

Teaching Capacity of Technology Teachers: Applying in the Training Program of Technology Teacher in Vietnam

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Received November 15, 2018; Revised December 17, 2018; Accepted December 19, 2018

Abstract Teaching capacity, learning outcomes, and the training program of technology teacher in this study aim to guide the training of technology teachers under the program on general education renovation in Vietnam. Based on the analysis of the Technological Pedagogical Content Knowledge (TPACK) model, the impact of the 4th industrial revolution, and the requirement of technology teacher's capacity, this study presents the teaching capability of technology teachers including the combination of core competencies (necessary skills in the 21st century), competency in engineering and technology, competency in teaching methods, and competency in the application of technology in teaching. The combination of these competencies in the training program of technology teachers will contribute to the development of technology teachers with full of core competencies, technical and technological knowledges, teaching methods, technology application and teaching method renovation.

Keywords: *technology teacher, TPACK model, technology application in teaching, teaching capacity*

Cite This Article: Bui Van Hong, Tran Tuyen, and Nguyen Thi Luong, "Teaching Capacity of Technology Teachers: Applying in the Training Program of Technology Teacher in Vietnam." *American Journal of Educational Research*, vol. 6, no. 12 (2018): 1662-1667. doi: 10.12691/education-6-12-11.

1. Introduction

Along with the strong development of science and technology, common application of hi-tech products in the life, industry and education, the need of learners for learning is increasing. In particular, technology education is associated with the development of technology and directly influenced by technology, so the need of learners for learning have changed rapidly and varied [1]. While the technological education strongly influenced by the 4th industrial revolution (Industry 4.0) and the STEM education trend (Science, Technology, Engineering, Mathematic), the teaching capacity of technology teachers who directly participates in the teaching, needs to be changed and developed appropriately, especially the application of digital technology and STEM education in the teaching. In fact, however, most of the training programs of technology teachers in Vietnam are only equipped with knowledge, technical and pedagogical skills but the application of digital technology in the teaching, so many technology teachers in Vietnam faced many difficulties in the application of digital technology in the teaching, especially in the teaching method renovation [1]. Therefore, it is indispensable to determine the capacity of technology teachers and to change the training program of technology teachers in Vietnam.

In recent years, the study on the application of digital technology in the teaching is more popular. Many studies and products of the application of digital technology in the teaching have contributed significantly to improving the quality and effectiveness of teaching.

In 2013, Bui Van Hong and Nguyen Thi Luong studied and developed the teaching method for Basic Electronics under the combination of techniques in physics and virtual teaching based on TPACK model [2] model. The results show that the integrated teaching technique as a teacher, teaching and providing knowledge and instructing students in learning. Moreover, the integrated teaching technique supports and guides teachers in the use of teaching methods. However, this study has only been researched on the integration of technology in teaching technique but the integration of technology in the remaining factors of the teaching. Bui Van Hong (2013) has proposed a process and solutions for integrating technological knowledge into the training program of technology teachers.

To meet the need of learners, technology knowledge should be integrated into all factors of the teaching, from the change of teaching objectives under the content, teaching methods and teaching & evaluation techniques. A solution for this integration is that training institutions need to modernize their network infrastructure and technology equipment, and increase the initiative of teachers in the teaching [3]. The results of this study provide a basic for the application of technology in the

