

DEVELOPMENT OF PRACTICAL ACTIVITIES IN DISTANCE EDUCATION FOR A POST-PRESS TECHNIQUE COURSE ACCORDING TO THAI QUALIFICATIONS FRAMEWORK

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ABSTRACT

The objective of this paper is to present the development of practical activities for a post-press technique course corresponding to the Thai Qualifications Framework for Higher Education. The research instruments comprised questionnaires, focus group guidelines, and the model practical activities for the post-press technique course. The research samples for the questionnaires were 24 Sukhothai Thammathirat Open University students in the Bachelor of Science Programme with a major in Printing and Packaging Technology who registered for the post-press technique course and attended the practical activities. The research samples for focus group discussion were 15 students selected from the 24 students who answered the questionnaires and 12 post-press experts. Data were collected from the questionnaires and focus group discussions together with the model practical activities. The model practical activities was developed by all post-press technique instructors and the researchers by analysing the previous practical activities used in semester 2/2012, textbook content, and the curriculum mapping for the post-press technique course based on the Thai Qualification Framework. Data were analysed by frequency, percentage and content analysis. As a result of the study conducted, the model practical activities which comprised 8 self-practical activities and 10 field-practical activities was revised to the new practical activities which comprised 7 self-practical activities and 8 field-practical activities. The new practical activities were developed mainly by altering the procedures along with five learning domains of the Thai Qualification Framework.

Keywords: *post-press technique, practical activities, Thai Qualifications Framework*

INTRODUCTION

Sukhothai Thammathirat Open University (STOU) is an open distance learning (ODL) university in Thailand. Courses offered by the university contain 15 units of textbook and workbook presented in both print and electronic mediums as well as supplementary distance media. Science and technology courses provide both self-practice and field-practice similar to the practical laboratory sessions and home experiments used by instructors at Bindura University of Science Education, Zimbabwe. (Bhukuvhani, Mupa, Mhishi, & Dziva, 2012).

Students' needs for practice as a part of ODL science courses are also supported by the science students' opinion from National Open University of Nigeria and the Open University of Hong Kong. Most National Open University of Nigeria students need practical work to learn science courses since practical work can promote the engagement and interest of students as well as develop a range of skills, science knowledge, and conceptual understanding (Eunice, & Aarin, 2012). Most Open University of Hong Kong students place a high value on face-to-face practice in science courses to develop their understanding and skills (Chan & Shin, 2006).

The School of Science and Technology (SST) at STOU provides the Bachelor Science Programme with a major in Printing and Packaging Technology. Students who attend practical courses undertake: 1) self-practical activities (SPA) delivered at home, which help them in practicing some post-press skills on their own, and 2) field-practical activities (FPA) at the National Printing Technology Training Center and The University Press. Students are expected to study practical content from the textbook and workbook and engage in SPA which is delivered at home TV programmes via the STOU website as well as conduct the face-to-face practice. In comparing the practical content with other similar courses at 3 non-ODL universities, the practical activities of the post-press technique course involving folding, cutting, perforating, die cutting, packaging forming, bookbinding, coating, laminating, hot foil stamping, and embossing/debossing (School of Science and Technology, 2013) are similar to the post-press technology course at Faculty of Industrial Technology, Suan Sunandha Rajabhat University (Faculty of Industrial Technology, 2013), the print finishing courses of Faculty of Mass Communication and Technology, Rajamangala University of Technology Thanyaburi (Faculty of Mass Communication and Technology, 2013) and Faculty of Science and Technology, Rajamangala University of Technology Krungthep (Faculty of Science and Technology, 2013). At present, folding, die cutting and bookbinding are in accordance with the professional qualifications of the Thai printing industry professional qualification (Thailand Professional Qualification Institute, 2015). These post-press practical activities also relate to all 15 units of the textbook content listed below.

