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Research Article

USING PORTFOLIO TO ASSESS STUDENTS' COMPETENCE IN SCIENCE SUBJECT IN PRIMARY SCHOOLS IN HO CHI MINH CITY

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ABSTRACT

Among various assessment tools, portfolio assessment has been viewed as an effective assessment method in various subjects and educational activities. However, portfolios have not been effectively utilized to assess students' competencies in the science subject due to various reasons. This article explores the reality of using portfolios to assess students' competencies in science subjects at some primary schools in Ho Chi Minh City through surveys of 198 primary teachers teaching in grades 4 and 5 at several primary schools in Ho Chi Minh City. The findings indicated that the portfolio assessment has yet to be effectively employed in classrooms because teachers have faced several difficulties. From there, the authors propose specific suggestions to improve the effectiveness of using this tool to assess students' competencies in the Science subject.

Keywords: assessment; portfolio; primary education; the Science subject

1. Introduction

Following the 2018 general education program and Circular 27/2020 on the regulations for assessing primary students (MOET, 2020a), the curriculum of the Science subject in primary education requires teachers to apply diverse and flexible methods and tools to comprehensively assess students' learning processes, based on coordinated assessments by students, parents, and the community. In reality, assessment methods such as observation, questions and answers, written tests, and assessment through portfolios, products and learning activities have all been used by teachers in the process of teaching the Science subject. However, portfolio assessments have not been effective because primary school teachers lack mastery in developing and using this assessment tool.

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In Vietnam, some articles, studies, and training materials on assessment mention students' portfolios and their use in assessment (MOET, 2020b). However, these studies primarily address general issues (concepts, characteristics, advantages, limitations, etc.), or they discuss portfolios in other subjects (Math, English) and at different educational levels (middle and high school) (Ho et al., 2022), without in-depth research on the use of portfolio in assessing educational outcomes in the Science subject in primary school (Bo et al., 2022; Nguyen, 2021; Pham et al., 2018; Pham, 2019; as cited in Truong, 2022). Meanwhile, internationally, there are many studies and articles about portfolio assessment in various subjects, including the Science subject in primary education (Chere-Masopha & Mothetsi-Mothiba, 2022). However, studies are conducted in different countries, so their practical application in Vietnam faces certain differences, challenges, and discrepancies. Based on these practical issues, the article is conducted to reveal how primary teachers in Ho Chi Minh City use portfolios to assess their students' learning performance in the Science subject..

2. Content

2.1. Theoretical background

2.1.1. Portfolio assessment

Portfolios are identified as a combination of students' learning process and products, reflecting the developmental processes of students (Hamp-Lyons & Con, 2000; Apple & Shimo, 2004). Slater (1996)) categorised portfolios into two main types: a showcase portfolio containing evidence of a student's best work and a working portfolio that includes all products from a student's learning process.

Previous studies have proposed various processes for portfolio assessment to evaluate students' competencies. Bryant & Timmins (2002), Sewell & Horn (2008) identified three critical stages of employing portfolio assessment: collection, selection, and reflection. Meanwhile, Jeffrey & Peggy (1995) proposed six steps: planning, demonstrating requirements through evidence, defining criteria, constructing criterion-referenced rubrics, assessing the learning portfolio, and evaluating the process.

2.1.2. Portfolio assessment in the Science subject

Regarding using portfolios to assess learning outcomes in the Science subject, an international literature review has discussed concepts, roles, and possible evidence of portfolios (Winnie, 2004; Harrison, C., 2015; Jansen et al., 2015, Keeley, 2015; Karissa, 2019; Lauren & Whitworth, 2021). However, these studies lack detailed analysis on using portfolios to assess students' competencies in the Science subject.

