Teaching Design Process for Modules Belonging to the Specialized Knowledge Block of Information Technology for University Students According to the Competency Approach

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ABSTRACT: The article begins by summarizing the content of "Teaching through a Competency-based Approach", analyzing the curriculum of specialized courses in Information Technology, emphasizing the crucial role of this field in various aspects of life and national development. The focus of the article is on the training objectives in the field of Information Technology, particularly the aim to educate bachelor's degree holders with sufficient knowledge, skills, and political qualities to meet industry requirements. The article lists key Information Technology courses such as databases, computer networks, system analysis and design, programming, information security, artificial intelligence, and software development. Subsequently, the article describes important factors in the teaching process, including teaching tools and methods. This encompasses the necessity of using tools such as simulation software, instructional videos, and diverse teaching methods such as problem-based learning, project-based learning, and case study-based teaching. Finally, the article presents a detailed design process following the competency-based approach, from establishing training outcome standards, aligning objectives with standards, to identifying conditions and criteria for competency implementation in real-world professional settings. The article proposes a specific teaching plan for each specialized course, ensuring the integration of knowledge, skills, and attitudes, as well as the integrity of the teaching process. The article serves as a comprehensive guide on how to design teaching in the field of Information Technology using a competency-based approach. It highlights challenges and opportunities for improving the quality of education in this field in Vietnam.

KEYWORDS: Competency, Competency-Based Approach, Information Technology, Lesson Design, Teaching Tools, Teaching Methods.

INTRODUCTION

Teaching based on competency approach has become an inevitable trend in the era of Industry 4.0, demanding high-quality human resources across various life domains. The focus is on aligning educational goals with the practical demands of the job market. Information Technology plays a crucial role globally, evident in numerous life sectors such as education, healthcare, culture, business, and governance. It is considered a solid foundation for sustainable national development. Researching and proposing a detailed instructional design process for IT-specialized courses for university students following the competency approach is significant. It helps educators clearly see the steps needed to organize effective teaching, achieve program goals, and contribute to enhancing IT human resources.

1. Teaching based on competency approach:

1.1 Definition of competence, competency approach:

According to F.E. Weinert (2002), competence synthesizes existing or learned abilities and skills, along with the learner's readiness, to responsibly solve arising problems and taking action with criticism to reach solutions. J. Coolahan (2001) views competence as fundamental abilities based on knowledge, experience, values, and tendencies developed through educational practice. Vu Dung (2008) defines competence as a combination of unique psychological attributes or qualities, acting as internal conditions favorable for performing specific activities effectively. Nguyen Quang Uan (2007) sees competence as unique attributes meeting the requirements of a specific activity, ensuring successful outcomes. Bui Hien (2001) considers competence as the ability

to be formed and developed, enabling success in physical, mental, or professional activities, demonstrated through the execution of a task.

Author Tran Khanh Duc (2015) defines competency as the ability to receive and effectively apply the synthesis of all human potentials (knowledge, skills, attitudes, physical fitness, beliefs, etc.) to carry out work or deal with a specific situation or condition in life and professional labor under specific conditions and certain standards. The competencies of each individual are expressed in a rich and diverse manner. There are various ways to classify competencies, with the main classification including general competencies and specialized/occupational competencies. Specifically:

(1) General Competencies: These are fundamental, essential, and core competencies that form the foundation for all human activities in life and work. Examples include perceptual competence, intellectual competence, language and mathematical competence, communication competence, motor competence, etc. These competencies are formed and developed based on human genetic instincts, the education process, and life experiences.

(2) Specialized Competencies: These are unique competencies formed and developed based on general competencies in a specialized, separate direction within specific activities, jobs, or situations and environments. For example, quick identification competence is formed based on general competencies related to vision, judgment, comparison, etc., along with specific qualities and specialized talents.

Competency-based approach is an approach focused on the outcomes of the teaching and learning process, emphasizing what learners need to achieve in terms of competencies upon completing an educational program. In other words, the quality of outcomes plays a crucial role in competency-based education.

1.2 Teaching based on competency approach:

Authors Nguyen Van Cuong and Bernd Meier (2010) focused on clarifying the advantages and disadvantages of outcome-oriented, competency-oriented, and outcome development-oriented programs in their research on "Some common issues in innovating teaching methods in high schools." Their study concluded that to overcome the "rigidity, verbosity" of the current education system, approaching outcome-oriented and competency development-oriented programs is the optimal choice. Teaching methods should actively engage learners in intellectual activities, simultaneously train problem-solving competence related to real-life and professional situations, linking intellectual activities with practical application and reality.