- (1) Introduction to post-press
- (2) Varnish coating and laminating for paper printed products
- (3) Laminating for flexible packaging
- (4) Cutting, folding and perforating
- (5) Hot foil stamping, embossing and die cutting
- (6) Bookbinding
- (7) Post-press for newspaper, continuous business form and calendar production
- (8) Flexible packaging converting
- (9) Cylindrical set-up packaging converting
- (10) Paperboard box converting
- (11) Corrugated box converting
- (12) Converting of product labels, tags and product displays
- (13) Control technique for printed product inventory and delivery
- (14) Introduction to packaging and environment aspects
- (15) Post-press innovation

National Qualifications Framework in a country is developed to meet the education need of the country, to assure graduate quality and reach international academic standards. The expected learning outcomes (ELO) in accordance to the respective Qualification Framework at the Bachelor degree level are compared in Table 1 for six different frameworks: Australian Qualifications Framework (AQF), European Qualifications Framework (EQF), Framework for Higher Education Qualifications in England, Wales and Northern Ireland (FHEQ), Scottish Credit and Qualifications Framework (SCQF), Thai Qualifications Framework (TQF) and Malaysian Qualifications Framework (MQF). Most ELOs emphasise knowledge and skills. SCQF, MQF, and TQF have additional focus ELO about social interaction, communication,

numeracy and IT skills. The ELO of SCQF and TQF are most similar. The TQF has an additional ELO on ethics and morals.

Table 1: Comparison of ELO described in six national qualifications frameworks

Expected Learning Outcomes	AQF	EQF	FHEQ	SCQF	TQF	MQF
knowledge	✓	✓			✓	✓
knowledge and understanding			✓	✓		
skills	✓	✓				
practical skills						✓
cognitive skills					✓	
generic cognitive skills				✓		
application of knowledge and skills	✓					
practice, applied knowledge and understanding				✓		
application and action			✓			
competence		✓				
autonomy and accountability			✓			
autonomy, accountability and working with others				✓		
social skills and responsibilities						✓
interpersonal skills and responsibility					✓	
communication, leadership and team skills						✓
communication, numeracy and IT skills				✓		
numerical analysis, communication and information technology skills					✓	
ethics and morals					✓	
values, attitudes and professionalism						✓
problem solving and scientific skills						✓
information management and lifelong learning skills						✓
managerial and entrepreneurial skills						✓

Source: AQF Council (2013), European Communities (2008), The Framework for Higher Education Qualifications in England, Wales and Northern Ireland, The Qualifications and Curriculum Authority (2010), Office of the Higher Education Commission (2009), and Malaysian Qualifications Agency (2010).

Five learning domains were determined under the TQF to provide appropriate points of comparison in academic standards for institutions in their quality assurance processes, (Office of the Higher Education Commission, 2009). In 2010, the STOU with major in Printing Technology was revised to major in Printing and Packaging Technology. The ELOs based on the TQF learning domains were mapped into the curriculum by the instructors without other stakeholder participation. In this study, each practical activity of the post-press technique course was revised with specified ELO relevant to TQF learning domains. The student-centered teaching methods were applied according to The National Education Act 2542 (1999) of Thailand; Chapter 4: National Education Guidelines, Section 22:

“Education shall be based on the principle that all learners are capable of learning and self-development. The teaching-learning process shall aim at enabling the learners to develop themselves to the best of their potentiality”,

and Section 24:

“Educational institutions shall: (1) provide substance and arrange activities in line with the learners’ interests and aptitudes, bearing in mind individual differences; (2) provide training in thinking process, management, how to face various situations and application of knowledge for obviating and solving problems; (3) organise activities for learners to draw from authentic experience; drill in practical work for complete mastery, enable learners to think critically; (4) achieve, in all subjects, a balanced integration of subject matter, integrity, values, and desirable attributes; (5) enable

instructors to create the ambiance, environment, instructional media, and facilities for learners to learn and be all-round persons; and (6) enable individuals to learn at all times and in all places.”

Table 2 shows all five TQF domains and their corresponding ELOs. The curriculum mapping of the post-press technique course shows that the ELOs under TQF 2 are embedded in the textbook (self-learning), while and the ELOs under TQF 1, 3, 4, and 5 are embedded in the practice (School of Science and Technology, 2013).