teaching, helping use flexible teaching methods and develop the digital technology application skill for students. However, in this study, proposed process and solutions is just on the theory but practice. The development of technology has gradually changed the role and function of teachers, so Okworo Gibson Samuel et al. (2016) argued that in order to apply technology in the learning, technical teachers need to improve their technological capability [4]. Similarly, Teemu Valtonen et al. (2017) said that in order to meet the expectation of skill development in the 21st century, teachers need to be familiar with the variety of pedagogical methods and use appropriate ICT [5]. The authors focused on the necessary skills in the 21st century under the TPACK model, a well-known theoretical model that is well suited for the study on the application of ICT in the teaching of teachers. Bui Van Hong (2017) analyzed the diversity of learning needs of learners under the influence of technology, thus suggesting the integration of technology knowledge and practical skills in the training program of technology teachers at Ho Chi Minh City University of Technology and Education based on the TPACK model for creating the technical teachers who good at technology, practical skills, teaching methods and the application of digital technology in the teaching. The author also proposed core capabilities which integrated in the training program of technical teachers, including: technology competence; competence in practical skills; competence in pedagogy, competence in applying technology in teaching [1]. Based on the success of Ho Chi Minh City University of Technology and Education in applying Blended Learning in the development of classes applied digital technology, and the strong development of Internet of Things (IoT) technology, Bui Van Hong (2018) asserts the application of IoT technology to develop the digital teaching model in Ho Chi Minh City University of Technology and Education is suitable for creating a variety of training, teaching and evaluation forms, thereby meeting the diverse learning needs of students [6]. However, the application of IoT technology in teaching is still a new issue, therefore, in the study, the author just analyzes the trend of technology development and proposes some solutions for expanding the digital teaching model based on IoT technology but provide examples of specific applications.

With the aim of identifying the capacity of technology teachers and developing the training program of technology teachers in Vietnam, this study focuses on the capacity of teachers in the TPACK model and the impact of the 4th industrial revolution to technology teachers.

2. Content

2.1. Research Methodology

The study uses following research methodology:

2.1.1. Theoretical Research Methodology

- Collecting documents related to profession of technology teachers; the status and requirements for developing the capacity of technology teachers; the impact of 4th industrial revolution on technology teachers in Vietnam.

- Analyzing the professional standards of technology teachers; the capacity of teachers under the TPACK model [7] as a basis for determining the capacity of technology teachers and for applying in the development of training program of technology teachers in Vietnam.

2.1.2. Deep-interview

- Working with the leaders of high schools in Ho Chi Minh City, Vietnam on the current situation and needs for capacity development of technology teachers.

- Working with educational experts on common assessments of professional qualifications, teaching capacity, and the applicability of digital technology of technology teachers in Vietnam.

- Collecting information by interview, analyzing and comparing data on the current status and the need of technology teachers collected from other sources to ensure the accuracy of data.

2.2. Contents

2.2.1. TPACK Model of Matthew J. Koehler

TPACK (Technological Pedagogical Content Knowledge) developed by Mishra & Koehler (2006) with the structure shown in Figure 1 [7].

This model is a complex integration of three different types of knowledge, including: content knowledge (CK), pedagogical knowledge (PK) and technological knowledge (TK). Therefore, TPACK can be understood as follows:

TPACK is the intergration of content knowledge (CK), pedagogical knowledge (PK) and technological knowledge (TK). It means teacher' capacity in profession, pedagogy and technology in the teaching.

The TPACK model in Figure 1 shows that the integration of the three basic types of knowledge help appear new types of knowledge in cross-over.

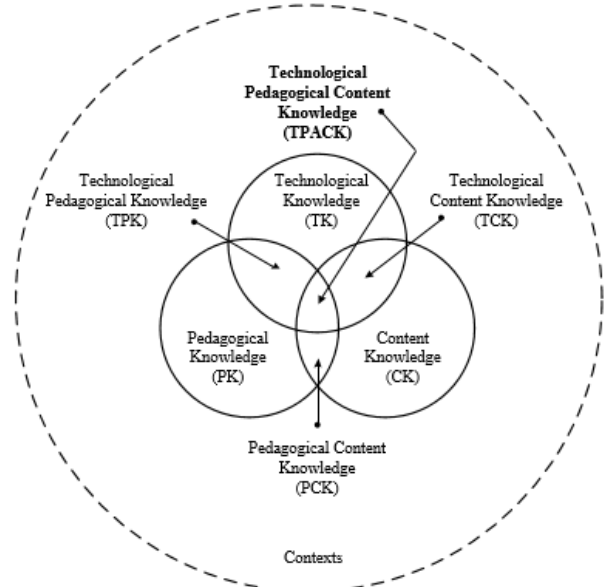


Figure 1. The TPACK framework [7]

In which:

(1) At the cross-over of pedagogical knowledge (PK) and content knowledge (CK), pedagogical content knowledge (PCK) is created. This is the idea of

pedagogical knowledge used in the teaching of a specific content.

