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The Process of Designing Exercises to Develop the Competency of Exploring the Surrounding Natural and Social Environment in Primary Schools: A Case Study in Grade 2

Phan Thi Tra My[1], Nguyen Bao Hoang Thanh[2], Nguyen Minh Giam[3]

[1]Master's student, University of Science and Education - the University of Da Nang, Vietnam

[2]Associate Professor, Ph.D., University of Science and Education - the University of Da Nang, Vietnam

Email: thanhnbh@ued.udn.vn

[3]Faculty of Education, Thu Dau Mot University, Vietnam

https://orcid.org/0009-0002-9895-2079

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Corresponding Author
Nguyen Minh Giam

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ABSTRACT: In the context of the educational reform under the 2018 General Education Curriculum, designing competency-oriented exercises for the Natural and Social Sciences subject is an urgent requirement but remains a major challenge for many primary school teachers. This article presents a scientific 4-step exercise design process aimed at developing "the competency of exploring the surrounding natural and social environment" for students through a case study on the theme "Family" in Grade 2. Based on the analysis of theoretical foundations and practical surveys, we have specified this competency into 3 core behavioral indicators (T1, T2, T3) and successfully designed a system of 54 exercises associated with practical situations, accompanied by a 3-level evaluation Rubric.

To verify its effectiveness, a quasi-experimental study was conducted on 57 Grade 2 students (including 28 students in the experimental group and 29 students in the control group) in Da Nang city. The results of the qualitative process evaluation via Radar charts show the progressive and steady improvement of the experimental group. Quantitatively, the average score of the comprehensive test of the experimental group reached 7.64 points, significantly higher than the 7.03 points of the control group; in particular, the rate of Good - Excellent scores in the experimental group reached 50% compared to 31.03% in the control group. The research results affirm that the proposed process and exercise system have high feasibility, resolve the difficulties regarding learning materials for teachers, and contribute to substantially improving the teaching quality of the Natural and Social Sciences subject at the primary school level.

1. INTRODUCTION

The 2018 General Education Curriculum in Vietnam marks a major transformation in primary education, shifting from a mere focus on knowledge transmission to an orientation toward the comprehensive formation and development of students' qualities and competencies. In this context, the Natural and Social Sciences subject plays a foundational role in helping students perceive, explore, and learn how to interact appropriately with the surrounding world. However, to achieve this goal, teaching methods cannot remain stagnant. The use of exercises requires a fundamental change: shifting from merely testing rote memorization to designing meaningful learning situations that require students to synthesize knowledge and personal experience to solve practical problems.

Although the necessity of this reform orientation is well recognized, the reality of implementation in primary schools reveals a situation with many limitations. Through a practical survey of teachers teaching the Grade 2 Natural and Social Sciences subject in Da Nang city, we observed a paradox: the majority of teachers clearly understand the importance of competency-based exercises, but when it comes to implementation, they encounter numerous barriers. Many teachers admit to experiencing confusion during the

exercise design phase, facing difficulties in selecting formats, and failing to accurately identify the focus of the targeted competency objectives. Particularly, the root cause of these difficulties is the lack of instructional materials and sample examples.

The absence of a system of learning materials and a standardized exercise design process has directly affected the learners' reception process. When dealing with current exercises, the majority of Grade 2 students confess that they frequently do not understand the requirements and do not know how to complete them. This highlights a reality: without exercises designed following a proper process, suitable for their developmental psychology, and closely tied to their familiar living environment, it will be very difficult for education to spark learning interest and foster competencies in a substantial way.

Stemming from the aforementioned gaps and urgent practical demands, this study was conducted with the desire to directly resolve these difficulties for teachers. The article focuses on proposing a scientific 4-step exercise design process, while also introducing a set of measurement tools and demonstrating its effectiveness through a case study on the theme of "Family" in Grade 2. We expect that the research results will not only provide a practical pedagogical solution that empowers teachers to autonomously design learning materials, but also make a significant contribution to fostering the competency of exploring the surrounding natural and social environment for primary school students.