Table 2: TQF Learning domains and ELO of the post-press technique course

TQF learning domains	Expected learning outcomes in the curriculum mapping
TQF 1 ethics and morals	1-1 knowledge and understanding of ethics, moral and professional ethics responsibilities
	1-2 habits of acting with discipline, punctually, honestly, selflessly, responsibly in personal and public life *
	1-3 ability to analyse and resolve ethics and moral conflicts reasonably through creative solving
	1-4 awareness of social and environmental impact from production technology application
TQF 2 knowledge	2-1 knowledge and systemic understanding of main concepts, principles, theories in industrial technology
	2-2 knowledge and understanding of required technologies for the printing profession
	2-3 knowledge and understanding of regulations and standards relevant to the printing profession
	2-4 ability to search for knowledge and new methods and follow up technological advances including appropriate application to specific situations
	2-5 ability to analyse and solve problems with science processing skills and be able to cumulate a body of knowledge
	2-6 ability to integrate industrial technology knowledge to relevant disciplines' knowledge
TQF 3 cognitive skills	3-1 ability to explore, collect and evaluate the information relevant to the printing profession
	3-2 ability to analyse, evaluate and solve problems with appropriate suggestions
	3-3 ability to apply knowledge to practice and qualify essential professional skills according to curriculum *
	3-4 ability to create professional development
TQF 4 interpersonal skills and responsibility	4-1 ability to work effectively in groups and exercise either leadership or followership in order to facilitate proper solutions under different circumstances and be able to exercise effective team working skills and interpersonal skills
	4-2 ability to initiate and present problem issues and be able to analyse and solve problems appropriately either individually or in a group
	4-3 responsibility for individual and group assignments
	4-4 ability to modernise self- development and professional development
TQF 5 numerical analysis, communication and information technology skills	5-1 ability to choose statistical and mathematical techniques and apply them to analyse problems, explore and propose solutions properly *
	5-2 ability to communicate and present information effectively with appropriate presentation media applicable to situation and target audience
	5-3 ability to use information technology for data collection, processing, interpretation, and presentation

* the specified TQF for the post-press technique course which are TQF 1-2, 3-2, 3-3, 3-4, 4-1, 4-2, 4-3, 4-4, 5-1, 5-2, and 5-3

OBJECTIVE OF THE RESEARCH

The research problem that this study aims to address is two-fold. First, the previous practical activities (PPA) for the post-press technique course were inconsistent with the contents of the revised major (Printing and Packaging Technology) and did not employ all textbook units. Moreover, there was no indication of the TQF and ELOs required by Ministry of Education. Therefore, the objective of the research presented in this paper was to develop practical activities for the post-press technique course in correspondence to the Thai Qualifications Framework (TQF) for Higher Education.

RESEARCH METHODOLOGY

The research is focused on the development of the new practical activities (NPA) from MPA and PPA, respectively. The PPA refers to the PPA employed in semester 2/2012. All instructors of the post-press technique course and the researchers modified PPA to MPA via brain storming. The revision of MPA to NPA was accomplished through analysis of data collected from questionnaires and focus group discussions. The main changes resulted from the improvement, integration, and transfer of the practical activities. The number of SPA and FPA across NPA, MPA and PPA were different. Some titles, practical procedures and ELO were also redesigned according to the TQF. The conceptual framework in Figure 1 shows the change needed to eliminate the overlap between some post-press practical activities and those of the packaging design course and the effort to apply all 15 units into practice. It also highlights the TQF requirement and the National Education Act.

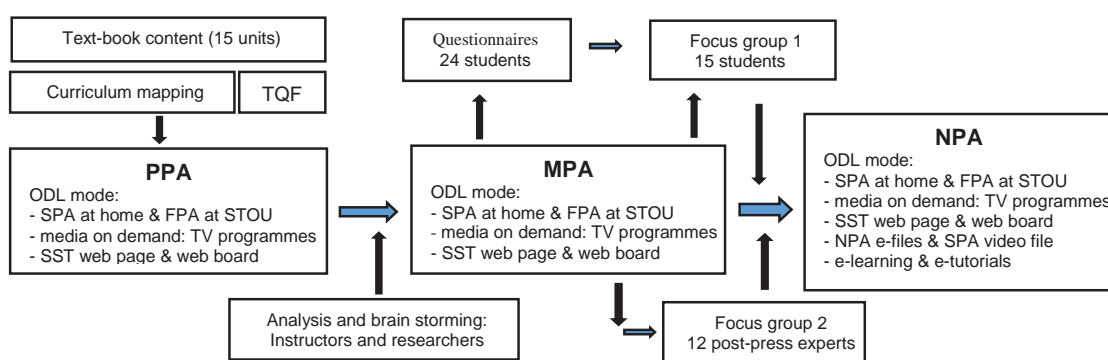


Figure 1: The conceptual framework

The PPA only employed only 12 units of textbook without reference to the ELOs and TQF. Thus, it was necessary to redesign PPA into MPA. The MPA handbook was drafted, employing all 15 units aligned with the determined ELOs and TQF. Evaluation was done using a questionnaire, followed by focus group discussion with selected students. The findings resulted in the redesign of MPA to NPA. The ODL modes used were 1) study practical content from textbook/workbook and print-based, with the SPA delivered at home using media on demand (TV programmes) via the STOU website; 2) practice SPA at home and; 3) study print-based FPA and practice at STOU. The research methodology comprised 4 steps as follows:

Step 1 Development of MPA for the post-press technique course

The MPA was developed by analysing the PPA, textbook content (15 units), and the curriculum mapping for the post-press technique course via the instructor and researcher involvement in brainstorming sessions and use of student-centered teaching methods according to National Education Act of B.E. 2542 (Chapter 4: Section 22 and Section 24, 1999). The ELO for each TQF learning domain specified in the MPA handbook was used in the research instruments (questionnaire and focus group discussion guidelines).

Step 2 Data collection from questionnaires and data analysis

The population comprised 30 students who have registered for the post-press technique course and attended the practical activities. The questionnaire for each practical activity was in the form of a checklist (agree or disagree to the specified ELOs for each TQF learning domain) and had open-ended questions (additional opinions). Data collected from 24 students (80% response rate) were analysed to obtain frequency, percentage, and

suggestions. Fifteen students who gave fruitful suggestions were selected for the first focus group discussion.

Step 3 Data collection from focus group discussions and data analysis

The focus group discussion involved 3 stakeholder groups: students, instructors, and graduate users. Focus group 1 was made up of the 15 students from step 2. Focus group 2 were 12 post-press experts, comprising 10 post-press instructors (6 from STOU; 3 from other universities; 1 from National Printing Technology Training Center) and 2 post-press company owners who were also on the TPQI subcommittees for post-press professional qualification. The instruments were focus group discussion guidelines and the MPA handbook. The focus group discussion guidelines for each practical activity were in the form of a checklist (selecting and voting on the ELOs for each TQF learning domain) and open-ended questions (additional opinions on practical activity processes and ELOs modification, handbook format and other suggestions). In each activity, the criteria for TQF selection was a 67% (2/3rds) vote based on the supermajority vote principle. In the case of the 15 students and 12 experts, a "2/3rds vote" would be 10 and 8, respectively. Data obtained were integrated and analysed according to frequency, percentage, and suggestions.

Step 4 Development of the NPA for the post-press technique course

Data obtained from both focus group discussions were integrated and analysed. The NPA were developed by adjusting the MPA according to the results of the data analysis. The NPA development process for the post-press technique course is shown in Figure 2.

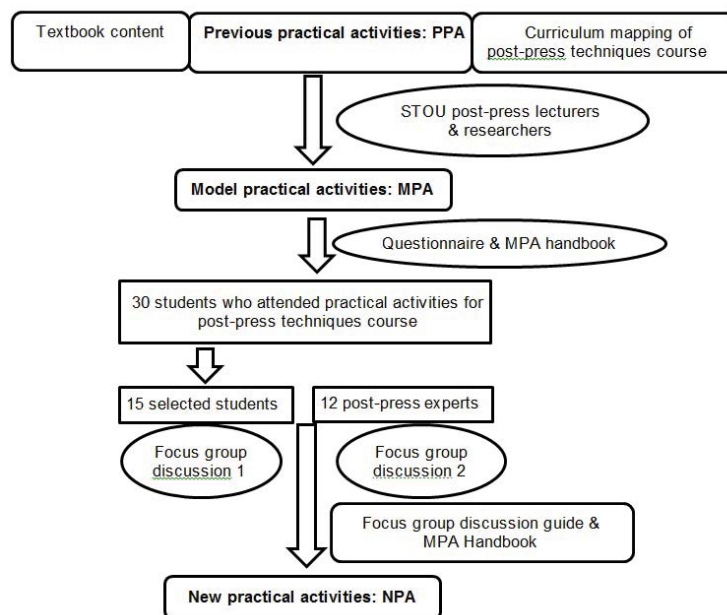


Figure 2: The process of developing the new practical activities for the post-press technique course

RESULTS

The main results of this study can be summarised as follows:

The MPA development

The MPA consisted of 8 SPA and 10 FPA, which differed from the PPA in the following aspects: 1) The number of practical activities; 2) The revision of each practical activity; 3) The selection of ELOs according to TQF learning domains for each activity; 4) The employment of all 15 units of textbook content; and 5) The revised titles of each practical activity and ELOs, relevant to the procedures of each activity. The comparative results between the PPA and the MPA are shown in Figure 3.