(2) At the cross-over of technological knowledge (TK) and content knowledge (CK), technological content knowledge (TCK) is created. This is the knowledge of the relationship between content and technology. It means technological knowledge is used in the teaching of specific content.

(3) At the cross-over of technological knowledge (TK) and pedagogical knowledge (PK), technological pedagogical knowledge (TPK) is created, which focus on the existence, composition and uses of new technology equipment used in the teaching. In other words, this is pedagogical knowledge when using new technology in the teaching.

(4) Finally, at the cross-over of these three types of knowledge, technological pedagogical content knowledge (TPACK) is created. This result is the integration of teachers' capacity in the teaching. This integration focuses on the knowledge and adjusts the relationship between the three types of knowledge of teachers. In other words, to effectively teach a subject, the teacher's competence shall be in the cross-over of content, pedagogical and technological knowledge.

As a result, to get the effectiveness in teaching, teachers shall be good at profession, pedagogy, and the application of ICT in the teaching.

2.2.2. Capacity of Technology Teachers

2.2.2.1. Impact of the 4th industrial revolution on technology teachers

The 4th industrial revolution (Industry 4.0) is based on the integration of some new technologies such as artificial intelligence, Internet of Things (IoTs), big data, and Icloud,... which are developing rapidly and have a strong impact on all aspects of socio-economic, including occupational education [8]. With breakthrough developments in technology, this revolution will dramatically change the natural and structure of jobs in the coming time. As a result, many old jobs will be disappeared, and many other new jobs will be created. In particular, automated robots and artificial intelligence will replace the human; thus, the human will have a risk of not being able to master their jobs [9]. This affects the change of structure and list of jobs in the training system. Therefore, technology teachers shall actively improve their knowledge and skills for meeting the requirements of their jobs in the new context. Accordingly, the training program and methods shall be changed.

2.2.2.2. Requirements on capacity of technology teachers

Core competencies all students should equip in the 21st century include: cooperation capacity, communication capacity, capacity of using information technology, culture and society; creativity, critical thinking and problem-solving skills. In particular, the using of IT of students is very important. Students shall be able to use IT as a tool for learning, cooperating, problem solving, creative thinking and renovation in the 21st century. In other words, IT skill play a main role in the skills of the 21st century [5]. Thus, these skills are must-have skills of technology teachers in the current context in Vietnam.

Besides, under the influence of the Industry 4.0, in addition to technical and technological capabilities, technology teachers must be able to apply technology and innovate teaching methods as follows:

- Teachers should guide students to study for new knowledge instead of providing knowledge to them.

- Changing teaching methods, especially applying the teaching method using digital technology under the model of Blended Learning and Flip – Flopped Classroom; Project based learning; learning through doing; ...

- Combining providing students with professional knowledge and skills, technical creativity with the development of self-control and self-responsibility skills; education on professional ethics, labor discipline and industrial behavior.

- Applying IoTs technology in the Distal Pedagogy and virtual - reality technology in the teaching.

As a result, the role of teachers will be changed from the provider of knowledge to the instructor. And the classes applied the dital pedagogy and virtual - reality technology will be popular [8]. Learners will be familiar with the learning on the internet with the guidance of online teachers. This is an indispensable development trend in the training of technology teachers in Vietnam.

2.2.2.3. The capacity components of Technology teacher

From teacher capacity according to model TPACK [7] and the impact of the 4th industrial revolution and requirements for capacities of technology teachers, the capacity of technology teacher is the integration of Technical capacity, pedagogy, and digital technology application on teaching and core skills in the 21st century, namely:

- (1) General core capacity.
- (2) Professional capacity of Technique and Technology.
- (3) Capacity of Pedagogy.
- (4) Capacity of Technology application in teaching.

