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Research Article

Measuring Communication and Collaboration Skills in Sciences of Secondary School Students in New General Curriculum: A Case of Vietnam

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Abstract

Communication and collaboration are important skills for students in the 21st century. In order to develop these skills, students will interact with others in specific situations, where they will need to face a situation directly. In Vietnam, the new general education curriculum was issued by the Ministry of Education and Training in 2018. This curriculum has been developed using competency-based approach. Communication and collaboration are identified as core competencies in this curriculum, and these competencies have been proposed with detail components and criteria for students at the final stage of each education levels (e.g., primary, lower secondary and upper secondary education). However, one of the practical problems teachers and students facing is that these criteria are too general. Therefore, it is difficult for teachers and teachers to monitor and assess these competencies in specific subjects. The purpose of the present research is to propose a detailed assessment framework and to validate an instrument for assessing communication and collaboration competencies in the Science subject based on general criteria of these competencies in the general education curriculum in Vietnam. The present research used Exploratory Factor Analysis (EFA) to analyse the research data. The results show that there are three components to measure communication and collaboration competencies with 19 out of 20 indicators having good factor loadings. Reliability analysis for each factor using Cronbach's alpha shows that each factor has internal consistency, with values ranging from .704 to .861.

Keywords

Communication, Collaboration, General Education Curriculum, Assessment, Vietnam

1. Introduction

Communication and collaboration are important skills for students in the 21st century. In order to develop these skills, students will interact with others in specific situations, where they will need to face a situation directly. In many countries, educators have identified communication and collaboration skills as crucial competencies for students who living in the 21st century [1]. With the strong development of science and technology and the urgent requirements of the international

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integration process, in recent decades, requirements have been set for learners to become global citizens, which emphasize the formation and development of core competencies.

The general education curriculum [10] in Vietnam has been developed in the direction of competency-base approach, to support students forming and developing expected qualities and competencies. Thereby equipping future generations with a solid cultural foundation and high adaptability to all changes of nature and society. In particular, communication and collaboration competencies are competencies that are considered important for global citizens in the 21st century. The 2018 general education Curriculum [10] has defined the structure of communication and collaboration competencies including different components and criteria. The purpose of present research is to propose a detailed assessment framework and to validate an instrument to assess communication and collaboration competencies in the Science subject based on general criteria of these competencies in the general education curriculum in Vietnam.

2. Literature Review

Many terms have been coined to name these competencies such as 21st century competencies, transversal competencies, key/core competencies. International organizations and some researchers suggest that communication and collaboration competencies are two of the many important competencies required for a global citizen in the 21st century [14]. There are many conceptions of communication competency but in general, communication competency is said to be the ability of students to understand and be understood by others. This manifests itself in communicating ideas to others effectively, actively listening in conversations, giving and receiving feedback, and speaking in public. In 2006, the European Parliament Recommendation identified 8 key competencies, of which communication in the mother tongue and communication in a foreign language are two of these 8 competencies. The Council of the European Union [19] also identifies communication as one of the key competencies that every European needs to develop and update throughout his or her life in order to be able to adapt to the ever-changing life and the changing future. The British Columbia, Canada education curriculum has outlined the competencies to be achieved as well as the level to be achieved by each type of competency [4]. In this curriculum, the structure of communication competency includes (1) Connecting and engaging with others; (2) Focus on intent and purpose; (3) Collection and presentation of information. However, with specific descriptions of communication competency manifestations in the framework, specific guidelines are given to suggest teachers to develop this competency through educational activities without specific toolkits to measure this competency.

In terms of measuring communication and collaboration competencies in general, Megumi et al. [9] developed a questionnaire with 29 questions to measure communication competency which consists of 2 components: general communication skills (6 questions) and communication skills with others (23 questions). This questionnaire builds on communication competency characteristics and was tested with 159 participants to measure the reliability and validity of the toolkit. Douglas and colleagues [5] also developed a questionnaire to measure communication competency with testing it on a sample of 256 participants. The questionnaire consists of 30 questions structured on a modified Likert scale with four possible response levels of (1) never or rarely; (2) sometimes; (3) regular; and (4) often or always. The test results gave reliable and valuable results.