2. RESEARCH METHODOLOGY

To resolve the shortage of learning materials and objectively evaluate the development of students' competencies, this study was conducted through a combination of designing pedagogical tools and organizing controlled experiments. Specifically as follows:

2.1. Exercise design process framework

To ensure the exercise system closely aligns with the objectives of the 2018 General Education Curriculum and is suitable for the psychology of Grade 2 students, we conducted the design following a scientific 4-step process, inherited from reputable professional guidelines (Ministry of Education and Training, 2018b; Nguyen Thi Hanh, 2019): Step 1: Research the curriculum and textbooks. Review the expected learning outcomes of the lesson to serve as a basis for accurately formulating the exercise objectives (Ministry of Education and Training, 2018b). Step 2: Determine the position and purpose of the exercise. Clarify at which stage of the teaching process the exercise will be used (warm-up, knowledge formation, practice, or application), thereby selecting the corresponding format and quantity of exercises (Nguyen Thi Hanh, 2019). Step 3: Design the exercises. Directly construct learning tasks associated with practical situations, prioritizing creating opportunities for students to observe and experience. Step 4: Analyze, revise, and finalize. Review and adjust the content and format of the exercises to ensure accuracy and practical applicability. Based on this process, we have successfully designed a system consisting of 54 practical exercises for 3 core lessons under the theme "Family".

2.2. Competency measurement and evaluation framework (Rubric)

To have an accurate measurement tool for students' progress, we proceeded to encode the Competency of exploring the surrounding natural and social environment into 3 core behavioral indicators: T1: Ask simple questions about surrounding objects, phenomena, and relationships. T2: Perform simple observations and practices to inquire into objects and phenomena. T3: Give remarks, compare the similarities, differences, and changes of objects and phenomena. At the same time, strictly adhering to the regulations on primary student evaluation (Circular 27/2020/TT-BGDĐT), each behavioral indicator was established into a specialized Rubric with 3 development levels: Level 1 (M1), Level 2 (M2), and Level 3 (M3). This division reflects the progressive trajectory from the initial recognition ability to the level of understanding and practical application of students.

Table 1. Evaluation criteria for the competency of exploring the surrounding natural and social environment

Evaluation criteria	Level 1 (M1)	Level 2 (M2)	Level 3 (M3)
T1. Ask simple questions about some surrounding objects, phenomena, and relationships in nature and society.	Ask simple questions about familiar objects and phenomena.	Ask questions showing the connection between objects and phenomena.	Ask inferential or hypothetical questions, demonstrating deeper thinking.
T2. Perform simple observations and practices to inquire into surrounding objects, phenomena, and relationships in nature and society.	Observe or perform simple operations with guidance.	Know how to combine observation and simple operations to collect information.	Observe carefully, know how to ask questions or draw remarks from practice.
T3. Give remarks on external characteristics, compare the similarities and differences between surrounding objects and phenomena, and their changes over time in a simple way through observation and practice results.	Give simple remarks on the external characteristics of objects or phenomena after observation.	Give remarks and compare a few similarities and differences between two objects or phenomena.	Give remarks on the changes of objects/phenomena over time and compare them analytically.

2.3. Subjects and pedagogical experimental design

The study uses a quasi-experimental method (controlled experiment) to verify the effectiveness of the exercise system. Research sample: We selected a sample of 57 Grade 2 students at Duy Phuoc No. 2 Primary School (Da Nang City). Among them, Class 2B (28 students) was selected as the Experimental Group (learning with the designed competency-based exercise system) and Class 2C (29 students) as the Control Group (learning with the traditional method). The two classes have equivalent learning conditions and input quality. In-depth case study (Case Study): To have a clear view of the competency transformation of each individual, within the Experimental Group, we randomly selected 8 students representing 3 academic performance groups (3 Excellent students, 3 Completed students, and 2 Not completed students). The behavior of these 8 students was closely monitored and recorded using evaluation forms throughout each lesson to draw Radar charts describing the development trajectory of the 3 indicators T1, T2, and T3. Quantitative measurement: After completing 3 experimental lessons under the theme "Family", both groups took a comprehensive evaluation test to statistically compile and compare the degree of difference in scores.