The relationship among capacity components of technology teacher is illustrated in Figure 2 as follows:

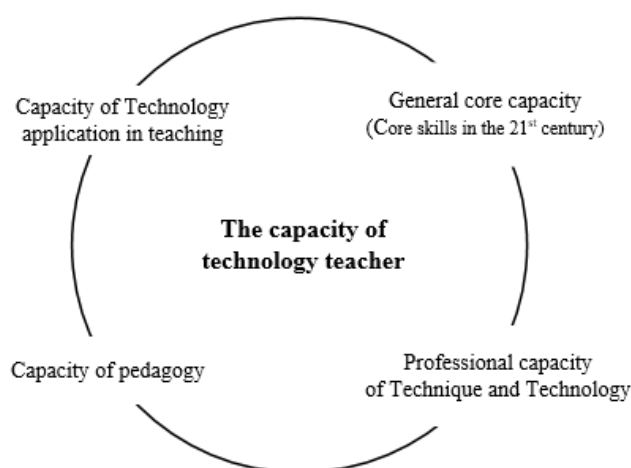


Figure 2. The capacity components of technology teacher

In which:

- The general core capacity: is the core capacity of the 21st century that all students need including: Capacity of cooperation, communication, IT use, culture and society; Capacity of creation, critical thinking and issue settlement [5]. These capacities are deemed as compulsory for

technology teachers in current context of international integration of Vietnam.

- Professional capacity of Technique and Technology: is the capacity of applying Technical and Technology knowledge and skills for a Technology teacher to teach students in Technology education such as: Electrical – Electronics Technique, Mechanical technique, Car technology, Manufacturing technology, Biotechnology, ...

- Capacity of pedagogy: is the capacity of using flexibly teaching method and strategy of teachers to organize activities for students in technology education, especially for capacity of reforming and applying digital teaching method according to Blended Learning and Flip-Flopped Classroom; Project based Learning; Learning by doing;...

- Capacity of technology application in teaching: is the capacity of using competently technology by teachers in classroom, including skills of using competently computer, technology tools and applications in teaching such as: Operation of basic technology, use of individual technology, ethical and social issues and technology application in teaching [4]. In addition, technology capacity also consists of application of STEM and programming for STEM products in teaching.

Thus, capacity of technology teachers is expressed through integration of capacity components such as: general core capacity of the 21st century, professional capacity of Technique and Technology, Capacity of Pedagogy, capacity of technology application in teaching. The capacities of technology teachers are formed and developed through process of training, improvement and self-learning. Therefore, these capacity components must be integrated into training and improvement program for teachers.

2.2.3. Program of Technology Teacher Education

2.2.3.1. Output standard of Technology Teacher Education program:

Based on analysis results of capacity components for technology teachers and opinions from relevant parties for education program, the core capacities of technology teachers are integrated with output standards of technology teacher education program as follows:

- (1) Knowledge and Arguments of Technology Teacher Education and Training
- (2) Personal skills and qualifications in technology education
- (3) Communication, cooperation and teamwork skills in technology education
- (4) Design, deployment and operation in technology education

In which, the capacity components are described in the output standard as follows [10]:

Knowledge and argument of Technology teacher Education and Training

1. Analyze basic principles in terms of education science, social science and natural science
2. Synthesize fundamental technology knowledge in term of mechanical engineering, automobiles, electricity, electronics and informatics
3. Synthesize knowledge on organizing educational and vocational training activities

4. Select modern teaching methods; develop teaching program
5. Synthesize knowledge on new technologies and develop technical projects

Personal skills and qualifications in technology education

1. Analyze and argue educational situations, teaching contents
2. Analyze and solve problems of technology, technical projects and situations
3. Test and practice technique, technology and education
4. Analyze educational program; system of knowledge
5. Analyze technical system and technology process
6. Be confident, serious and self-motivated in educational activities, technical and technology activities
7. Self-learn and study about field of technology and education
8. Determine exactly political qualification, teacher personality and professional style
9. Demonstrate career position and skills in the job
10. Be autonomous and responsible for adjusting and improving activities of technology, technique and education