In the context of science subject at schools, these competencies also play an important part to develop scientific literacy. For instance, the Partnership for 21st Century Skills (P21) in the USA proposed that students need to develop the skills and competencies to think about new ideas in different scientific contexts, especially, in this P21, the skills such as effective listening and understanding the key ideas from others through communication and collaboration are emphasized [15]. Moreover, National Research Council proposed a Framework for K-12 Science Education [12]. In this framework, one of key practices of science is "obtaining, evaluating, and communicating information". Communication and collaboration competencies are also identified as one of important factors to learn science at schools, and there are some national curriculums providing the detailed instructions to do so. For example, The Curriculum Framework for Kindergarten to Year 12 Education in Western Australia [3] states that students need to be developed those competencies across subjects and educational activities. The National Science Curriculum in Korea [11] also emphasizes that students should be able to communicate their ideas on science and socio-scientific issues as well as to work with others on different topics in science. Besides, Spektor-Levy et al. [17] also proposed a general model for developing communication skills to help students in the classroom with science subject. In this model, science teachers were provided different strategies to help students actively communicate to peers.

There are some studies to propose different instruments to measure communication and collaboration competencies in science subject. For example, Yoonsook Chun and colleagues [2] proposed ways to develop communication competencies for students in science lessons with a sample of 132 9th graders in Korea. In this study, the authors came up with the communication competency structure in science with 4 components: (1) understanding the ideas of others; (2) appreciating the perspectives of others; (3) develop positive judgments; (4) build common understanding. Tanner and colleagues [18] also develop an instrument to measure collaboration competencies in science subject with the structure of five components for effective collaboration, namely (1) active interdependence; (2) interaction promotes face-to-face; (3) individual and group accountability; (4) interpersonal and small group skills; (5) group processing.

3. Material and Method

3.1. Participants

The present research recruits a sample of 731 students in grade 6 and 7, who had studied natural sciences under the 2018 general education curriculum. Table 1 provides the characteristics of the sample. The sample was selected from 03 schools representing advantaged and disadvantaged areas in Hanoi city of Vietnam.

Table 1. *Information about the sample.*

Year Groups	Gender	
	Male	Female
Grade 6	177	169
Grade 7	198	185
Total	375	354
Total of sample	731	

At the time of data collection, the 2018 general education curriculum has only implemented in grade 6 and grade 7. That is the reason why the sample of the present research only focus on grade 6 and grade 7 students. The students were announced to aims of the research at the beginning of the data collection phase and they participated the research voluntarily.

3.2. Instruments

An assessment framework is a structured concept map of a curriculum's learning outcomes along with descriptive elements of how outcomes are measured [16]. Structurally, the assessment framework consists of two main components: (1) the content framework, which provides a definition of the structure to be measured, descriptions of achievement levels, (2) a technical framework or test blueprint, which defines the content and manner of assessment to generate sufficient evidence to support the interpretation of the assessment [8]. According to Nguyen et al. [13], the competency assessment framework for learners needs to fully reflect the structure (components, behaviors) of the competencies; At the same time, it must demonstrate an integrated relationship with the objectives and content of the subject curriculum. Griffin et al. [6] also developed a process for developing a competency assessment framework, as shown in Figure 1.