3. RESEARCH RESULTS: A CASE STUDY IN GRADE 2

3.1. Results of applying the learning material design process

Based on the proposed 4-step process, the study successfully designed a learning material system consisting of 54 exercises developing the Competency of exploring the surrounding natural and social environment. This system is allocated to 3 core lessons under the Grade 2 "Family" theme, including: Lesson 1 - Generations in the family (21 exercises); Lesson 2 - Occupations of adults in the family (10 exercises); and Lesson 3 - Preventing poisoning at home (23 exercises).

The difference in this exercise system is the shift in focus from testing memorization to solving practical situations. Typically, in Lesson 3 (Preventing poisoning), instead of asking students to copy down the causes of poisoning, we designed a "Doctor role-playing exercise" (Exercise No. 10), requiring students to role-play as a doctor to explain to their friends the reasons for food and drink poisoning. This type of exercise not only creates interest but also helps teachers directly measure students' ability to make remarks and link problems (Indicator T3).

Table 2. Statistics of the exercise system developing the competency of exploring the surrounding natural and social environment designed for the theme "Family"

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No.	Lesson name	Number of exercises	Focus of measured competency indicators
1	Lesson 1: Generations in the family	21	T1, T2, T3
2	Lesson 2: Occupations of adults in the family	10	T1, T2, T3
3	Lesson 3: Preventing poisoning at home	23	T1, T2, T3
Total	**The entire Grade 2 "Family" theme**	**54**	**Comprehensively covering 3 indicators T1, T2, T3**

3.2. Competency development through qualitative evaluation

To closely monitor the transformation in the Competency of exploring the surrounding natural and social environment, we conducted an in-depth case study through continuous evaluation of 8 random students belonging to 3 different academic performance groups (Excellent, Completed, Not completed) in the Experimental Class 2B. Their behaviors were evaluated through 3 indicators (T1, T2, T3) and 3 levels (M1, M2, M3) throughout 3 experimental lessons (TN1, TN2, TN3). The monitoring results show a positive development trajectory as follows: For the Excellent student group: Typically, student P.L.M.A, right from the first lesson, achieved level M3 in all 3 indicators T1, T2, T3 and maintained this level steadily until the final lesson. For the Not completed student group: The progress was most clearly demonstrated. Specifically, in the case of student N.M.N in Lesson 1 (TN1), the student only achieved level M2 in the indicators of observation and practice (T2) and making remarks and comparison (T3). However, thanks to continuous training through practical situations with advanced repetition, by Lesson 3 (TN3), the student had improved and achieved level M3 in indicator T3. Overall, across all 8 studied cases, the behaviors constituting the students' Competency of exploring the surrounding natural and social environment all tended to increase in scores to level M3, with absolutely no student showing a decrease in behavioral manifestation. This proves that the teaching process and the designed exercise system are completely suitable for the cognitive development zone of the students.

Table 3. Summary of changes in behavior scores (T1, T2, T3) of 8 case study students across 3 experimental lessons *(Evaluation level convention: M1 = 1.0 point; M2 = 2.0 points; M3 = 3.0 points)*

Initial competency group	Student name	Lesson 1 (TN1) *(T1 - T2 - T3)*	Lesson 2 (TN2) *(T1 - T2 - T3)*	Lesson 3 (TN3) *(T1 - T2 - T3)*	Evaluation of overall progress trend
Excellent group	P.L.M.A	3.0 - 3.0 - 3.0	3.0 - 3.0 - 3.0	3.0 - 3.0 - 3.0	Stable at the maximum level (M3)
	N.T.T.D	3.0 - 3.0 - 3.0	3.0 - 3.0 - 3.0	3.0 - 3.0 - 3.0	Stable at the maximum level (M3)
	Đ.N.T.N	3.0 - 3.0 - 2.0	3.0 - 3.0 - 3.0	3.0 - 3.0 - 3.0	Increase in indicator T3 to M3
Completed group	P.N.M	3.0 - 3.0 - 2.0	3.0 - 3.0 - 3.0	3.0 - 3.0 - 2.0	Well-maintained levels M2, M3
	Đ.T.G.H	3.0 - 3.0 - 2.0	3.0 - 2.0 - 2.0	3.0 - 2.0 - 2.0	Maintain a stable level
	L.N.D.K	3.0 - 3.0 - 2.0	3.0 - 3.0 - 2.0	3.0 - 3.0 - 2.0	Maintain a stable level
Not completed group	D.M.Đ	3.0 - 2.0 - 2.0	3.0 - 2.0 - 2.0	2.0 - 3.0 - 2.0	Strong improvement in indicator T2
	N.M.N	3.0 - 2.0 - 2.0	3.0 - 2.0 - 2.0	2.0 - 2.0 - 2.0	Show a positive shift