Findings from the 24 students are as follows: A high percentage of students agreed with all the TQF determined in the MPA (98.3% for 8 SPA and 98.7% for 10 FPA). Interesting suggestions are summarised as follows:

<p>MPA: self-practical activities</p> <ol style="list-style-type: none"> 1. Print surface finishing 2. Die cutting 3. Folding 4. Conventional printed product converting 	<p>Suggestions</p> <p>Prepare printed product samples with various post-press techniques and send them to students.</p> <p>It was difficult for students who did not have post-press experience or work in printing factories to collect the printed product samples with post-press problems, analyse them and suggest solutions to the problems.</p>
<p>MPA: field- practical activities</p> <ol style="list-style-type: none"> 1. Watching video on " Post-press techniques" 4. Practical work on paperback bookbinding 7. Practical work on hardcover bookbinding 	<p>Suggestions</p> <p>Prepare printed product samples with a variety of post-press techniques to study while watching a video.</p> <p>Students will have an opportunity to do practical work in groups, which is similar to real working situations in printing factories.</p>

The results from focus group discussions and the NPA development

The main suggestions from the student focus group were as follows:

- (1) Remove the procedures of collecting printed product samples with post-press problems from SPA
- (2) Move the problem analysis procedures from some SPA to FPA
- (3) Group students with post-press experience and without experience in the same group
- (4) Prepare printed product samples with a variety of post-press techniques for SPA
- (5) Remove the problem analysis procedures from some SPA (caused TQF 3-2 removal).

The main suggestions from the post-press expert focus group were as follows:

- 1) The main content of the MPA was appropriate but the practical procedures along with TQF learning outcomes should be revised; 2) Move one MPA; and 3) integrate some related MPA.

The revisions were summarised as follows:

- (1) Move *Watching video on "Post-press techniques"* from FPA to SPA, so students would be able to repeat viewing and have more time for FPA
- (2) Integrate 3 SPA: 1) *Print surface finishing*, 2) *Folding*, and 3) *Conventional printed product converting* into *Post-press technique for conventional printed product*, in order to reduce the number of printed product samples used by students to analyse several post-press techniques
- (3) Integrate 2 FPA: 1) *The University Press study tour and demonstration on "Paperback bookbinding"*, and 2) *Practical work on paperback bookbinding* into

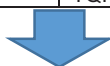
- (4) *Paperback bookbinding (The University Press Study tour, demonstration and practical work)* in order to give students a greater understanding of process flow. Most procedures and some TQF learning outcomes of each NPA were revised. The TQF learning outcomes (TQF 1-1, TQF 2-2, and TQF 2-6) were added: FPA: *Lecture on “Post-press technique innovation*, SPA: *Watching video on “Post-press technique” and Post-press technique for conventional printed product*, and SPA: *Efficiency of box stacking on pallet and Packaging and environment protection*, respectively.

As a result, each NPA was developed in line with ELOs and associated TQF learning domains. The development flow chart from PPA to MPA and NPA, respectively, are shown in Figure 3.

Previous Practical Activities (PPA)	
Self-practical activities	Field-practical activities
1. Print surface finishing 2. Die cutting 3. Folding 4. Conventional printed product converting 5. Flexible packaging converting	1. Watching video on “ Post-press techniques” 2. Folding 3. Cutting 4. Wire stitching and spiral wire binding 5. Sewn bookbinding 6. Lecture on “Post-press technique” 7. Perfect binding 8. Hot foil stamping and laminating 9. Die cutting 10. Hardcover bookbinding 11. Box model making
The employed textbook units: 1-8	The employed textbook units: 1-11, 14
TQF based on the curriculum mapping of post-press technique course: TQF 1-2* TQF 3-2, 3-3, 3-4 TQF 4-1, 4-2, 4-3, 4-4 TQF 5-1, 5-2, 5-3	



