



USING RUBRIC TO ASSESS PRIMARY SCHOOL STUDENTS' COMPETENCE IN TEACHING SCIENCE IN VIETNAM

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Abstract:

Vietnam is in the early stages of implementing the reform of the curriculum and textbooks. Vietnam's general education is changing strongly from content-based teaching to competence-building teaching [1]. That change has been implemented by researchers and teachers in all elements of the teaching process, including testing and evaluation. Evaluation of educational outcomes needs to shift from testing memorization to assessing the ability to apply knowledge to solve practical problems, attaching importance to both assessment of learning outcomes and assessment in the learning process. In this situation, testing and assessment in teaching Science in primary schools are also interesting to many teachers, and assessment of scientific competence in teaching this subject is considered an important factor contributing to improving the quality of Science and the quality of subject teaching in the direction of developing students' ability. The article mentions some theoretical foundations and the actual situation of using Rubric in assessing the scientific competence of students in grades 4 and 5 when teachers teach Science, thereby proposing some measures to improve the effectiveness of assessment in teaching this subject.

Keywords: rubric, assessment, competence, teaching, primary school students, Science subject, Vietnam

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1. Introduction

Rubric is a term used in many different fields for the purpose of designing criteria to evaluate a certain activity [2], [3]. A rubric is a scoring tool by listing all the evaluation criteria for a lesson, assignment or work done by learners by ranking them in a hierarchy [2], [4]. It can be asserted that a rubric is a tool used to evaluate the learning outcomes of learners, which is represented by a specific description of the evaluation criteria and the levels of achievement of each of those criteria in terms of the student's learning process or product.

Currently, a rubric is widely used as an assessment tool in the classroom from primary to secondary school and is considered a tool with many advantages in student assessment [5]–[7]. If properly designed and used, rubrics are not only a highly effective assessment tool, but they also provide regular and positive feedback on student performance. Moskal indicated that the rubric has two great advantages: (1) Rubric supports checking the level of achievement of the prescribed evaluation criteria; (2) Rubric provides students with a way to improve and develop their competence in the future [8]. In the world, the use of rubrics in teaching and assessment has been studied by theorists for a long time. They have used rubrics for different purposes, such as program evaluation, teaching improvement, and student achievement [2], [3], [6], [9]–[12].

A rubric has many advantages when used for assessment in teaching. It provides specific evaluation criteria and clearly describes the levels achieved through the criteria [13]–[18]; ease of use by teachers and students. Students, parents, and educators are provided with tools to see their own abilities through the clearly described quality of learning products [4], [16]. A rubric is a reliable and objective tool; consistency [19]; validity and fairness [2]. Researches on the rubric as a tool to assess learners' ability and to support teaching have been conducted very early in countries with advanced education such as the United States, Australia, and Canada. Most of the studies confirm the role of rubric in assessing learners' competence in both regular assessment and periodic assessment of student learning outcomes. A rubric is divided into 2 types: analytical rubric (also known as a quantitative rubric) and synthetic rubric (also known as a qualitative rubric). The division into analytical rubrics or synthetic rubrics is based on how the criteria are described in a scale. The synthetic rubric describes all the criteria of competence together, while for the analytical rubric, each criterion is described separately.

In Vietnam, in 2004, the rubric was emphasized and mentioned as a tool to assess students' competence in the Workshop “The role of testing - assessment activities in innovation in education in Vietnam”. In 2010, Vietnam's Ministry of Education and Training published some illustrative rubrics on grading criteria, but specific guidelines for teachers on how to design and use rubrics in assessment activities in schools have not yet been given. In December 2010, Vietnam's Ministry of Education and Training issued 8773/BGDĐT-GDTrH on guiding teachers on how to build a test matrix (actually a rubrics

table in the form of a 2-D matrix). Also in this dispatch, the Ministry of Education and Training has also encouraged teachers to use rubrics in building a grading scale to grade students [20]. Up to now, there are also many Vietnamese authors who have studied the design and use of rubric in teaching subjects. Most of these studies have also shown the role of rubric in orienting learners to form learning motivation, actively planning their own learning, and at the same time making it easier for teachers in the assessment work [5], [21]. Using rubric in teaching is not only aimed at assessing the necessary knowledge and skills in classroom teaching content, but also in self-study content outside of class time, and practical application activities. [2], [7], [13], [16], [17].

