

FOSTERING EXTERNAL DIDACTIC TRANSPOSITION CAPABILITY OF STUDENTS OF PHYSICS EDUCATION: A CASE STUDY IN VIETNAM

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Abstract

The external didactic transposition capability consists of 5 competence elements based on the didactic transposition theory and the concept of competence. In this research, fostering the didactic transposition capacity is understood as the process of equipping more knowledge, skills about didactic transposition and didactic transposition capacity to improve the didactic transposition capacity of pedagogical students. The fostering course is proposed based on the current status of this capacity of physics students at Thai Nguyen University of Education, Hanoi Pedagogical University 2. It has followed the structure of capacity, the defined process, and promoting self-study as well as applying information technology in practical teaching. The assessment of students' competencies in the refresher course focuses on the process assessment and considers the progress of students compared to themselves by using tools such as tests, exercises and assignments, tablets. The results of pedagogical experiment have proved the feasibility of the training process, the dependence of the external didactic transposition competence on student behavior.

Keywords: Competence fostering, external didactic transposition competence, physics pedagogical students.

1. Introduction

Didactic transposition is the task of converting the scholarly knowledge into knowledge to be taught in the curriculum of textbooks, then transforming from the knowledge to be taught into taught knowledge in the classroom [1]. The didactic transposition process consists of two phases: external didactic transposition and internal

didactic transposition [2]. There are two transposition chains during the teacher training process. Pedagogical students have two different roles in this chain. In the one hand, they are learners in the first transposition chain. In the other hand, they are people who carry out the transposition process in the second transposition chain. These chains are also corresponding to the current training stages in pedagogical universities [3].

Didactic transposition competence can also be interpreted as the ability to transform from the scholarly knowledge (represented in books, textbooks (universities) and other sources) into the knowledge to be taught in the curriculum, textbooks and from the knowledge to be taught into taught knowledge in the classroom in the context of specified curriculum subjects based on the combination of understanding about didactic transposition, knowledge to be transformed as well as the requirements of transposition with skill and attitude. We have suggested the structure of didactic transposition competence consists two components: the external didactic transposition competence (EDTC) and the internal didactic transposition competence (IDTC) (corresponding to two stages of the didactic transposition process). They all have 5 competence elements with 15 behavior indicators (signed EDTC₁, EDTC₂, EDTC₃, EDTC₄, EDTC₅ and IDTC₁, IDTC₂, IDTC₃, IDTC₄, IDTC₅) [4]. In Vietnam, researches on students' EDTC have been paid more attention, shown in dissertations on fostering the teaching capacity for teachers and pedagogical students (PSs).

In the past 5 years, the researchers have focused on: Fostering teaching skills at angles [5], forging exercise teaching skills [6] for physics PSs; Fostering/developing/improving the integrated teaching competencies for Geography PSs of [7], teaching capacity by using micro methods [8]; fostering/developing/improving the integrated teaching capacity for Chemistry PSs [9, 10], for junior high school teachers [11]; Forging lesson design skills [12, 13]; designing teaching situation of Maths for

Primary PSs [14]. In addition, there are training differentiated teaching skills [15]; Developing the capacity to apply positive teaching methods to Chemistry PSs [16]... Studies have paid attention to the peculiarities of teaching subjects, contributing to perfect teaching capacity for students. Pedagogical staff members of various specialties, thereby contributing to the improvement of students' learning quality. In terms of EDTC, no research has been conducted methodically and explicitly. For teachers or PSs, the EDTC is actually the capacity of didactic transposition analysis but it has paid much attention to analyzing the current general curriculum and textbooks, not paying much attention to the projection of knowledge from university level down to high school.

The purpose of this research was to propose a fostering process - a way to foster the EDTC for students thereby helping to improve this competence for Physics PSs.

2. Methods

Methods used in this research included: theoretical research, survey, pedagogical experiment and case study method.

