collecting and presenting work, reviewing, self-assessment, peer-assessment, as well as teacher assessment and feedback [35].

5. Evaluate The Portfolio Process

In the evaluation stage, all documentation produced during learning activities is uploaded to the e-portfolio in stages and then assessed by yourself, friends, and teachers. The teacher determines whether the portfolio meets the assessment objectives and whether the evaluation is accurate and consistent. For example, if the teacher's goal is to document an increase in mastery of concepts and habits of mind are not showing progress, then the teacher needs to determine why. There may be an insufficient sample of student work, the rubric is inaccurate, or the rater's assessment is subjective. The teacher will identify weaknesses in the assessment instruction and address them before the next semester. Taking time to reflect at the end of the semester leads to more efficient planning, more informed instruction, and more successful outcomes for your next portfolio project [6]. Evaluations conducted through an e-portfolio system must articulate learning objectives, goals, assessment data, and allow complex and subjective skills to be measured .

4. CONCLUSION

The portfolio assessment framework described in this article provides chemistry teachers with a model for systematically designing and implementing an assessment portfolio and tools for conducting further research on portfolio assessment techniques in chemistry learning. This framework provides a scoring system that emphasizes validity and credibility, ensuring that assessments are fair and appropriate for students. The portfolio system adapts to the learning process so that the objectives, outcomes, and criteria are interrelated. The resulting portfolio creates interactive assessments that involve teachers and students forming partnerships in the learning process. Portfolios show what students know, how to achieve their chemistry learning goals, and how their skills have changed over time. Teachers need to adapt their portfolios to their situation and document the process so that they can systematically investigate portfolio outcomes and challenges in different education systems.

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