In Vietnam, existing studies have mentioned using portfolio assessment in various subjects such as History, Geography, Mathematics, and English at different educational levels (Bo et al., 2022; Ho et al., 2022; Nguyen, 2021; Pham et al., 2018; Pham, 2019; as cited in Truong, 2022). However, there has been no research focusing on employing portfolios to assess students' competencies in the science subject at the primary education

level. The above gap requires further studies, which will be the focus of this present study. In terms of the structure of portfolios, based on the research of Vitale (2000), Bryant & Timmins (2002), Sewell & Horn (2008), this study determines a structure of portfolio with six components: (1) self-introduction; (2) objectives of the portfolio; (3) the list of learning products; (4) learning products related to learning the Science subject; (5) evidence of the working process; (6) self-assessment and analysis of the portfolio.

2.2. Methodology

This paper focuses on the practical use of portfolios to assess students' competencies in the Science subject at some primary schools in Ho Chi Minh City. To investigate the research subject, the researchers surveyed 198 teachers teaching in grades 4th and 5th in Ho Chi Minh City in January 2024.

The following questions are proposed to guide the research: *[Question 1] What are primary teachers' perspectives on employing portfolio assessment in the Science subject?; [Question 2] What difficulties have they faced in employing portfolio assessment in the Science subject?; [Question 3]: Do primary teachers with different teaching experiences face different challenges?*

Table 1. *Demographics of participants*

Teaching Experience			***Grades***		
Years of Teaching	**Number of Participants**	**%**	***Grades***	**Number of Participants**	**%**
Less than 5 years	60	30.3	Grade 4	113	57.1
From 5 to 10 years	71	35.9	Grade 5	85	42.9
Greater than 10 years	67	33.8			
Total	198	100%	Total	198	100%

During the research process, theoretical research methods, survey methods with survey questionnaires, and interview methods were used. Mathematical statistical methods (using SPSS software) were also used to analyse the collected data. Moreover, some survey questions in the study used a 5-point Likert scale with the following values:

1.00 – 1.80: Strongly disagree / Completely inappropriate / Very difficult

1.81 – 2.60: Disagree / Not really appropriate / Difficult

2.61 – 3.40: Neutral / Undecided

3.41 – 4.20: Agree / Appropriate / Slightly difficult

4.21 – 5.00: Strongly agree / Completely appropriate / No difficulty

2.3. Result and discussion

2.3.1. Employing portfolio assessment in the Science subject in Ho Chi Minh City

(1) Teachers' perspectives on the form of learning products and the structure of portfolios

Previous studies show that diversity learning products allow students to demonstrate their competencies and help teachers to assess students' competencies in a comprehensive,

valuable, and meaningful way. Based on this, the paper investigated the forms of the learning products students created during Science lessons. (Winnie, 2004; Jansen et al., 2015)

Table 2. *Categories of studying products in the Science subject*

Types of Learning Products	Average Scores	Deviation Standard	Rank
Experiment/ Practicing Reports	4.02	0.698	3
Writing products about scientific problems	3.48	0.846	7
Projects	3.50	0.797	6
Collections (drawings, pictures, articles, etc.)	4.05	0.717	2
IT products (PPT presentations, student-made videos)	3.51	0.867	5
Lesson notes/ Observing sheets	4.27	0.630	1
Open Ended Responses	3.80	0.755	4

The results show that short lesson notes/observation sheet collections, and reports on processes of practice/investigation/experimentation are learning products that are frequently used by teachers. Meanwhile, learning products in project-based learning or articles on a scientific issue are less commonly used (with an average score of 3.5 and a standard deviation of 0.797). Although some learning products are less frequently used than others, it is evident that teachers still pay attention to using a variety of learning products' forms while teaching Science in elementary education.