- Theoretical research method:

This method was used to gather relevant documents on fostering, fostering competence, the structure of didactic transposition competence, assessment and evaluation according to ability. Since then, we have offered the concept of supporting didactic transposition competence, training process, levels of EDTC and evaluation tools of EDTC.

- Investigation and survey method:

We used investigation and survey method to assess the level of EDTC and IDTC of physics PSs at Thai Nguyen University of Education and Hanoi University of Education 2. We also evaluated the limitations and strengths of students then propose the modules to foster the components of the didactic transposition competence.

Survey tool was a questionnaire that included: the awareness of students about didactic transposition competence, the self-assessment of students about their levels of didactic transposition competences, the students' assessments about the frequency of component competences fostering and their desire to be fostered competence components.

Survey subjects were 164 third-year physics PSs and 147 fourth-year physics PSs from Hanoi Pedagogical University 2, Thai Nguyen University of Education. The survey period was from August 2016 to February 2017. The results of the questionnaire were listed according to the percentage of respondents.

- Pedagogical experiment method:

- The experiment purpose was to evaluate the effectiveness of the didactic transposition competence training process.

- The contents of experiment: Fostering EDTC for physics PSs through two modules: "Module 1: Knowledge of didactic transposition, didactic transposition capability" and "Module 2: External didactic transposition capability". In which, module 1 provided students with the most basic

concepts of didactic transposition, important terms in the transposition process. Module 2 focused on fostering three competence elements, namely EDTC₁, EDTC₂, EDTC₃, and instructed students to self-cultivate elements EDTC₄ and EDTC₅ using situations-related knowledge exercises in Mechanics and Thermology.

- Pedagogical experiment is conducted in 2 times:

- +) The first pedagogical experiment times: Conducted with 15 second-year physics PSs of the 50th course of Thai Nguyen University of Education (External didactic transposition group TN₁) from March 13th 2017 to May 28th 2017. The task of the first experiment round (experimental pedagogical exploration) was to study how to draw out the shortcomings and limitations of training materials to evaluate and adjust documents as well as activities in the training process; complete and standardize measurement tools of EDTC.

- +) The second pedagogical experiment times: Conducted with 21 junior students of physics pedagogy, the 50th course of Thai Nguyen University of Education, divided into 2 groups (didactic transposition group TN₂ - 11 students and didactic transposition group TN₃ - 10 students) from September 5th 2017 to December 30th 2017. The second task of round 2 (official pedagogical experiment) was to adjust teaching and overcoming existing problems of the first pedagogical experiment times, to follow up specific case studies to assess the progress of competency elements.

- In each pedagogical experiment times, we carried out the following tasks:

Teaching with experimental groups which have been chosen to foster knowledge about didactic transposition and element capacities of EDTC according to the plan; Collecting evidences related to refresher activities (including: results of learning cards; tests; attitude questionnaires; checklists of attitude and behavior; essays, etc...); Assessing the progress of capacity elements through the levels achieved by behavior indicators; Analyzing the results of pedagogical experiment after each times to find the correlation between component competencies, the correlation between transposition knowledge and component competencies with attitudes and behaviors.

- Case study method:

Selecting and analyzing the characteristics of the 2 students' EDTC to clarify the results obtained from pedagogical experiment. Of which, one student had the best expression during the training process, an other student had not really been active in the training process.

3. Results and discussion

3.1. The concept of fostering and fostering didactic transposition capability

Fostering is to equip more knowledge and skills with the aim to improving and perfecting the operational capacity in specific fields [17] (narrow meaning). Combining the concept of fostering and the above didactic transposition capability, fostering didactic transposition competence in research is understood as the process of equipping more knowledge, skills about didactic transposition, didactic

transposition capacity to improve the didactic capacity of PSs. The improvement starts from “weak, poor to fair, good”, from substandard to standard. Fostering is on the basis of what is available, researching is to find out how to foster on the basis of what is available and on the basis of learning characteristics of university students (self-study, self-training, groupwork, learning through experience, ...). The research does not research thoroughly about the process of formation and development of didactic transposition capability in students. We only consider the process of fostering didactic transposition capacity in PSs is the process of purposeful impact from the training institution and the students themselves made the didactic transposition capacity of students develop from the low level to the high one, from simple to complex, from less to more completed.