Model Practical Activities (MPA)	
Self-practical activities (SPA)	Field-practical activities (FPA)
① Print surface finishing (TQF: 3-1 3-2 3-3) ② Die cutting (TQF: 3-1 3-2 3-3 5-1) ③ Folding (TQF: 3-1 3-2 3-3) ④ Conventional printed product converting (TQF: 3-1 3-2 3-3) ⑤ Flexible packaging converting (TQF: 3-1 3-2 3-3) ⑥ Product tag making (TQF: 3-1 3-3 3-4) ⑦ Efficiency of box stacking on pallet (TQF: 3-2 3-3 5-1) ⑧ Packaging and environment protection (TQF: 1-4 3-1 3-2 3-3 3-4)	① Watching video on “Post-press techniques” (TQF: 2-2) ② The University Press study tour and demonstration on “Paperback bookbinding” (TQF: 2-2 3-3) ③ Analysing quality of paperback bookbinding case study (TQF: 2-2 3-2 3-3) ④ Practical work on paperback bookbinding (TQF: 2-2 3-2 3-3 4-1 4-2 4-3 5-2 5-3) ⑤ Die cutting (TQF: 2-2 3-2 3-3 4-1 4-2 4-3 5-1) ⑥ Print surface finishing (TQF: 3-3) ⑦ Practical work on hardcover bookbinding (TQF: 2-2 3-2 3-3 4-1 4-2 4-3 5-1 5-2) ⑧ Identifying post-press techniques on printed product samples (TQF: 3-2 3-3) ⑨ Lecture on “Post-press technique innovation” (TQF: 2-2 2-4 2-6 3-3 3-4 4-1 4-2 4-4) ⑩ Printed product model making for promotional purposes (TQF: 3-3 3-4 4-1 4-2 4-3 4-4 5-2 5-3)
The employed textbook units: 1-8, 12-15	The employed textbook units: 1-12, 14-15
summarised TQF from all SPA: TQF 1-2*, 1-4 TQF 3-1, 3-2, 3-3, 3-4 TQF 5-1	summarised TQF from all FPA: TQF 1-2*, 1-4 TQF 2-2, 2-4, 2-6 TQF 3-1, 3-2, 3-3, 3-4 TQF 4-1, 4-2, 4-3, 4-4 TQF 5-1, 5-2, 5-3



New Practical Activities (NPA)	
Self-practical activities (SPA)	Field-practical activities (FPA)
1. Watching video on “ Post-press techniques” (TQF: 2-2) (moved from ①) 2. Die cutting (TQF: 3-3 5-1)	1. Paperback bookbinding (The University Press Study tour, demonstration and practical work) (TQF: 2-2 3-2 3-3 4-1 4-2 4-3 5-1 5-2 5-3) (integrated ② and ④) 2. Analysing quality of paperback bookbinding case

<p>3. Post-press technique for conventional printed product (TQF: <u>2-2</u> 3-1 3-3) (integrated ❶, ❷ and ❸)</p> <p>4. Flexible packaging converting (TQF: 3-1 3-2 3-3)</p> <p>5. Product tag making (TQF: 3-1 <u>3-2</u> 3-3 3-4)</p> <p>6. Efficiency of box stacking on pallet (TQF: <u>1-4</u> <u>2-6</u> 3-2 3-3 5-1 <u>5-3</u>)</p> <p>7. Packaging and environment protection (TQF: 1-4 <u>2-6</u> 3-1 3-2 3-3 3-4)</p>	<p>study (TQF: 2-2 3-2 3-3 <u>4-1</u> <u>4-2</u> <u>4-3</u>)</p> <p>3. Die cutting (TQF: 2-2 3-2 3-3 4-1 4-2 4-3 5-1)</p> <p>4. Print surface finishing (TQF: <u>2-2</u> <u>3-2</u> 3-3)</p> <p>5. Practical work on hardcover bookbinding (TQF: 2-2 3-2 3-3 4-1 4-2 4-3 5-1 5-2 <u>5-3</u>)</p> <p>6. Identifying post-press techniques on printed product samples (TQF: <u>2-2</u> 3-2 3-3)</p> <p>7. Lecture on "Post-press technique innovation" (TQF: <u>1-1</u> <u>1-4</u> 2-2 2-4 2-6 3-3 3-4 4-2 4-4)</p> <p>8. Printed product model making for promotional purposes (TQF: <u>2-2</u> 3-3 3-4 4-1 4-2 4-3 4-4 5-2 5-3)</p>
The employed textbook units: 1-8, 12-15	The employed textbook units: 1-12, 14-15
<p>summarised TQF from all SPA: TQF 1-2*, 1-4 TQF : 2-2, 2-6 TQF 3-1, 3-2, 3-3, 3-4 TQF 5-1, 5-3</p>	<p>summarised TQF from all FPA: TQF 1-1, 1-2*, 1-4 TQF : 2-2, 2-4, 2-6 TQF 3-1, 3-2, 3-3, 3-4 TQF 4-1, 4-2, 4-3, 4-4 TQF 5-1, 5-2, 5-3</p>

* Learning outcomes according to TQF 1-2 resulted from habits of acting with discipline, punctuality, honestly, selflessly, and responsibly in person and in groups.