Based on the research of Vitale (2000), Bryant & Timmins (2002), Sewell & Horn (2008), a portfolio consists of six components: (1) self-introduction; (2) objectives of the portfolio; (3) the list of learning products; (4) learning products related to learning Science; (5) evidence of the working process; (6) self-assessment, reflection and analysis of the portfolio. The core components of the portfolio are (2), (4), (5), and (6). Based on the previous studies, the authors conducted a survey of the portfolio's structure used by teachers in actual classrooms. They obtained the following results: 40 teachers (20.2%) identified portfolios with all six components, and 54 teachers (26.47%) identified portfolios with all four essential elements. In comparison, the remaining 104 teachers (53.33%) identified a lack of at least one critical component of the portfolio. Notably, only 2.5% of teachers identified that the portfolio should include a self-assessment and analysis of the portfolio by the student. Thus, the structure of a portfolio needs to be more clearly defined in scientific research and in assessment guidelines for teachers.

Additionally, the survey's results also show that only 8.6% of teachers solely use paper portfolios, while 23.6% use electronic portfolios. Significantly, 67.7% of teachers tend to use a combination of both forms, with a higher percentage favoring electronic portfolio compared to paper portfolio (60-70% vs. 30-40%). This finding aligns with the research results of several authors who highlighted the advantages of electronic worksheets over paper-based ones in both learning and assessment. Notably, the electronic format offers

convenient storage, space-saving, and ease of adjustment and improvement (Ntuli et al, 2009; Ocak & Ulu, 2009).

(2) Teachers' perspectives on using portfolios to assess students' competencies in Science

Chart 1. *Teachers' perspectives on employing portfolio assessment in the Science subject*

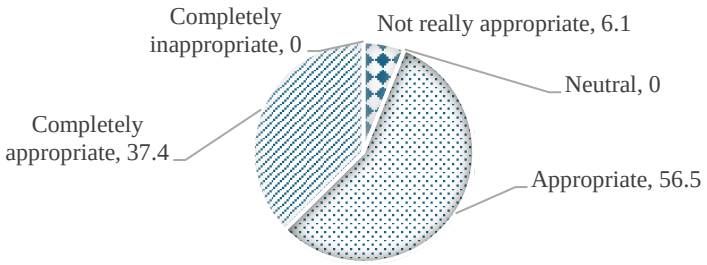


Chart 1 points out that up to 96% of teachers participating in the survey believe that using a portfolio to assess student competencies in Science is appropriate and entirely appropriate, with an average value of 4.18, a standard deviation of 0.853, and falls within the relevant range. Further discussing this, Ms. H.T.T.T. from T.H.D Elementary School (District 1) shared: "In Science, students join in many activities and have the opportunity to create a variety of learning products (reports, drawings, surveys, etc.). Therefore, this assessment tool is meaningful, convenient and effective for comprehensively assessing students' learning processes. Moreover, through portfolios, students can reflect on and assess their learning process. Thanks to this, they can adjust their own learning strategies." Additionally, Ms. D. H. N from T.S.N Elementary School (Tan Phu District) also agreed, stating: "The use of portfolio is feasible in Science because organising students' learning products through portfolio allows teachers and students to review the content knowledge in each product, thereby aiding students in deeply understanding and applying this knowledge to real-life situations." These opinions are also entirely consistent with the results from the other studies researched by Winnie (2004), regarding the role and advantages of portfolios in assessing students' capabilities in Science.

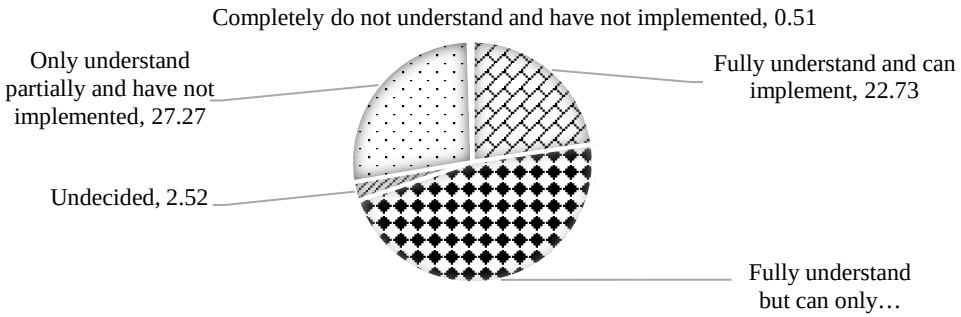
Moreover, to assess teachers' understanding of the content that needs to be evaluated when using portfolio, the research also surveyed to gather teachers' opinions and obtained the following results:

Table 3. *Teachers' perspectives on portfolio assessment contents*

Portfolio's Assessment Contents	**Number of participants**	**%**
Only final products	17	8.6
Only processes of making products	13	6.6
Both processes and final products	168	84.9
Total	198	100

Table 3 shows that most teachers agree that portfolio assessment requires evaluating both the products and the process of their creation, ensuring a comprehensive assessment that accurately reflects the student's learning process. However, when asked about teachers' understanding and implementation of using portfolios to assess students' competencies in their classroom, the results show that only 22.73% of teachers feel confident that they are performing well. Most teachers understand but only implement it partially (47.33%), and 27.27% of teachers only partially understand and have not yet implemented it. Thus, it is true that teachers understand the significance and content of portfolio assessment. Nevertheless, they are not confident and effective in this practice due to a lack of understanding of developing and using portfolio assessment in Science.

Chart 2. *Teachers' perspectives on portfolio assessment and their practical implementation*



Based on the contradictions in teachers' perspectives and practical application regarding assessment through portfolio, the researchers conducted a survey to investigate the difficulties teachers face at each step in assessing natural science competencies using portfolios.

Table 4. *The level of difficulty for teachers with the steps in the portfolio assessment process when teaching the Science subject*

No.	Assessment Process	The level of difficulty		
		Average Scores	Deviation Standard	Rank
1	Portfolio assessment planning	3.82	0.636	4
2	Lesson planning, portfolio and specific assessment tools designing	1.94	0.659	2
3	Teaching organizing	4.0	0.707	5
4	Collecting portfolio, assessing students' portfolio	1.88	0.600	1
5	Data analyzing and giving feedback	3.76	0.752	3

The result shows that most teachers have difficulties in the process of "Collecting portfolio, assessing students' portfolio" and "Lesson planning, portfolio and specific assessment tools designing " (with average scores of 1.88 and 1.94 and standard deviations

of 0.600 and 0.639 respectively, indicating a concentration on the 5-point scale). Explaining this, Ms. L. T. H. from T.H.D. Elementary School shared: "Although developing lesson plans, designing learning products, and assessment tools are familiar tasks for teachers, this work for an entire topic requires a lot of time, concentration, and meticulousness to tailor it appropriately to the students' levels in the class."

(3) Teachers' perspectives on difficulties in using portfolio assessment in the Science subject

Table 5. *Challenging aspects of using portfolio assessment in teaching Science*

Challenging Aspects	Average Scores	Deviation Standard	Rank
An extensive amount of time and effort requirement of teachers, parents and students.	4.3	0.780	4
A lack of reference materials and instructions for using portfolio assessment.	4.34	0.748	1
Inconvenience in storing, processing and controlling teaching materials in an overcrowded class.	4.18	0.888	6
Large-size class and unequal differentiation in student levels.	4.28	0.849	5
Less reliable assessment will be resulted if the expected outcomes is unclear.	4.31	0.741	3
Parents' intervention in the process of making products may affect the results of the portfolio assessment.	4.32	0.744	2
Lack of training workshops related to portfolio assessment for teachers.	4.17	0.843	7
Average Score		**4.271**	
Cronbach's Alpha		**0.918**	

The results from Table 5 show that with an average score (Mean) of 4.271, teachers agree with the statements regarding the difficulties they face when using portfolio to assess students' competencies in teaching Science. Additionally, a Cronbach's Alpha coefficient of 0.918 indicates that the scale used is highly reliable, and the standard deviation ranging from 0.895 to 0.917 shows that the 5-level scale is concentrated.