3.2. The status of didactic transposition capability of Physics pedagogical students

The results of survey show that:

- Regarding the level of fostering the elements of the EDTC: Very few students assessed the frequency of fostering all the components of the EDTC as “very often”. Most of the comments said that the competency components are “occasionally” fostered. As for the EDTC₅ component, the majority of students (77.17%) said that was “rarely” fostered, a small percentage of students (18.01%) thought that the pedagogical schools “sometimes” fostered them.

- Regarding the quality of fostering EDTC: many students (67.85%) assessed that pedagogical schools had fostered EDTC but have not yet concretized the competence elements and their performance criterias. A modest proportion (18.01% and 11.58%) said that the refresher activities which were conducted very well and not very well, should be conducted more.

Without specificization of the elements of the EDTC will make it is difficult to detect at which stage the student is limited and the construction of the assessment tool will not be close. From the theoretical and practical issues that allow us to determine that building the training programs to develop EDTC for Physics PSs has the base.

3.3. The process of fostering external didactic transposition capability for Physics pedagogical students

The structure of the EDTC has 5 elements [4]: Analyze the knowledge of different stages in the transposition process ($EDTC_1$); Analyze the objectives, knowledge contents in the textbooks ($EDTC_2$); Analyze the diagram of the scientific process of knowledge development and applyinication ($EDTC_3$); Point out the applications of knowledge in techniques and in practice ($EDTC_4$); Restructure the knowledge content in the textbooks ($EDTC_5$).

We have built an EDTC fostering process including 4 stages (Figure 1). When conducting training, we foster each element of the EDTC. With each competence element, we also built our own implementation steps.

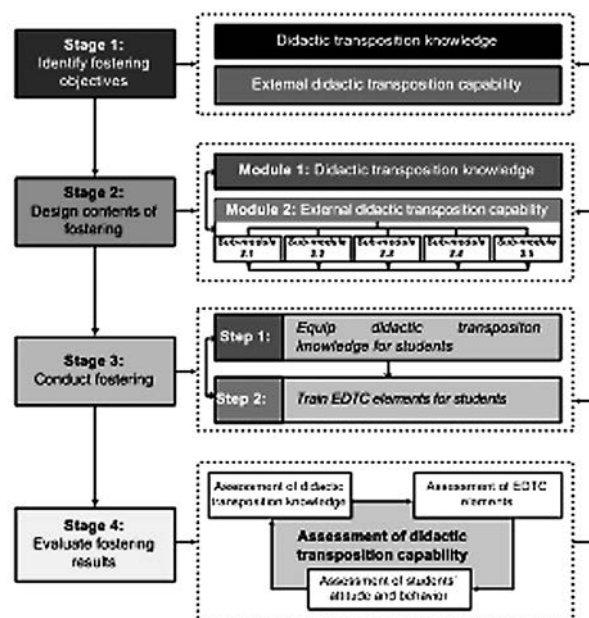


Figure 1. Process of fostering external didactic transposition capability for Physics pedagogical students

Example 1: The process of fostering element EDTC_j:

Step 1: Locate the knowledge in different types of documents.

Step 2: Determine the type of knowledge contents presented in the curriculum and the textbooks.

Step 3: Compare the level of knowledge contents between the curriculum and the textbooks.

Step 4: Indicate the knowledge presentation and formation in different documents.

Step 5: Demonstrate the differences in the levels of knowledge content, knowledge presentation and formation.