The subject of Science in Vietnam's primary schools aims to *“contributing to the formation and development of students' autonomy and self-study, communication and cooperation, problem-solving and creativity. In particular, the subject contributes to the formation and development of natural science competencies in students, helping them to have an initial understanding of the natural world, initially having skills in understanding the natural environment around them. and the ability to apply knowledge to explain things, phenomena, relationships in nature, solve simple problems in life, behave appropriately to protect the health of oneself and others, protect natural resources and the surrounding environment”*. The teaching of Science at primary schools in Vietnam is a highly integrated subject. The teaching has not been really interesting for many teachers, in which the assessment process also has many difficulties, especially in the assessment of scientific competence - the specific competence of Science subjects [22]. Many Vietnamese studies also mention the use of rubric in assessing many subjects, such as Maths, Vietnamese, and Biology, but there are no specific studies on using rubrics in assessing the scientific competence of students in teaching Science.

2. Research questions

The purpose of the article is to analyze the Science curriculum in primary schools in Vietnam to answer the research questions: What are the manifestations of the natural science competence of students in learning Science? How does the Rubric design assess students' natural science competencies? Then, a rubric was built to illustrate the assessment of natural science competencies in teaching Science to primary students according to the proposed design process.

2.1 Manifestations of natural Science competence in Vietnam's primary Science curriculum

Science is taught to students in grades 4 and 5, formed and developed from the subject of Nature and Society in grades 1, 2, and 3. This is a highly integrated subject, aiming to form and develop natural science abilities in students. In the Science curriculum promulgated by the Ministry of Education and Training of Vietnam, natural science competence includes the following components: the ability to perceive natural science; the ability to understand the surrounding natural environment; ability to apply

knowledge and skills learned [23]. The manifestations of natural science competence in Science subject are described as follows:

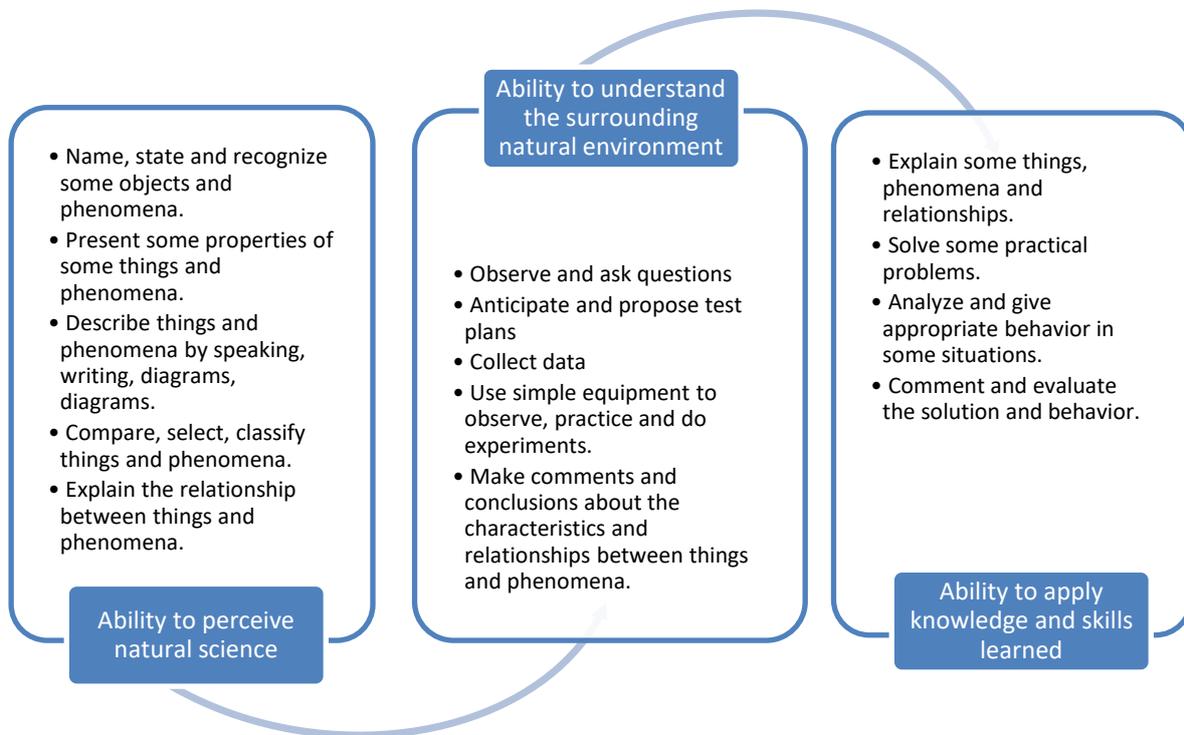
Ability to perceive natural science: students name, state and recognize a number of simple things and phenomena in nature and life, including some problems of matter, energy, plants, animals, fungi and bacteria, humans and health, organisms and the environment. Students can present some characteristics of some simple things and phenomena in nature and life, describe things and phenomena by means of expressions such as spoken, written, diagrams, and diagrams, compare, select, and classify objects and phenomena based on certain defined criteria, explain the relationship (at a simple level) between things and phenomena (cause and effect, structure-function) [23].