3.3. Intervention effectiveness through quantitative evaluation

To evaluate the impact of the exercise system on the overall learning outcomes most objectively, after completing 3 experimental lessons, we organized a comprehensive test for all 57 students (including 28 students in Experimental Class 2B and 29 students in Control Class 2C). Statistical results showed a clear difference in favor of the pedagogically intervened group.

Regarding the average score, the Experimental class reached 7.64 points, significantly higher than the 7.03 points of the Control class. More notably is the shift in the score distribution:

In the Experimental class (2B), the score distribution concentrated heavily in the Good - Excellent range. Up to 14/28 students (accounting for 50%) achieved scores from 8 to 10. The number of students achieving absolute scores (10 points) was 5 students (equivalent to 17.85%).

In contrast, in the Control class (2C), the score distribution was mainly distributed in the Average - Good range. The number of students scoring 6 and 7 reached 17/29 students (accounting for nearly 60%). The number of students scoring 8-10 only accounted for about 31.03%.

Table 4. Frequency distribution and average score results of the comprehensive test at the end of the "Family" theme

Score (Xi)	Control Group (2C): Quantity	Control Group (2C): Rate (%)	Experimental Group (2B): Quantity	Experimental Group (2B): Rate (%)
Score 5	3	10.34%	2	7.14%
Score 6	9	31.03%	6	21.42%
Score 7	8	27.58%	6	21.42%
Score 8	4	13.79%	5	17.85%
Score 9	3	10.34%	4	14.28%
Score 10	2	6.89%	5	17.85%
Total	**29**	**100%**	**28**	**100%**
Average score	**7.03**		**7.64**	

An in-depth analysis of the frequency distribution of scores (Xi) instead of relying solely on the average score (7.64 compared to 7.03) has clearly demonstrated the substantial quality and effectiveness of the intervention measure. The data shows a positive shift in the score distribution in favor of the Experimental class: the rate of students achieving Good - Excellent scores (8-10 points) increased to 50% compared to 31.03% in the Control class; in particular, the rate of absolute scores (10 points) increased nearly threefold (from 6.89% to 17.85%). In parallel, the Average - Good score range (5-7 points) sharply decreased from 68.96% (Control class) to only 50% (Experimental class). This transformation in the score structure affirms: the competency-oriented practical exercise system not only helps mainstream students easily absorb the lessons and reduces the rate of low scores, but also promotes and maximizes the problem-solving application thinking of the good and excellent student group, creating a substantial and profound elevation in educational quality.

From the qualitative and quantitative data mentioned above, there is a basis to affirm that: Organizing teaching by allowing students to actively solve the practical exercise system instead of passively memorizing has stimulated their enthusiasm, enhanced their

ability to explain phenomena, thereby directly promoting the development of their Competency of exploring the surrounding natural and social environment.

4. DISCUSSION

From the results obtained through the case study in Grade 2, we realize that applying the competency-oriented exercise design process has brought positive impacts, directly solving the problems currently existing in the practical teaching of the Natural and Social Sciences subject.