3.4. The level of external didactic transposition capability

Based on the structure of EDTC of Physics PSs, we have proposed 5 development levels of EDTC elements and the development model of EDTC elements as follows:

Table 1. The level of development of EDTC elements

Level	Description	Standard score
5	Fully comply with the requirements in the behavior indicators of element competence in similar situations and new situations with good use of the guidance process.	42 - 50
4	Fully comply with the requirements the behavior indicators of element competence in familiar situations with good use of the guidance process.	34 - 41
3	Relatively comply with the requirements the behavior indicators of element competence in familiar situations with some errors, lack and quite good use of the guidance process.	26 - 33
2	Partially comply with the requirements the behavior indicators of element competence in some given situations and not good use of the guidance process.	18 - 25
1	Comply with very few requirements the behavior indicators of element competence in the given situation with no use of the guidance process.	1 - 17

The development line of a certain competence element of EDTC is shown in figure 2.

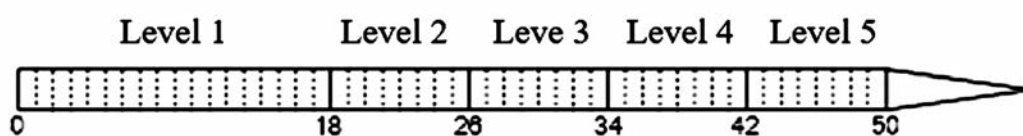


Figure 2. The development of competence element of EDTC

3.5. The tool for evaluating external didactic transposition capability

In order to measure the level of EDTC during the fostering process, we simultaneously assess the knowledge of

didactic transposition, evaluate the EDTC elements and assess the attitude, behaviors that students exhibit when participating in the capacity fostering program. EDTC assessment tools are as the followings:

Table 2. The method of evaluating the content of didactic transposition competence

Contents	The measurement tools and data processing
Didactic transposition knowledge	<ul style="list-style-type: none"> - Using a standardized test, the scores are marked on a scale of 50 applies to students after they have completed the tasks of the training course. The test is independently scored by 3 lecturers with the same expertise to ensure that the fair results are obtained. - The test score data of students' knowledge after classification will be used to compare the correlation with the attitude observation board, as well as assessing the competency element of each student.
External didactic transposition skills	<ul style="list-style-type: none"> - We use students' study cards in each fostering sub-module, exercises that students performed at the end of each sub-module. We analyze them to assess the level of expression of behavior indicators appropriate with individual competency element: <ul style="list-style-type: none"> +) Qualitative assessment of EDTC is based on the evaluation sheet according to the specific criteria for each element of the capability to be fostered. +) Quantitative assessment of EDTC is based on test scores and classification scales. Study cards and the final essay are evaluated on a scale of 50, and combined with the evaluation guide according to criteria to convert the performance level of each student for each behavior indicator of capacity component. <ul style="list-style-type: none"> ▪ The assessment of the EDTC level of students achievement is conducted during the refresher course, thereby showing the student's progress/change with those elemental competencies. ▪ The information collected is used to compare correlation with knowledge test points with attitude and behavior points.
Attitudes and behaviors of students with the fostering of didactic transposition capability	<ul style="list-style-type: none"> - Students self-assess their attitude by answering questionnaires about the attitude and questions of the interview outline. - Students assess each other about the awareness of participating in activities, each individual will evaluate the remaining students in the group and lecture will also evaluate students through the checklist. Students' results are averaged by a factor of 0.4. The result of lecturer evaluation for students is multiplied by a factor of 0.6. The formula for calculating points to observe students' attitudes and behaviors is as follows: $TB = \frac{X_1 + X_2 + \dots + X_{N-1}}{N-1} \cdot 0,4 + X_{Lec} \cdot 0,6$ <p>In which N is the number of students of the group; X_1, X_2, \dots, X_{N-1} is the point of the members in the group respectively that are evaluated other members, X_{Lec} is the point that lecturer is marking.</p>

3.6. The results of Pedagogical experiment

• The results of the first Pedagogical experiment times:

At the end of the first round of pedagogical experiment, we have made the following additions and amendments:

Adding definitions of basic concepts such as: scholarly knowledge, knowledge to be taught, taught knowledge, learnt knowledge in refresher documents; Further analysis of the role of reference social practice in

determining the knowledge to be taught; Adding the suggestions in the learning card based on the process that students will have to generalize; Supplementing students with theoretical knowledge (knowledge of logic forming basic knowledge of physics, logical mapping of the process of building science and applying knowledge) to support analysis of content features, knowledge-forming logic; Maintaining regular contact with students so that they can follow the requirements of the job; Responding promptly to the students'

strengths and limitations after each study card so that students can take advantage of their strengths and overcome their limitations.