Ability to understand the surrounding natural environment: students observe and ask questions about things, phenomena, relationships in nature, the biological world including humans and health problems. Students can make predictions about things, phenomena, relationships between things and phenomena (cause and effect, structure-function), propose a plan to test the prediction, collect information about things, phenomena, relationships in nature and health in many different ways (observing things and phenomena around, reading documents, asking adults, searching on the Internet), use simple equipment to observe, practice, do experiments to learn about things, phenomena, relationships in nature and record simple data from observations, experiments, and practice. From the results of observation, experiment, practice, students can draw comments and conclusions about the characteristics and relationships between things and phenomena [23].

Ability to apply knowledge and skills learned: Students can explain a number of things, phenomena and relationships in nature, including humans and measures to protect the health, solve some simple practical problems using scientific knowledge and skills from other related subjects, analyze the situation, thereby giving appropriate behavior in some situations related to the health of oneself, family, community and surrounding natural environment; exchange, share and mobilize people around to do the same, comment, evaluate the solution and how to behave in life-related situations [23].

It is possible to briefly describe the manifestations of natural Science competence in Vietnam's primary Science curriculum through the following diagram:

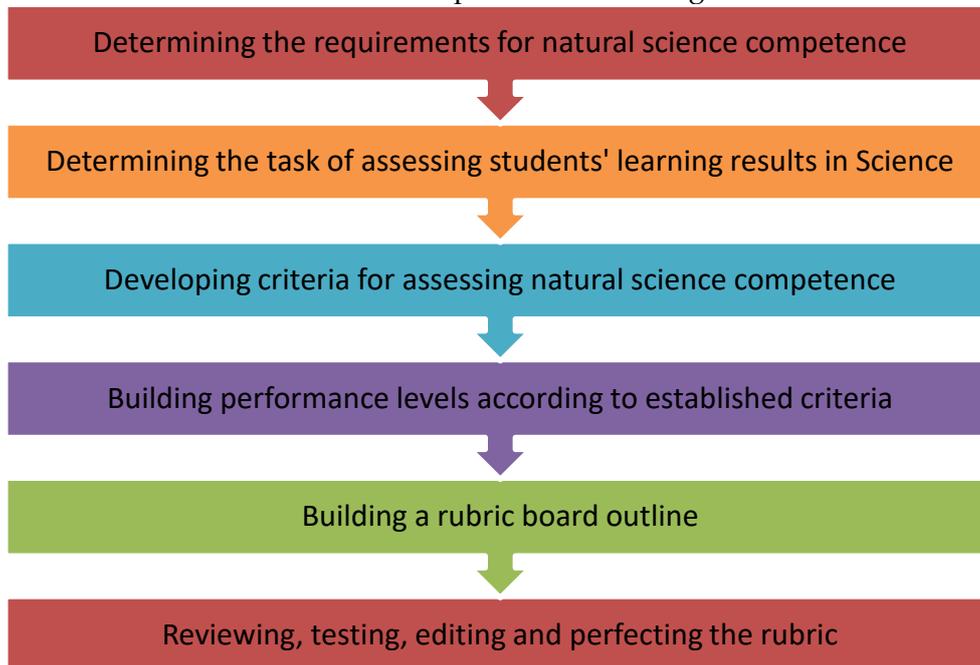
Diagram 2.1: Manifestations of natural science competence in the Science curriculum of Vietnam