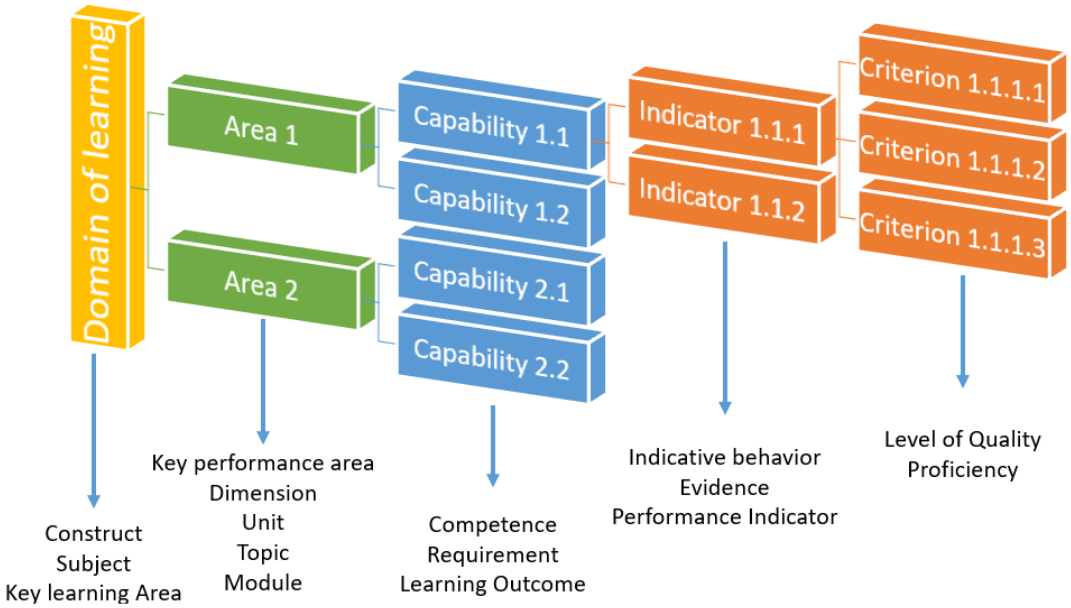

Figure 1. *The structure of an assessment framework.*

Starting from defining the latent variable (competencies) to be measured, then determining the structure of the latent variable (constituted by which components, elements, behavioral indicators), finally describing the quality criterion (proficiency) of each behavior. The latent variable (what needs to be measured) can consist of multiple components. Each component continues to be concretized by cognitive skills, practical skills, and each skill is materialized by a range of behaviors such as writing, speaking, doing, creating. And the development of the latent variable is conceivable through the quality criterion of behaviors.

Applying this process in developing a framework for assessing communication and cooperation competencies for lower secondary students, the components and elements come

from specific regulations presented in the 2018 general education curriculum. This provision is presented in Table 2 below.

Table 2. *Requirements for secondary school students' communication and collaboration competencies.*

Competency Component	Requirements
Determine the purpose, content, means and attitude of communication	1) Know how to set communication goals and understand the important role of setting goals before communicating. 2) Understand the content and method of communication that needs to be suitable for the purpose of communication and know how to apply it to communicate effectively. 3) Receive texts on simple issues of life, science and art, using language combined with charts, figures, formulas, symbols, images. 4) Know how to use language combined with charts, figures, formulas, symbols, images to present information, ideas and discuss simple issues about life, science and art. 5) Know how to listen and have positive feedback in communication; Recognize the context of communication and the characteristics and attitudes of the communication object.
Establish and develop social relations; correct and resolve conflicts	1) Know how to establish, maintain and develop relationships with members of the community (relatives, friends, neighbours). 2) Recognizing conflicts between oneself and others or between others; have a willingness to mediate and know how to settle conflicts.
Define the purpose and mode of cooperation	Know how to proactively propose the purpose of cooperation when assigned tasks; Know how to identify the tasks that can be best accomplished by teamwork.
Define your responsibilities and activities	Understand the team's mission; Assess your abilities and take the right job for yourself.
Identify the needs and capabilities of collaborators	Assess the aspirations and abilities of each member of the group to propose a plan to organize cooperation activities.
Organize and persuade others	Proactively and exemplary in completing assigned tasks, suggesting adjustments to promote common activities; humbly learn from team members.
Evaluating cooperation activities	Comment on the strengths and shortcomings of yourself, each member of the team and the whole team at work.
International integration	1) Have a basic understanding of relations between Vietnam and some countries in the world and about some international organizations that have regular relations with Vietnam. 2) Know how to actively participate in a number of international integration activities suitable to themselves and the characteristics of schools and localities.