- The results of the second pedagogical experiment times:

- The assessment of Didactic Knowledge: students have achieved understanding level. Students have named correctly the important concepts in the transposition process (such as: scientific knowledge, knowledge to be taught, taught knowledge), students also have distinguished these concepts. In particular, students have identified the factors that govern the knowledge to be taught, taught knowledge to students and pupils.

- Regarding the didactic transposition analysis skills, students performed quite well in the elements EDTC₁, EDTC₂ and EDTC₄. However, the behavior indicators corresponding to these factors are not uniform. For example, in terms of the ment EDTC₁, students know how to clearly identify knowledge type, exploit the aspects of knowledge content, but they inadequately explain the difference of students' knowledge formation and the explanation of some students is quite similar in terms of knowledge (although it has been instructed quite carefully) (Figure 3).

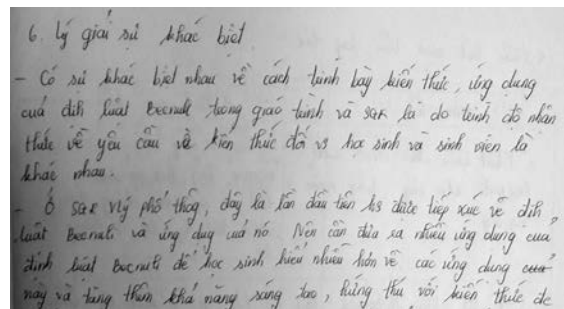
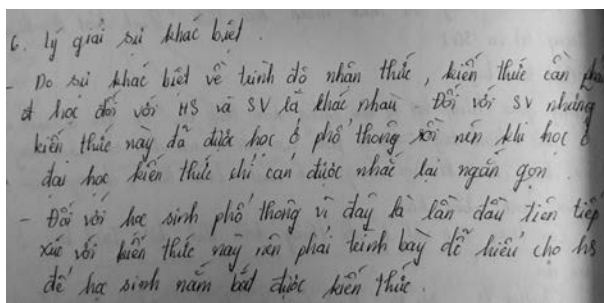


Figure 3. D.T.T.T's explanation of the differences in knowledge formation in the Law of Boyle – Mariotte and the Application of Bernoulli's Law

In terms of EDTC₃, students express well in stages of forming knowledge, especially the concept of physics (physics quantity). They present the stages of knowledge formation pretty good (Figure 3). In the logical diagram of the process of building knowledge and applying knowledge, they confront difficulties in orienting the solution to the given problem.

As for the element EDTC₅, very few students have found unreasonable grades of lessons in the textbook. It is not feasible to propose the logic to form knowledge that is different from textbooks that almost students do not have with the guidance of lecturers. Therefore, we do not perform quantitative analysis of this competency element. This is also a limitation of the research.