Bold: summarised TQF added in the MPA compared with the PPA.

Bold-Italic: summarised TQF added in the NPA compared with the MPA.

Highlight: TQF removed from the MPA.

Underline: TQF added in the NPA.

Figure 3: Development flow chart: PPA to MPA and NPA

DISCUSSION

The main development of the NPA resulted from improvement, integration, and transfer of some MPA. In addition, the NPA was redesigned in line with the students' interests, aptitudes and authentic experience, in consideration of individual differences, in accordance with The National Education Act of B.E. 2542 (Chapter 4, Section 22 and 24, 1999). The development employed various student-centred teaching methods: knowledge and skill-based learning, experiential learning, creativity-based learning, problem-based learning, resource-based learning, and project-based learning. A number of post-press machines, instruments, materials, and instruction media were provided, which enabled students to actually perform drills in practical work. Implementing group work encouraged students to share their own experiences and developed interpersonal skills, communication skills, and responsibility.

The development of the NPA is summarised as follows:

- (1) The NPA comprised 7 SPA and 8 FPA, which is a reduction from MPA (8 SPA and 10 FPA) according to post-press experts' suggestions. The procedures, along with the ELOs of each activity, were revised and developed as a result of both focus group discussions.
- (2) Most titles of the NPA were quite similar to post-press practical activities at selected local universities. Some NPA, such as die cutting, folding and bookbinding also meet the needs of printing industry's professional qualification for post-press implemented by TPQI (Thailand Professional Qualification Institute, 2015).
- (3) All NPA were defined corresponding to TQF learning outcomes, fulfilling the criteria of all 5 TQF learning domains. The summarised TQF learning outcomes from all SPA were TQF 1-2, 1-4, 2-2, 2-6, 3-1, 3-2, 3-3, 3-4, 5-1, 5-3 and from all FPA were TQF 1-1, 1-2, 1-4, 2-2, 2-4, 2-6, 3-1, 3-2, 3-3, 3-4, 4-1, 4-2, 4-3, 4-4, 5-1, 5-2, 5-3. The added TQF learning outcomes from the MPA TO NPA were TQF 1-1, 2-2, and 2-6. The most learning domains employed in the NPA were TQF 3: cognitive skills, followed by TQF 4: interpersonal skills and responsibility. The most specified learning outcome was TQF 3-3: to apply knowledge to practice and qualify essential professional skills according to curriculum.

- (5) The content of unit 12, 13, and 15 which were not employed in PPA were addressed in both MPA and NPA. Unit 12 “Converting of Product Label, tag and product display” related to SPA: *Product tag making*; Unit 13 “Control technique for printed product inventory and delivery” related to SPA: *Efficiency of box stacking on pallet*; and Unit 15 “Post-press innovation” related to FPA: *Lecture on “Post-press Technique Innovation”*. The application of all 15 units was a learning strategy that enabled students to read through the textbook, understand the content, and do better practical work.

CONCLUSION

As a result of NPA development, a more ubiquitous learning via the ODL mode can be offered. The NPA content in e-files and SPA video file on post-press techniques can be uploaded on the university's website together with the arrangement of e-learning and e-tutorials. The major limitation of the research is the communication about TQF concept and the research tools to the students and the post-press experts. Another limitation is the practical activities of the post-press technique course which concern real printed samples and the use of the three sensory systems (vision, somatic sensation, and olfaction). The ability of students to analyse and identify which post-press techniques are used in each printed sample, including quality control, depends on these sensory systems. Psychomotor skills should be reconsidered and applied to the post-press technique course as well as some other practical courses with highly developed physical skills. The findings of this paper may cause educators or institutions to reconsider practical work development and offer science courses in the ODL mode. For further study, the NPA of the post-press technique course proposed by this study should be used and evaluated in real situations. The results provide a guideline for research on the development of other practical courses, programmes and curriculum according to TQF.

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