Nguyen Minh Giam and colleagues (2023) state that teaching competency development is an organized teaching process helping learners stimulate psychological movements to enhance awareness, skills, and learning attitudes from the existing level to a higher level, aiming to achieve predetermined training goals. They also propose measures to develop self-learning competencies for students using AI Chatbot in teaching chemistry to develop self-learning competencies for high school students. Through these measures, teachers guide, support students or let students conduct research to develop self-learning competencies, independent research skills, creative thinking skills, information utilization and retrieval skills, and communication skills on machines with the support of AI Chatbot, aiming to develop self-learning competencies for students in each competence component.

Nguyen Thanh Thuy (2022) states that teaching based on competency development for students is a teaching process aiming to maximize the potential of students through organizing positive learning activities, stimulating the creativity of students under the guidance and control of teachers, focusing on outcomes. It also emphasizes reasonable interaction coordination between teaching and learning activities, highlighting the competence levels that students need to achieve according to the outcomes of a program or a specific course. Therefore, "teaching based on competency development can be considered as a new teaching model to concretize the goals of outcome-oriented training programs, in which the competence groups that need to be achieved are specifically described in teaching goals."

Author Tran Khanh Duc (2020) believes that if the following recommendations are implemented during the teaching process, the teacher is teaching based on the competency approach "Putting the learner at the center." They are: (1) Teaching must start from the learner: Determining the goals, selecting content, etc., based on the learner's motivations, characteristics, qualities, conditions, levels, etc., to "for" the learner. (2) Teaching must pay attention to individualization and differentiation: Not all learners have similar abilities, but efforts should be made to help them achieve the desired results. (3) Creating conditions for learners to be active, self-reliant, and proactive in perception and learning. (4) Creating conditions for learners to self-consult, self-assess, and evaluate.

To implement this approach, various methods should be combined, using diverse technical and teaching aids, with the ultimate goal of promoting positive, active, creative, and effective qualities for the class as a whole and each student individually, creating conditions for students to utilize their potential and provide the most benefits for students.

According to this approach, when examining the teaching process at a certain time, it includes elements such as teaching goals, teaching content, teaching methods, strategies based on the competency approach, organization forms based on the competency approach, teaching aids, the relationship between teaching factors and learning factors, and evaluation in teaching based on the competency approach. Among these elements, teaching goals are the most important.

From the above analysis, it can be understood that teaching based on the competency approach is a process where, under the organization, guidance, and assistance of the teacher, the learner is conscious, active, creative, self-organizing, and self-regulating in the perception-learning activities to develop the necessary competencies. It employs positive teaching methods to effectively carry out teaching tasks, thereby achieving the objectives required by the training program, meeting the requirements of life and profession.

2. Analysis of the curriculum of IT-specialized courses:

Information Technology (IT) plays a vital role globally, including Vietnam, across various life sectors. In modern society, the role of the IT sector is evident in education, healthcare, culture, business, management, etc. It is considered a solid foundation for sustainable national development. This necessitates continuous changes in educational institutions to update goals, content, tools, and innovate training methods for the IT sector.

Regarding goals: Most higher education institutions set the following goals for IT programs: To train information technology (IT) engineers with sufficient knowledge, skills, professional demeanor, political qualities, organizational discipline, professional ethics, and health to meet the research, development, and application requirements of information technology in society and the country's international integration. The goals of IT-specialized courses mainly focus on training students with in-depth skills and knowledge in the field, such as the ability to design, deploy, and maintain information systems, as well as the ability to analyze and solve problems.

Regarding content: Courses in the IT-specialized curriculum mainly develop skills and attitudes, values needed to form competence, and develop the practical skills of IT learners related to specific job requirements. The content of courses in the IT-specialized curriculum may include databases, computer networks, system analysis and design, programming, information security, artificial intelligence, and software development.

Regarding teaching aids: Teaching aids are tools used by teachers to support the learning process, helping learners better understand the lesson content. The nature of teaching IT specialized courses requires a lot of practical work and experimentation, making teaching aids crucial. Some typical teaching aids for IT courses include network labs with practical problems closely related to professional reality, simulation software, and specialized devices for data analysis, retrieval, and recovery.

Regarding teaching methods: Teaching IT-specialized courses requires the use of a variety of active teaching methods, emphasizing practical learning and application. Some effective methods include problem discovery and solving, project-based learning, case study-based teaching, and WebQuest teaching methods.

3. The instructional design process for teaching courses within the specialized Information Technology knowledge block through a competency-based approach:

Teaching is the process of positive cognitive engagement by learners under the guiding influence of the instructor: design, organization, control, etc., aimed at effectively carrying out teaching tasks. In the teaching process, learning takes center stage and essentially embodies a distinctive cognitive process.