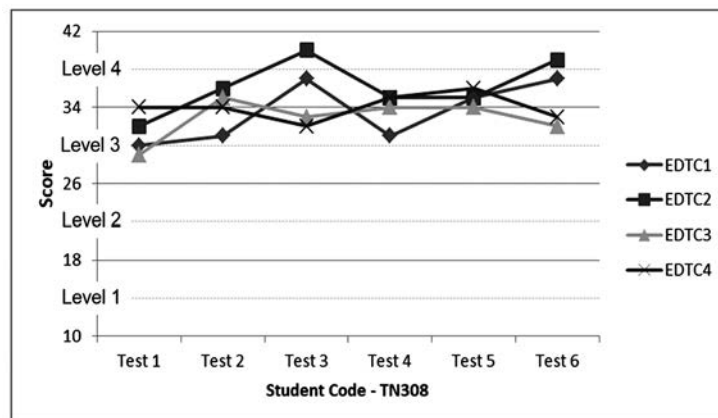


Figure 4. The development of T.T.Tr's the EDTC elements

- Regarding the consciousness of participating in fostering sessions (attitudes and behaviors): students are more excited, shown in performing tasks, students refer to more documents when performing tasks, performing re-assigning tasks when not yet reached, proactively contacting the lecturers with advice, exchanging and answering questions when needed. Through each study session, students are increasingly aware of the meaning, the role of EDTC for the formation and development of occupational competence for themselves. (Student-TN208's opinion: I am interested in the research process of didactic transposition capability and fostering the elements of the EDTC. Studying this process is necessary for PSs, especially physics students...). However, in the process of fostering, there are students who are not really focused on performing the tasks, so the assessment results in knowledge are not good, do not make much progress or have instability in skills in the training process (students TN205, TN206, TN303, TN309).

• Case studies:

- The first case: T.T.Tr (Student code TN308), is a quite active student, studying hard and actively participating and making many contributions to the activities of the class and the department. In class, T.T.Tr also actively participates in discussing, exchanging and sharing ideas with friends.

+) T.T.Tr has an initial classification of all components at level 3, but EDTC4 at level 4. The classification shows that her level 3 is quite close to level 4 so in the process of fostering with her due diligence, she is able to reach level 4 in the components EDTC2, EDTC3 after the first test and maintains that achievement until the end of the training. From the graph in Figure 4, it can be seen that she has the advantage of analyzing the goal, the features of knowledge content (EDTC2), and analysis of knowledge at different stages in the transposition process (EDTC1).

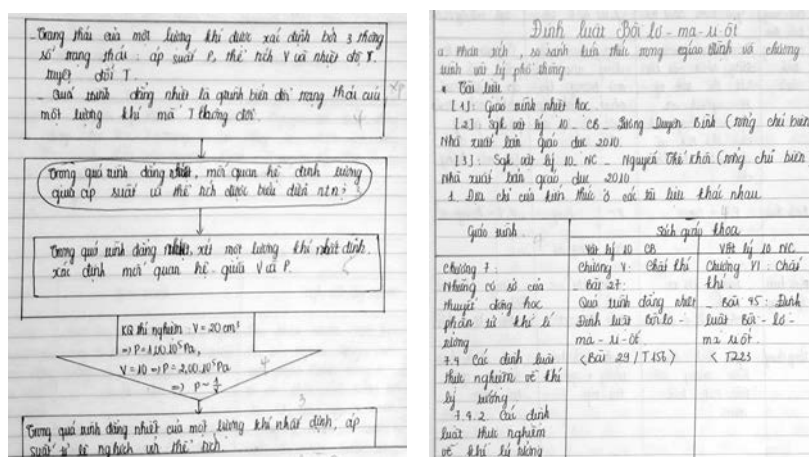
+) T.T.Tr's advantages and disadvantages during performing external didactic transposition are shown in Table 3:

Table 3. Advantages and limitations of T.T.Tr when performing external didactic transposition