It can be seen that the 2018 general education curriculum has introduced specific components of communication and collaboration competencies, including seven different components and twelve specific requirements for secondary school students. Given the characteristics of natural sciences, this study did not include the international integration component in the development of the communication and collaboration competencies assessment framework. Therefore, the study relied on the remaining six competency components and ten requirements to be met to come up with a detailed assessment framework. Applying the methodology from Griffin et al. [6] approach, the above requirements have been developed to 20 criteria, which are detailed in Table 3.

Table 3. *Criteria for assessing communication and collaboration competencies according to 2018 curriculum.*

No	Criteria
1	Know how to set communication goals and understand the important role of setting goals before communicating.

No	Criteria
2	Understand that the content and method of communication need to be suitable for the purpose of communication and know how to apply it to communicate effectively.
3	Receive texts on simple issues of life, science and art using language combined with charts, figures, formulas, symbols, pictures.
4	Know how to use language combined with charts, figures, formulas, symbols, images to present information and ideas
5	Can discuss simple issues about life, science, art, …
6	Know how to listen and have positive feedback in communication
7	Be aware of the context of communication and the characteristics and attitudes of the communication object
8	Know how to establish, maintain and develop relationships with members of the community (relatives, friends, neighbors)
9	Be aware of conflicts between myself and others or between other people
10	Be willing to mediate and know how to resolve conflicts
11	Know how to proactively propose the purpose of cooperation when assigned a task
12	Know how to identify tasks that can be best done by teamwork
13	Understand the mission of the team
14	Assess abilities and took the job that was right for me
15	Assess the aspirations and abilities of each member of the group to propose a plan to organize cooperation activities
16	Know how to be proactive and exemplary in completing the assigned task
17	Participate in suggestions, adjustments to promote common activities when joining the group
18	Humbly learn from other team members
19	Be able to comment on my own strengths and shortcomings
20	Be able to comment on the strengths and shortcomings of each member of the team and of the whole group in the work

There are many different types of instruments for measuring communication and collaboration competencies. Within the scope of this study, a students' questionnaire on communication and collaboration competencies in natural sciences were developed based on the proposed communication and collaboration competencies assessment framework. In this questionnaire, in addition to information about student characteristics, the criteria that students self-evaluate using the Likert scale include 05 frequency levels for each criterion: (1) never; (2) rarely; (3) occasionally; (4) regular; (5) very often. Students were required to applied all the criteria in the context of learning natural science in their classroom.

3.3. Analysis Procedures

The present research employed the Exploratory Factor Analysis (EFA) [7] to analyse the research data because the instrument was newly developed based on the requirements of communication and collaboration competencies in the new general education curriculum in Vietnam. At the first step, the data has been cleaned to ensure that the data is sufficient for data analysis. The reliability analysis was also applied to test the reliability of each factor and the whole instrument Based on the results of the analysis, the researchers decided to keep or eliminate certain items.

4. Results and Discussion

One of the results from the EFA analysis should be consider was KMO and Bartlett's Test. Table 4 shows this result. It can be seen from this table that Kaiser-Meyer-Olkin Measure of Sampling Adequacy is .936, above the commonly recommended value of 6, and the Bartlett's Test of Sphericity is significant ($\chi 2$ (190) = 4422.601, p <.05). This result indicates that the EFA analysis is valid.

Table 4. *The results of KMO and Bartlett's Test.*

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.936
Bartlett's Test of Sphericity	Approx. Chi-Square	4422.610

KMO and Bartlett's Test	
df	190
Sig.	.000

The test results were analyzed using EFA techniques. In this analysis, the principal components analysis was applied with the use of rotation of varimax. Table 5 provides the results of the EFA of 20 indicators. The factor loadings under .04 were not shown in the table and the factor loadings were sorted by size in each factor.