3. Rubric design process to assess natural science competence of primary school students and illustrative examples

The design of the rubric to assess students' natural science competence takes place in parallel with the process of teaching Science. On the basis of reference to how to build a rubric to assess the competence of some Airasian authors Peter W; Kubiszyn T. & Borich G; Nitko A. J & Brookhart S.M [24]–[26], and based on the rubric's constituent elements (evaluation criteria and achievement levels of the criteria), the rubric design to assess the natural science competence of primary school students in the process of teaching Science can be done according to the following steps:

Diagram 3.1: The rubric design process to assess students' natural science competence in teaching Science



Step 1: Determining the requirements for natural science competence of the lesson.

In the 2018 General Education Program, the requirements for the Science subject are described quite clearly in association with action verbs with 3 groups of component competencies (generalized in Diagram 2.1). Therefore, when studying the content of each lesson, teachers can study the subject program and determine the requirements to be met that the lesson aims to serve as the initial basis for determining the output standards that students want to achieve when building a rubric.

Example: Lesson: Some characteristics of water (Science 4)

Requirements to be achieved: after the lesson, students can:

- State some characteristics of water (colorless, odorless, tasteless, shapeless; flowing from high to low, spreading in all directions; permeating some objects and dissolving some substances). (ability to perceive natural science).
- Observe and do simple experiments to detect some characteristics of water (ability to understand the surrounding natural environment).
- Apply the characteristics of water in some simple cases (ability to apply knowledge and skills learned).

Step 2: Determine the task of assessing students' results in Science.

The assessment should aim to solve two basic tasks: (1) Help students see and self-assess the process and results of learning Science lessons, what has been done, and limitations and obstacles; (2) Provide feedback to teachers, help teachers understand clearly the level of achievement of students in order to have appropriate interventions and impacts. Therefore, in this step, the rubric design needs to clearly define the

assessment task as to assess the activities, products or to assess both the operation process and the product, from which there is a basis to build the criteria.

Example: Lesson: Some characteristics of water (Science 4): The assessment task is to combine the assessment of both the student's observation and experimentation process and the product, the results of the knowledge and skills that students have obtained after conducting the experiment.

Step 3: Develop criteria for assessing natural science competence.

In this step, teachers need to clearly identify specific manifestations of natural science competence that need to be assessed in the lesson based on the requirements to be achieved. Teachers analyze and concretize each of those competencies into elements, characteristics or jobs so as to show the characteristics of natural science competencies. These are important and necessary actions, factors, and characteristics that determine the success of the exercise of natural science competence. This is the most important step in developing the criteria. After doing this, teachers will have a list of initial criteria. Then, teachers can edit and perfect the criteria by choosing the most appropriate criteria (only about 3-5 criteria should be suitable for each competence) and express them so that it is possible to observe the work and actions of students in the process of learning Science, especially those related to the ability to understand the natural environment and the ability to apply learned knowledge and skills.

For example, in the lesson "Some characteristics of water" (Science 4), based on the requirements to be met and the assessment task identified, the assessment criteria can be developed as follows:

- Stating the characteristics of water.
- Proposing an experiment to detect the characteristics of water.
- Conducting an experiment to discover the characteristics of water.
- Sharing opinions about the process and results of experimenting on the characteristics of water.
- Listing some applications of the characteristics of water in life.

Step 4: Build performance levels according to the established criteria.