Elements	Advantages	Disadvantages
EDTC1	<ul style="list-style-type: none"> - Referring to various sources (Mechanical textbook - Dao Van Phuc, Mechanical textbook - Vu Thi Hong Hanh, Physical textbook Vol.1 - Luong Duyen Binh, Thermal textbook - Nguyen Huy Sinh); Identify quite well enough knowledge in different documents, with different knowledge. - Stating quite fully the features of knowledge content, and comparing the level of knowledge content in college curriculums and textbooks. - Identify the presentation and formation of knowledge in college textbook and textbooks; explain the difference between them. 	<ul style="list-style-type: none"> - Some tasks have not yet fully identified the type of knowledge: Molecular kinetic theory (lack of lessons on experimental laws, internal energy variation), Lesson gravity (lack of the section on attractive potential);
EDTC2	<ul style="list-style-type: none"> - Identifying and explaining the considering knowledge; - Identifying and analyzing the goals quite deeply according to the level of thinking. - Analyzing the characteristics of knowledge in one type of textbook; 	<ul style="list-style-type: none"> - The horizontal comparison of the characteristics of that knowledge between basic and advanced textbooks been profound.
EDTC3	<ul style="list-style-type: none"> - Identifying the path to forming knowledge under review; - Identifying the stages of knowledge formation in textbooks; - Identifying questions, problems to be solved, identify problem models and methods to solve problems, the knowledge to be built in the problem. - Drawing a logical diagram of the scientific process of building and applying knowledge. 	<ul style="list-style-type: none"> - Not deeply analyzing the characteristics of each stage of knowledge formation;
EDTC4	<ul style="list-style-type: none"> - Indicating and describing quite fully and elaborately the applications of knowledge in practice. - Identifying the role of knowledge in other subjects. 	<ul style="list-style-type: none"> Analyzing the role of knowledge in some test is not adequate enough.

+) Evaluating T.T.Tr's attitudes and behaviors during the training course:

In the process of training, it can be said that T.T.Tr is a member who always completes on time the tasks assigned by the lecturer and is also very active in re-implementing the tasks when she is not satisfied. She is also not afraid to share her insights with friends and is also a great help to the rest of the group, especially L.T.H.Y.

**Figure 5. The illustration of the good parts in T.T.Tr's tests**

- The second case: V.T.T.H (Student code TN303), has a quite strong personality, likes taking part in social activities.

After the training process of V.T.T.H, there was also progress in competency component levels. However, this progress in some components is not good (EDTC1, EDTC2). V.T.T.H had quite a significant difference in the level of competency components. From the graph of Figure 6, we can see that EDTC4

is her advantage. However, before and after fostering this element was still at level 3. The only difference is that the level of EDTC4 was pretty close to level 4 at the end of process. EDTC3 only reached the threshold of level 3 after the training process.

- V.T.T.H's advantages and disadvantages during external didactic transposition are shown in Table 4.

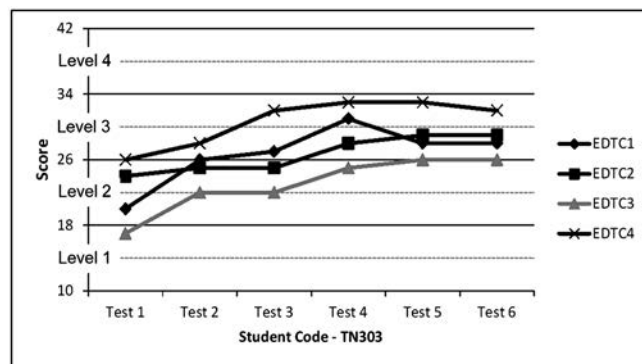


Figure 6. The development of V.T.T.H's the EDTC elements

Table 4. Advantages and limitations of V.T.T.H when performing external didactic transposition

Elements	Advantages	Disadvantages
EDTC1	Identifying the knowledge type quite completely compared to the request; Performing well the introduction and comparison of the level of knowledge content in some tests such as knowledge of Gravity Force;	Stating the content, comparing the content characteristics in some knowledge is simple (eg knowledge of applications of Bernoulli Law).
EDTC2	Identifying the type of knowledge; Identifying some teaching goals by levels.	Not explaining why the conclusion was that type of knowledge; Using words that cannot be quantified in some expressing of lesson goals (Example: Understanding the concept of gravity, the laws of universal gravitation); Analysis of the features of knowledge content in physics textbooks has not clearly separated the qualitative characteristics, quantitative characteristics, concept definitions, measurement units, applications of concepts (Acceleration concept); Some knowledge still does not fully identify the content of knowledge (Example: lacks potential knowledge, motion of matter / matter in gravity when presenting gravity force).
EDTC3	Identifying the logic for forming knowledge presented in textbooks. Name the stages of knowledge formation.	Not having built the logical process of science to form a knowledge completely. The logical process diagram missed symbols and used wrong symbols.
EDTC4	Naming and describing quite well some practical applications of knowledge; Identifying the role of knowledge in other subjects.	Analyzing the roles of the knowledge in techniques and in practice is not properly, the use of words is still in general.