The study also conducted an ANOVA analysis to determine the differences in these difficulties among different groups of teachers based on their teaching experience (under five years, from 5 to 10 years, and over ten years). The results are presented in Table 6 below.

Table 6. *Differences in difficulty levels of three groups of teachers with different teaching experiences in using portfolio assessment in the Science subject*

ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.275	2	0.138	0.304	0.738
Within Groups	88.299	196	0.453		
Total	88.574	198			

The ANOVA analysis results in Table 6, with a significance value of 0.738, indicate no difference between these three groups of teachers when evaluating the difficulties in using portfolios to assess students' competencies in teaching Science. It should give the indication of teachers' experience (number of years) with using portfolios in assessing student learning outcomes.

Discussing more about the difficulties that teachers face in the process of using portfolios to assess students' competencies in teaching Science, the researchers found that the main difficulties teachers encounter are related to the lack of adequate instructional materials for using portfolios in teaching Science (average score 4.34, standard deviation 0.748).s

In addition, there is a risk of failing to ensure fairness because, during the process of working on the portfolios, there may be parental intervention during the process of students implementing learning products at home (average score 4.32, standard deviation 0.744). Moreover, it is also because of the concern for unclear determination of purpose and assessment criteria (average score 4.31, standard deviation 0.741). Thus, to reduce this difficulty, teacher should not assign too complicated tasks for students because they need more time to finish it in a short time in schools. It is because the vital purpose of formative assessment is that teachers receive student data in real-time, which allows them to adjust their instruction as needed. Moreover, teachers should use four flexible types of formative assessment in the portfolio-based assessment process and in any science instructional unit: class checks, small group checks, self and peer checks, and individual checks. Furthermore, teachers must constantly monitor students' activities and ask them to present their learning portfolios and explain how they did it. Thanks to this, teachers can evaluate students' portfolios more accurately and objectively.

Based on teachers' difficulties in the process of portfolio–based assessment, it is necessary to provide additional training courses to help teachers clearly understand portfolio assessment and support technology applications for them to store portfolios. Furthermore, primary teachers also need to use various strategies to assess students' natural science abilities through diverse learning products such as science projects, investigation, science journal writing, and concept maps. Moreover, the tasks teachers assign students should be

appropriate to their abilities. Especially using diverse types of formative assessment (class checks, small group checks, self and peer checks, individual checks) and checking students for the process that they make portfolios are good ways to ensure portfolio assessment effectively. Thanks to these solutions, using portfolio assessment to evaluate students' competencies will become less challenging, reduce the burden on teachers, and achieve better results. (Winnie, 2004)

2.3.2. Some solutions for designing and using portfolios to assess students' competencies in the subject of Science in primary schools in Ho Chi Minh City

Based on the difficulties of primary teachers when using portfolios for assessing competencies in Science, the research team suggests some recommendations for managers, teachers and parents in using portfolio–based assessments in the Science subject.

(1) For educational administrators

To resolve conflicts in teachers' perceptions regarding the development and the use of portfolio in teaching and assessment, managers need to organise workshops and training courses systematically and comprehensively to enhance awareness and opportunities for practical application for teachers. Furthermore, portfolio assessments also require the cooperation of parents; therefore, managers and teachers need to coordinate and provide guidance for both parents and students on using portfolios to assess students' competencies in the Science subject.

Secondly, in reality, the implementation of portfolios requires a lot of time and effort from teachers. Therefore, to reduce pressure on teachers, managers could establish professional groups to exchange and share portfolio assessment experiences and develop a basic framework for learning tasks and corresponding assessment tools. Based on this general framework, teachers in each class can make adjustments to suit the class size, and the abilities of teachers and students to ensure that the assessment is feasible and effective.

Schools should also provide teachers with additional reference materials related to the use of portfolios in assessing students' competencies in the Science subject as well as in other subjects and educational activities (Bryant & Timmins, 2002; Birgin & Baki, 2007).