Table 5. *The results of exploratory factor analysis.*

No	Criteria	Factor		
		1	2	3
1	C17. I participate in suggestions, adjustments to promote common activities when joining the group	0.704		
2	C16. I know how to be proactive and exemplary in completing the assigned task	0.665		
3	C12. I know how to identify tasks that can be best done by teamwork	0.631		
4	C13. I understand the mission of the team	0.6		
5	C15. I assessed the aspirations and abilities of each member of the group to propose a plan to organize cooperation activities	0.573	0.48	
6	C18. I humbly learn from other team members	0.547		0.419
7	C20. I can comment on the strengths and shortcomings of each member of the team and of the whole group in the work	0.541		
8	C11. I know how to proactively propose the purpose of cooperation when assigned a task	0.537		
9	C14. I assessed my abilities and took the job that suited me	0.533		
10	C19. I can comment on my own strengths and shortcomings	0.529		
11	C04. I know how to use language combined with charts, figures, formulas, symbols, images to present information and ideas		0.751	
12	C03. I receive texts on simple issues of life, science and art using language combined with charts, figures, formulas, symbols, pictures.		0.647	
13	C01. I know how to set communication goals and understand the important role of setting goals before communicating.		0.563	
14	C02. I understand that the content and method of communication need to be suitable for the purpose of communication and know how to apply it to communicate effectively.		0.545	
15	C05. You can discuss simple issues about life, science, art		0.543	0.41
16	C09. I am aware of conflicts between myself and others or between other people			0.707
17	C08. I know how to establish, maintain and develop relationships with members of the community (relatives, friends, neighbors)			0.644
18	C07. I am aware of the context of communication and the characteristics and attitudes of the communication object			0.614
19	C10. I am willing to mediate and know how to resolve conflicts			0.437
20	C06. I know how to listen and have positive feedback in communication			

The result shows that it is possible to divide these 20 criteria into 03 different components. All criteria have factor loadings above 0.4 (except for criterion 06 (C06): I know how to listen and have positive feedback in communication). The first component includes ten criteria (from number 1 to number 10 in Table 5), which are the criteria related to col-

laboration skills. The second component includes five criteria (from number 11 to number 15 in Table 5) which refer to Determine the purpose, content, means and attitude of communication. The third component deals with establishing and developing relationships, including four criteria (from number 16 to number 19 in Table 5).

From the results of EFA, there are 19 indicators belonging to three components of the communication and collaboration competencies. Table 6 shows the reliability analysis of each scale using Cronbach's alpha. It can be seen that the scales are reliable since the Cronbach's alpha coefficient of reliability vary from .704 to .861. Therefore, the scales can be used to measure different aspects of the communication and collaboration competencies for Vietnamese students.

Table 6. *Cronbach's alpha of reliability.*

Component	No. of items	Cronbach's alpha
Collaboration skills	10	.861
Determine the purpose, and attitude of communication.	5	.738
Establishing and developing relationships	4	.704
Total	19	.906

5. Conclusions

Thus, it can be seen that with the tested data, it can be seen that communication and collaboration competencies can be considered as 03 key competency components. Results obtained from the EFA have been stable. Teachers can use the instrument to measure students' communication and collaboration competencies within science subject. The data through students' responses of the instrument could provide teachers useful information about their communication and collaboration competencies to promote teaching and learning these competencies in the classroom. Further studies are needed to have bigger sample and re-validated the instrument by testing other types of invariance.

Abbreviations

EFA: Exploratory Factor Analysis
P21: Partnership for 21st Century Skills

Author Contributions

Thi Thuy Ha: Conceptualization, Formal Analysis, Methodology, Resources, Writing – original draft

Thi Nga Hang Nguyen: Data curation, Investigation, Writing – review & editing

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Conflicts of Interest

The authors declare no conflicts of interest.

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