Communication, cooperation and teamwork skills in technology education

1. Communicate and work in multi-disciplinary teams; Work effectively in the form of text, e-mail, graphics and presentations
2. Lead and communicate properly with individuals and organizations
3. Communicate in English in field of technology and education

Design, deployment and operation in technology education

1. Recognize activities of education reform and scientific and technological development
2. Analyze characteristics of technology, technique and pedagogy in enterprises, plant and school
3. Analyze industry structure; determine labor and education demand, input level and perceptive characteristics of learners
4. Set up idea on organizing educational activities, and a scientific and technology playground
5. Set up idea on application and development of technology in manufacture
6. Design educational activities, and a scientific and technology playground
7. Design and develop technology applications in manufacture
8. Deploy educational activities and scientific and technology playground
9. Deploy technology applications in manufacture
10. Organize and manage educational activities, operate technical projects and scientific and technology playground
11. Operate and test technical system and technology applications
12. Develop creative thinking and communication capacity
13. Develop idea on products and services from new technologies

Table 1. Structure of proposed technology teacher education program [10]

NO.	Name of Module	Number of credits
GENERAL EDUCATION		50
A. Group of compulsory knowledge		37
1	Politics + Law reasoning	
2	Math and Natural Science	
3	Introduction to technology teacher training	
B. Group of selective knowledge		13
1	Selective Informatics	
2	Human and Social Sciences	
3	Natural Science	
4	General education	
TECHNOLOGY EDUCATION		82
A. Technology education foundation		26
1	Foundational of STEM Education	
2	Foundation of Technique and Technology	
3	Modules of general capacity development (capacity of the 21 st century)	
B. Major in Technique and Technology		33
1	Modules on technology application	
2	Modules on technology creation	
C. Major in Technology Education		16
1	Modules on teaching Technique and Technology	
2	Modules on developing digital teaching application	
3	Modules on developing technical project	
4	Modules on teaching STEM in technology education	
GRADUATION THESIS		7
TOTAL:		132

2.2.3.2. Structure of technology teacher education program

Based on output standard determined and analyzed above, the modules in program of bachelor level-technology teacher education as follows:

(1) General education: includes compulsory and elective modules

(2) Technology education: includes modules of technology education foundation; Technique and Technology; Technology Education

(3) Graduation thesis.

The program of bachelor level-technology teacher education is implemented for 4 years with program structure including group of modules and number of credits illustrated in [Table 1](#).

Review:

The program of technology teacher education as illustrated in [table 2](#) can meet requirement of technology teacher development in order to serve reform of general education in Vietnam today. Output standard and structure of proposed program can develop equally core capacities of teacher including: general core capacities, professional capacities on Technique and Technology, capacity of pedagogy, capacity of technology application in teaching.

The education program, apart from modules of major in Technique and Technology, is also integrated with modules of technology applying capacity development in teaching such as: STEM Education, IoTs Programming, Robotics, Development of Digital teaching applications, Development of technical project [\[11\]](#). These modules

helps teachers form and develop capacity of technology applications in teaching.

3. Conclusion

Under direct and in-depth impact of technology on current education, learning demand of people has been changed rapidly, especially for technology education. Therefore, nowadays, the technology teacher must be good at both knowledge of Technique and Technology and technology application as well as reform of teaching method. In addition, trend of international integration and globalization in field of education requires the teachers to equip themselves general core skills of the 21st century in order to bring global technology and skills to students. Thus, program of technology teacher education must be planned based on integration of general core capacity (skills of the 21st century), professional capacity on Technique and Technology, capacity of pedagogy, capacity of technology applications in teaching.

Output standard and content of technology teacher education program have link to impact of Industrial revolution 4.0 on technology education. The group of proposed modules in the structure of technology teacher education is in accordance with professional capacity and focuses on development of capacity of teaching and applying technology as well as reforming teaching method. Therefore, teaching capacity and structure of technology teacher education program can be applied for training and education of technology teacher, meeting requirement of current general education reform in Vietnam.