4.1. Resolving the practical issue of learning materials for teachers

As presented in the Introduction section, the biggest barrier that makes teachers hesitate to innovate teaching methods is their confusion during the exercise design phase (63.3%) and the shortage of sample examples (46.7%). The results of this study have directly removed that difficulty. The proposed 4-step process is not merely theoretical but has been concretized into a system consisting of 54 specific exercises for the theme "Family". Qualitative feedback from teachers directly participating in the experiment shows: this exercise system provides excellent support for organizing teaching, helping them easily cover, observe, and accurately evaluate the progress of each student based on a clear Rubric system. This affirms that the process proposed by the study is a pedagogical tool with high applicability and transferability.

4.2. The substantial shift in students' cognitive quality and learning attitude

The superiority in the average score (7.64 compared to 7.03) and the uniform expansion of the Radar charts in the Experimental group are not random results, but stem from the nature of the designed exercises. While traditional exercises merely stop at requiring students to reproduce knowledge (e.g., Naming family members), competency-based exercises have placed them in meaningful practical situations (e.g., Role-playing as a doctor to handle poisoning, drawing their own family generation diagram).

It is the integration of learning content with familiar living contexts that helps students become more interested and proactive. Process observation data show that students become bolder and more confident in asking questions (Indicator T1), know how to share, cooperate, and are not afraid to participate in problem-solving activities (Indicators T2, T3). These exercises have succeeded in shifting students from a state of "passive reception" to a state of "active knowledge construction", thereby significantly reducing the rate of underperforming students and significantly increasing the rate of good and excellent students.

4.3. The generalizability of the measurement toolset

Another important contribution of the study is the successful encoding of the Competency of exploring the surrounding natural and social environment into 3 behavioral indicators (T1, T2, T3) corresponding to 3 levels (M1, M2, M3). This approach is completely compatible with the spirit of evaluating primary school students according to the current Circular 27 of the Ministry of Education and Training (Ministry of Education and Training, 2020). Therefore, although this study limits its experimental evidence to the Grade 2 "Family" theme, the process framework and the Rubric toolset can be completely replicated to design and evaluate other themes, or even other grades at the primary school level.

4.4. Limitations of the study

Besides the positive results, this study also has certain limitations. Specifically, the experimental and survey sample has only been implemented on a narrow scale at Duy Phuoc No. 2 Primary School and Duy Nghia No. 4 Primary School (Da Nang City). Therefore, the test results, although showing significant differences, still need to be further replicated and verified on larger samples, in regions with different socio-economic conditions to affirm the absolute sustainability of the model.

5. CONCLUSION

This study was conducted stemming from practical concerns regarding how to resolve the bottleneck of learning materials for primary school teachers when approaching the 2018 General Education Curriculum. Through this article, we have systematized and successfully proposed a competency-oriented 4-step exercise design process, while establishing a specialized measurement toolset (Rubric) with 3 core behavioral indicators (T1, T2, T3) corresponding to 3 development levels. Based on that solid theoretical framework, a system consisting of 54 practical exercises closely associated with the context of the Grade 2 "Family" theme has been completely designed. These are the most direct and practical contributions in terms of teaching methodology that this article brings.

The results of the pedagogical experiment have clearly demonstrated the effectiveness and feasibility of the proposed solutions. The transition from the type of exercises requiring rote memorization to learning tasks associated with practical situations (such as observing, role-playing, and handling problems in the family) has created a strong driving force for students' cognitive development. Process evaluation data (via Radar charts) show the progressive and steady improvement of students in all 3 aspects: the ability to ask questions, perform observations and practices, and the competency to make remarks and comparisons. Quantitatively, the superiority in the average score (7.64 compared to 7.03) and especially the increase in the rate of Good - Excellent scores to 50% in the experimental group have affirmed the substantial learning quality created by this exercise system.

In conclusion, designing and utilizing the competency-oriented exercise system not only helps Grade 2 students become excited and proactive in exploring knowledge but also profoundly fosters their love and responsibility towards their families. We believe that

this design process and evaluation framework can completely become a useful reference material for primary school teachers. Furthermore, this model has great potential to be flexibly replicated across other themes and grades, contributing to fully realizing the goal of forming and developing the competency of exploring the surrounding natural and social environment for students.

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