- Evaluating V.T.T.H's attitudes and behaviors during the training course:

In the process of training, although actively attending school on time, V.T.T.H can sometimes complete the assignments on time. The irregular focus on the performance of tasks leads her to limited listening to the opinions of lecturers and other partners. This is reflected in the fact that although the lecturers have quite detailed instructions, analyzed the limitations that need to be overcome for students in each lesson, her progress is not improved.

3.7. Discussion

After the process of fostering, the results from graphs and analysis show that students have made progress in their didactic transposition skills (competency elements). The level of achievement of component competencies depends on the transposition knowledge and attitude and behavior of students. This relationship is linear. It means that students who is good at knowledge of transposition and attitude, behavior is also good didactic transposition skills.

Attitude and behavior are factors that have great impacts on the progress of the transposition skills. Students are analyzed and orientated about the role of the didactic transposition in the future career in each lesson, they have invested more focus on performing special tasks. Especially they finding solutions to overcome difficulties and complete the task as best as possible by themselves.

4. Conclusions

Pedagogical experiment confirms the use of self-study instruction modules, experiential learning as well as group sharing that contribute to the development of elemental competencies in each student; have shown the reliance on transposition skills of students on knowledge of transposition especially on the attitude and behavior. Since then, in order for the training activities to really have good results, besides explaining to the students the meaning of participating in the training program, it is necessary to coordinate the implementation synchronously and integrate into teaching general Physics subjects in appropriate sub-modules. However, the evaluation of attitudes and behaviors needs to add more diverse tools for the evaluation to gain valuable results. On the other hand, fostering didactic transposition capability for Physics PSs, if possible, should be extended to analyzing the logical structure of a chapter, part of a textbook or whole textbook. Moreover, it is necessary to continue fostering EDTC₅ competence element so that future teachers can really meet the requirements of renovation of general education.

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BỒI DƯỠNG NĂNG LỰC CHUYỂN VỊ DIDACTIC BÊN NGOÀI CHO SINH VIÊN SƯ PHẠM VẬT LÝ: NGHIÊN CỨU TRƯỜNG HỢP Ở VIỆT NAM

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Tóm tắt

Năng lực chuyển vị didactic bên ngoài bao gồm 5 thành tố được đề xuất dựa trên lý thuyết về chuyển vị didactic và khái niệm năng lực. Bồi dưỡng năng lực chuyển vị didactic trong nghiên cứu được hiểu là quá trình trang bị thêm những kiến thức, kỹ năng về chuyển vị didactic, năng lực chuyển vị didactic nhằm nâng cao hoàn thiện năng lực chuyển vị didactic của sinh viên sư phạm. Hoạt động bồi dưỡng được đề xuất dựa trên thực trạng năng lực này của sinh viên trường Đại học sư phạm Thái nguyên, đại học sư phạm Hà Nội 2, và bám sát cấu trúc năng lực, đề cao hoạt động tự học cũng như ứng dụng công nghệ thông tin trong dạy học thực tiễn theo quy trình xác định. Việc đánh giá năng lực của sinh viên trong quá trình bồi dưỡng coi trọng việc đánh giá quá trình và xem xét sự tiến bộ của sinh viên so với chính họ bằng các công cụ như bài kiểm tra, bài tập, nhiệm vụ giao cho sinh viên. Kết quả thực nghiệm sư phạm đã chứng tỏ tính khả thi của quy trình bồi dưỡng, sự phụ thuộc của năng lực chuyển vị didactic bên ngoài vào thái độ hành vi của sinh viên.

Từ khóa: *Bồi dưỡng năng lực, năng lực chuyển vị bên ngoài, sinh viên sư phạm vật lý.*