(2) For primary teachers

The survey data in Table 5 indicates that teachers perceive the portfolio assessment as very time-consuming and requires lots of effort from teachers, parents, and students. However, it is affirmed to be an appropriate tool for accurately assessing students' competencies in the Science subject. Therefore, teachers need to change perceptions and actions to ensure that the use of portfolio assessment in the science subject is feasible and effective.

Teachers should understand that portfolio assessment in the Science subject is not only meaningful for students but is also a process for teachers to develop professionally, identifying their strengths and limitations in the teaching process. Therefore, teachers need to have a progressive spirit to spend enough time and effort on this. Specifically, to reduce

their own resource load for this task, teachers can collaborate with professional groups to share unclear aspects about portfolio assessment and jointly plan and develop a basic framework for learning tasks and corresponding assessment tools. Furthermore, teachers also need to grasp the notes when designing and using portfolio to assess students' competencies in the Science subject. Below are the specific instructions:

- **Regarding the design of portfolios**

Within the scope of this article, based on references from the authors Bryant & Timmins (2002), Birgin & Baki (2007), and Tran (2022), the research team determined the process of building portfolios with four steps as follows:

- To decide the objectives of the portfolio and corresponding learning tasks

Based on the learning outcomes of the Science subject curriculums as well as the Science subject's teaching objectives, teachers need to determine the goals of the portfolio clearly: whether the portfolio is intended to assess students' natural science competencies or just one or two components of this competencies (cognitive competencies in natural science, competencies to explore the natural environment, competencies to apply learned knowledge and skills to reality)? At what levels will students demonstrate their competencies? How can students demonstrate their capabilities? How can teachers assess a range of students' knowledge and abilities?

After that, the teachers communicate and explain so that students understand the purpose of the educational portfolio. From there, the teachers proceed to establish specific tasks for learners based on considerations of time, class size, student capabilities, and available resources to ensure the feasibility and effectiveness of these tasks for students.

- To identify learning products to assess student competencies

Based on the teaching objectives, the objectives of the portfolio, and the corresponding learning tasks, the teachers need to determine the list of learning products to be collected. Specifically, everyday learning products in the Science subject include questions/short exercises, worksheets/observation sheets, collections, process reports of practices, experiments, etc. At this stage, to ensure the effectiveness of the evidence collection, teachers need to determine the type of portfolio that is used in the assessment: a showcase portfolio that contains evidence of the student's best achievements or a working portfolio that includes all products in the learning process. The teachers also need to consider whether to have students create traditional portfolio electronic portfolio, or a combination of both. This is because it also influences the process of portfolio assessment.

Consequently, to build an effective assessment plan through the portfolio, firstly, teachers and students need to identify the following fundamental issues: (1) teaching objectives, (2) objectives of the portfolio, (3) learning tasks, (4) evidence to be collected and methods for collecting, storing, and presenting this evidence in the learning portfolio.

- To develop detailed assessment tools to evaluate the evidence

At this step, the teacher decides assessment criteria corresponding to each learning task identified. Then, the teacher designs assessment tools corresponding to the established criteria. Teachers must ensure that assessment tools are developed with specific criteria to guarantee comprehensive activities, including self-assessment, peer and teacher assessments. Notably, teachers should guide students on how to perform self-assessments and reflect on their learning process.

- *To develop and complete the portfolio*

Based on the objectives of the portfolio, learning tasks, and assessment criteria agreed upon by the teachers, students build their portfolios. At this step, teachers need to provide detailed guidance to students on the necessary structure of the portfolio and advise students on how to scientifically collect and organise the portfolio elements to support storage and assessment.

- **Using Portfolios to assess students' competencies in the Science subject**

To use the portfolio to assess students' capabilities, teachers need to evaluate thoroughly two aspects: the learning products and the process of creating these products, based on accompanying and guiding students in collecting learning products and organizing reflections on the learning process with two main phases:

- Phase 1: Conduct for students to evaluate products and evidence related to making a portfolio

+ Step 1: Students self-assess.