To conduct effective teaching for the specialized Information Technology knowledge block using a competency-based approach, the author proposes an instructional design process consisting of the following main steps:
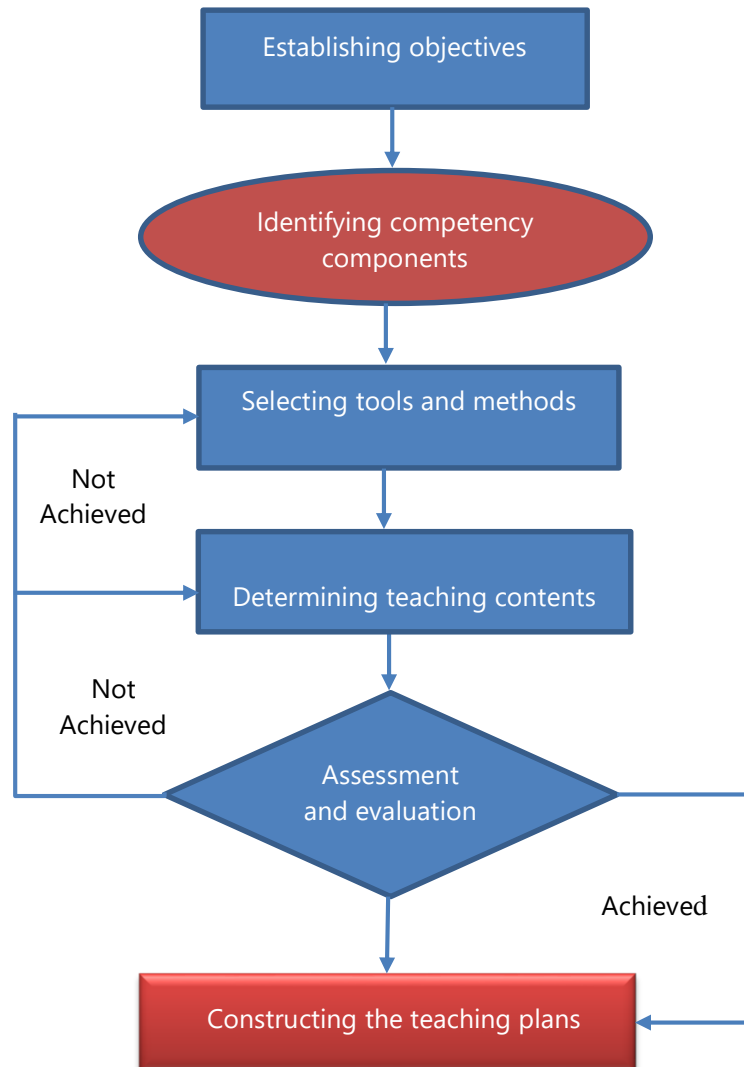
Figure 1: The instructional design process for courses within the specialized Information Technology knowledge block through a competency-based approach.

Step 1: Define training objectives and express output standards

Training objectives are the desired outcomes upon completion of the courses. Training objectives need to be specific, measurable, achievable, related to competencies, and aligned with the output standards of the training program.

The output standards for the Information Technology program are established and expressed as what learners can do after the training process, based on the minimum competency standards prescribed by the Ministry of Education and Training. The training output standards must encompass requirements for knowledge, skills, self-regulation and responsibility, physical fitness, learning capabilities, and post-graduation skill improvement.

Step 2: Identify competency components

Competencies to be developed for learners are identified based on the requirements of the Information Technology profession. These competencies may include both general and specialized skills, such as:

For general skills: Passion for technology and software; Creativity, intelligence, and logical thinking; Eagerness to learn, keen awareness of emerging trends; Absolute precision; Proficiency in foreign languages, etc.

For specialized skills: Programming ability; Data analysis and exploitation skills; Graphic design or website design skills; Cybersecurity offensive and defensive capabilities; Design, deployment, and maintenance of information systems, etc.

In addition to the aforementioned requirements, IT learners also need to be trained in situational handling, communication, time management, teamwork, etc., to effectively meet the professional demands of this field.

Step 3: Select tools and learning methods

Given the specific nature of the courses within the specialized Information Technology knowledge block, it is necessary to choose suitable tools and learning methods to allow learners to maximize their learning capabilities and achieve teaching objectives as quickly as possible.

Learning tools: We choose an AI Chatbot in conjunction with a Website to teach certain theoretical aspects of the information technology course.

Learning methods: Our selected methods combine active learning approaches, placing learners at the center, incorporating methods that empower learners to actively engage in learning activities, promoting critical thinking, creativity, problem-solving, cooperation, etc. This aims to develop essential skills such as teaching through discovery and problem-solving, project-based learning, differentiated teaching, case study-based teaching, and the WebQuest teaching method.

Step 4: Determine teaching content

Determining teaching content involves selecting and organizing the necessary knowledge, skills, and attitudes to develop the required competencies for learners. The teaching content needs to be chosen and organized scientifically, logically, aligning with teaching objectives, learner characteristics, and compatibility with AI Chatbot in conjunction with Website teaching.