References

- [1] Bui Van Hong (2017), Integrating the Knowledge of Technology and Practice of Vocational Skills in the HCMUTE's Technical Teacher Education Curriculums based on the TPACK Model, Journal of Science of HNUE, ISSN 2354-1075, Vol. 62, Iss. 4 (2017), pp. 91-99.
- [2] Nguyen Thi Luong - Bui Van Hong (2013), Developing the teaching mediums for the subject of basic electronic practice based on the TPACK Model at Ho Chi Minh City University of Technology and Education, Journal of Educational Equipment, Vol. 92 (04/2013), pp. 1-4.
- [3] Bui Van Hong (2013), Integrating the Knowledge of Technology in the Technical Teacher Education Curriculums, Journal of Educational Equipment, ISSN 1859 – 0810, Vol. 100 (12/2013), pp. 6-8 and 13.
- [4] Okworo Gibson Samuel, Caleb E. E, Touitou Tina C (2016), The Technical Teacher, Teaching and Technology: Grappling with the Internationalization of Education in Nigeria, International Journal of Scientific Research in Science and Technology, ISSN: 2395-602X, Volume 2, Issue 4, pp. 256-265.
- [5] Teemu Valtonen, Erko Sointu, Jari Kukkonen, Sini Kontkanen, Matthew C. Lambert, Kati Mäkitalo-Siegl (2017), TPACK updated to measure pre-service teachers' twenty-first century skills, Australasian Journal of Educational Technology, 2017, 33(3), pp. 15-31.
- [6] Bui Van Hong (2018), Internet of thing and applying to develop the digital classroom at HCMUET, Journal of Vocational Education and Training, ISSN 2354-0583, Vol. 52-53, pp. 90-98.
- [7] Punya Mishra, Matthew J. Koehler (2006), Technological pedagogical content knowledge: a Framework for teacher knowledge, Teachers College Record, Volume 108, Number 6, June 2006, pp. 1017-1054.
- [8] Molisa (2018), Proposal on training of laborers in response to the 4th Industrial Revolution, Hanoi, 8/2018.

- [9] Lee Rainie (2017), 10 facts about jobs in the future, Pew Research Center's Internet & American Life Project, <https://www.slideshare.net>.
- [10] Ho Chi Minh City University of Technology and Education (2018), Higher Education Program: Major of Technology Teacher Education, Code: 7140215, HCMC, 5/2018.
- [11] Harris, J., Phillips, M., Koehler, M. & Rosenberg, J. (2017). TPCK/TPACK research and development: Past, present, and future directions. *Australasian Journal of Educational Technology*, 33(3), i-viii.
- [12] Bui Van Hong (2016), Professional competences oriented developing the Curriculum of Technical Education at Ho Chi Minh City University of Technology and Education, *Journal of Science of HNUE*, ISSN 2354-1075, Vol. 61, No. 8 (2016), pp. 107-116.
- [13] Daniela, L. (2018) Smart Pedagogy for Technology Enhanced Learning. *Didactics of Smart Pedagogy: Smart Pedagogy for Technology Enhanced Learning*, ed. L.Daniela, Springer.
- [14] Nigel Zanker and Gwyneth Owen-Jeckson (2013), What makes a good Technology Teacher, *Debates about design and technology Education*, ISBN 979-0-415-68905-2, MPG PrintGroup, pp. 86-97.
- [15] Bui Van Hong – Le Van Ngoc (2018), Solutions for developing the digital pedagogy based on the blended learning at institutions of vocational education, *Journal of Vocational Education and Training*, ISSN 2354-0583, Vol. 62, pp. 42-46
- [16] Bui Van Hong – Nguyen Thi Luong (2017), School-Enterprise Collaboration Oriented Model of Skilled Worker Training in Mekong Delta Region, Vietnam, *American Journal of Educational Research*, 2018, Vol. 6, No. 6, 773-778.