+ Step 2: Peer assessment

- Phase 2: Based on the criteria for evaluating the learning products and the product implementation process, teachers synthesize and make assessment decisions.

During the process of assessing students' portfolios, teachers can choose one of the following approaches: (1) evaluate each part of the work within the portfolio and take the average of these parts for an overall assessment of the portfolio; (2) use an analysis diagram where separate levels are assigned to each different part of the work; (3) grade the students' work and provide a single score that focuses on various aspects of performance, known as the focused-comprehensive approach (Gelfer & Perkins, 1995; Bryant & Timmins, 2002)

(3) For parents

The results from Table 5 show that "parents' intervention in the process of making products may affect the results of the portfolio assessment" is the second most significant difficulty for teachers in portfolio–based assessment. Therefore, for portfolio assessment to be feasible and effective, parents should not interfere in implementing students' portfolios. Instead, parents can be companions to share and give comments on students' portfolios so that students can recognize their strengths and points that need improvement, thereby completing their learning portfolios and gradually developing their natural science competency in the Science subject.

3. Conclusion and recommendations

Being a subject that contributes to natural science competencies for students, fostering students' curiosity through diverse teaching activities such as observation, experimentation, practice, investigation, group work, etc., the use of portfolios to assess students' competencies in the Science subject is appropriate and effective, ensuring a comprehensive, objective, and valuable evaluation. However, the use of portfolios to assess students' competencies in Science subjects in Vietnamese primary schools is not really effective for many reasons. Therefore, based on the analysis of the actual use of portfolio assessment in the Science subject and the difficulties teachers face during the portfolio assessment, educational managers, teachers and parents need to change their perceptions and understand certain considerations in developing and using portfolios for assessment in the Science subject. In particular, teachers need to closely follow the requirements of the Science program in primary school, the specific types of teaching activities of the subject and the characteristics of students to build suitable portfolios with specific and transparent assessment criteria. Then, in using portfolio–based assessments in science, teachers need to pay attention to students' reflection activities to ensure that assessments are meaningful and valuable to students' progress. This ensures that portfolio assessments are scientifically implemented to enhance the effectiveness of teaching the Science subject in primary schools.

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SỬ DỤNG HỒ SƠ HỌC TẬP ĐÁNH GIÁ NĂNG LỰC HỌC SINH TRONG MÔN KHOA HỌC TẠI MỘT SỐ TRƯỜNG TIỂU HỌC Ở THÀNH PHỐ HỒ CHÍ MINH

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TÓM TẮT

Trong số các công cụ đánh giá, đánh giá qua hồ sơ học tập và sản phẩm học tập của học sinh được nhắc đến như một phương pháp đánh giá hiệu quả trong nhiều môn học và hoạt động giáo dục. Tuy nhiên, việc sử dụng hồ sơ học tập để đánh giá năng lực của học sinh môn Khoa học vẫn chưa được sử dụng hiệu quả vì nhiều lí do. Bài viết này tìm hiểu thực trạng sử dụng hồ sơ để đánh giá năng lực khoa học tự nhiên của học sinh môn Khoa học thông qua khảo sát 198 giáo viên tiểu học đang giảng dạy lớp 4 và lớp 5 tại một số trường tiểu học tại Thành phố Hồ Chí Minh. Kết quả chỉ ra rằng đánh giá hồ sơ chưa được sử dụng hiệu quả trong các lớp học thực tế vì giáo viên gặp phải một số khó khăn. Từ đó, tác giả đề xuất những đề xuất cụ thể để nâng cao hiệu quả sử dụng công cụ này để đánh giá năng lực khoa học tự nhiên của học sinh môn Khoa học.

Từ khóa: đánh giá; hồ sơ học tập; giáo dục tiểu học; môn Khoa học