The teaching content for specialized courses in the Information Technology training program is detailed in course syllabi, with content broken down for integration into the AI Chatbot and Website. Specific goals and output standards that learners need to achieve are defined, providing the basis for instructors to design learning activities.

Step 5: Assessment and evaluation

Teaching assessment is the process of collecting and processing information about the teaching process to determine the extent to which teaching objectives are achieved. Teaching assessment needs to be comprehensive, evaluating both knowledge, skills, and attitudes of learners participating in information technology courses. Assessing the effectiveness of the teaching process provides a basis for adjusting the teaching process accordingly.

Step 6: Develop the teaching plan

Developing the teaching plan involves synthesizing the contents of the above steps into a specific teaching plan. The teaching plan needs to be detailed, clear, and suitable for student demographics, helping them to leverage the necessary skills in studying specialized Information Technology courses.

From the contents carried out in the above steps, in this step, the instructor implements a specific teaching plan for each specialized course. The proposed template is as follows:

Table 1: Teaching Plan for Information Technology Courses Using a Competency-Based Approach.

Training Facility Name : ……………………………………..
Lecturer : …………………………………………….
Training Program : ………………………………………………….
Competency : ……………………………………………………….
Competency Duration: ………………… hours according to the program distribution
Support Assessment Time: …………………. Hours
Summative Assessment Time : ………………… Hours
Decision-making Evaluation Date: According to the plan

No.	Competency Element	⏱ (h)	Content Element	Teaching and Learning Activities	Teaching Steps	In-Process Evaluation	Learning Materials, Tools, and Resources
1	Element 1						
2	Element 2...						
3	Element n...						
4	Review and Summative Assessment Guidance						

From this outlined teaching plan, teachers can design teaching content based on the content of the information technology program prescribed by the Ministry of Education and Training in Vietnam. This is intended to help learners become interested and active in their studies, unleash their creativity, and maintain a lifelong learning spirit to achieve teaching objectives and meet the prescribed output standards.

4. Conclusion

The practical implementation of teaching specialized courses in the field of Information Technology for university students using a competency-based approach in Vietnam still faces challenges, including inadequate physical facilities, insufficient technological infrastructure, limited proficiency of both teachers and students in adopting new teaching and learning methods, and inadequate accompanying teaching conditions. However, with the continuous development of science and technology, there is an urgent need to effectively carry out teaching activities in the field of Information Technology.

The presented process of designing teaching for specialized courses in the Information Technology field using a competency-based approach serves as a suggestion for educators, providing a comprehensive overview of the aspects to be considered in designing effective teaching methods.

REFERENCES

1. Nguyen Van Cuong, Bernd Meier (2010). Some general issues about innovating teaching methods in high schools. Secondary Education Development Project (Loan No. 1979 - VIE), Berlin/Hanoi, Hanoi.
2. Tran Khanh Duc, Learning ability and capacity, Education Magazine, number 357, pages 19-21, 2015
3. Tran Khanh Duc (2020). Teaching theories and methods develop capacity and creative thinking. Hanoi National University Publishing House.
4. Vu Dung (2008), Psychology Dictionary, Bach Khoa Dictionary Publishing House, Hanoi.
5. J. Coolahan (2001), The historical development of teacher education in the Republic of Ireland.
6. Nguyen Minh Giam, Nguyen Van Doc, Nguyen Thi Hoai Nam, Nguyen Thi Huong Giang, Ngo Tu Thanh (2023), Building a self-study competency framework for junior high school students in teaching branch of natural sciences with the support of AI chatbot, Vietnam Journal of Education, Special issue 9 (September), ISSN: 2354-0753.
7. Giam, N. M. ., Doc, N. V. ., Nam, N. T. H. ., Giang, N. T. H. ., & Thanh, N. T. . (2023). Measures To Develop the Ability To Self-Study Chemistry For High School Students With the Support of AI Chatbot. Journal of Education For Sustainable Innovation, 1(1), 49–60. https://doi.org/10.56916/jesi.v1i1.519
8. Nguyen Quang Uan (2007), Textbook of General Psychology, Hanoi National University Publishing House. Bui Hien (editor) - Vu Van Tao - Nguyen Van Giao - Nguyen Huu Quy (2013). Educational dictionary learn. Science and Technology Publishing House.
9. Nguyen Thanh Thuy (2022). Teaching the subject of Teaching Theory towards developing teaching capacity for pedagogical students at the University. Doctoral thesis in Educational Sciences, Vietnam Institute of Educational Sciences.
10. F.E. Weinert (2002), Vergleichende Leistungsmessung in Schulen – eineumstrittene Selbstvrtondlichkeit.