At this step, it is necessary to determine whether the type of rubric to be built is an analysis or synthesis or a combination of analysis and synthesis. Normally, if using rubrics for the purpose of assessing the learning process of students in each Science lesson, the analytical rubric will have many advantages in providing teachers and students with specific strengths and limitations of students because it evaluates each component of each competence. If using rubrics to assess periodically after a semester or a school year of students, it is recommended to use a synthetic rubric. Rubric often uses a descriptive scale to express the level of student performance. Determining the number of levels is also very important with this scale, if more than 5 levels are determined, it is difficult for teachers and students to distinguish clearly when describing. Therefore, only 3 to 5 levels of description should be used. Regulations on the assessment of science

learning outcomes in primary schools in Vietnam identify three levels of assessment: good completion, completion and incompleteness. Therefore, when building a competency assessment level, it should be divided into three levels of assessment with a description of the assessment criteria at the highest level, best completion, and then a description of the remaining levels. For example, the lesson "Some characteristics of water" (Science 4), it can be built into 3 levels: good completion, completion and incompleteness. When describing, it is advisable to describe the level of good completion first, then describe completion and incompleteness.

Step 5: Build a rubric board outline.

A rubric is structured as an assessment table showing criteria, levels and scales, including horizontal and vertical columns. The top horizontal columns are level values expressed in words or scales. The first vertical column of the table contains the assessment criteria for each component. Each component has a different weight. For example: with the lesson "Characteristics of water" (Science 4), the rubric can be sketched as follows:

Criteria	Performance levels		
	Good completion (3)	Completion (2)	Incompletion (1)
Propose an experiment to detect the characteristics of water.	Propose to the group or to the class at least one experiment to discover the characteristics of water and describe how to do it.	Propose to the group or to the class at least one test plan to discover the characteristics of water but not fully describe how to do it.	Unable to propose to the group or to the class the plan of doing experiments to discover the characteristics of water.
Conduct an experiment to discover the characteristics of water.	Actively cooperate with the group to do experiments to discover the characteristics of water.	Participate in cooperation with the group to do experiments to discover the characteristics of water but lack of initiative.	Do not participate in group coordination or participate with a superficial attitude, which goes against the group's goal when doing experiments to discover the characteristics of water.
Share opinions about the process and results of the group's experiments on the characteristics of water.	State at least one personal opinion and listen to others share when doing the experiment with the group; State the results of the group's experiments on the characteristics of water.	Listen to friends share when doing experiments with the group; State the results of the group's experiments on the characteristics of water.	Lack of listening to others in the group sharing ideas when doing experiments; The results of the group's experiments on the characteristics of water cannot be said.
State the characteristics of water.	State the true and complete characteristics of water: colorless, odorless, tasteless,	State correctly but incompletely the characteristics of water, lack or incorrect in one of	Incorrectly state two or more of the following characteristics: colorless, odorless, tasteless,

	without definite shape; flowing from high to low, flowing in all directions; penetrates some substances and dissolves some substances.	the following characteristics: colorless, odorless, tasteless, without definite shape; flowing from high to low, flowing in all directions; penetrates some substances and dissolves some substances.	without definite shape; flowing from high to low, flowing in all directions; penetrates some substances and dissolves some substances.
List some applications of the characteristics of water in life.	State some applications of the characteristics of water in life and clearly explain the characteristics of water in that application.	State some applications of the characteristics of water in life, but the characteristics of water in that application have not been clearly explained.	Unable to state the applications of the characteristics of water in life.

Step 6: Review, test and edit and complete the rubric table.

After completing the rubric, the teacher let the students test rubric practice in a number of lessons, to check the correctness and suitability of the assessment criteria and determined levels.

4. Conclusion

Innovation in testing and assessment has great significance in the process of teaching and developing students' competence. Building rubrics to assess students' learning outcomes in a competence-based approach is not an easy job and requires a lot of time and effort from teachers. In teaching Science, a rubric is designed not only to describe the criteria associated with the results of scientific awareness that students achieve after the lesson/topic, but also to demonstrate the criteria associated with the process of participation and scientific activities to form the competence of students to explore and discover Science. Therefore, the use of a rubric to assess students in teaching Science has great significance, contributing to achieving the goal of forming scientific competence for students, and meeting the requirements of the General Education Program of Vietnam.

Conflict of Interest Statement

The authors declare no conflicts of interest.

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