Andragogical teaching patterns appropriate for work-integrated learning in the information technology industry

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This paper examines the teaching patterns of experts employed in the information technology (IT) industry. The objective was to study the teaching patterns that are used to develop new IT workers in organizations. Thematic content analysis was conducted on interviews with thirty-four IT professionals working in IT and non-IT industries with experience of mentoring new workers. The study investigated the use of adult-learning theory in four teaching patterns: time-based, function-based, technical-task-based, and case-based. Indications for the applications of the various patterns are described in detail. The researchers suggest the use of the patterns identified to optimize the process of enhancing the ability of IT students involved in work-integrated learning projects.

Keywords: IT education, teaching approach, IT industry, IT worker, digital economy, adult learning

The present digital age is a period in which the economy is growing following developments in science and technology. Information technology (IT) careers are a primary factor that supports the development of digital economies worldwide (Atkinson & McKay, 2007; Baller, Dutta, & Lanvin, 2016). IT professionals require both knowledge and skills to develop their abilities (Breivik, 2005). Universities, who have the primary responsibility to produce quality IT graduates for the market, appreciate the global situation (Raymond, McNabb, & Matthaei, 1993) and many now employ work-integrated learning (WIL) projects incorporating collaborative learning models, new curriculum designs and teaching approaches, and other practical methods for IT education (Siddoo, Janchai, & Sawattawee, 2018) but the outcome in terms of the quality of new graduates has been a matter of concern.

Many studies have identified short comings in the quality of potential recruits to the IT workforce which result in many of them not being employed (Barrie, 2004; Md Saad, Robani, Jano, & Majid, 2013; Siddoo, Sawattawee, Janchai, & Yodmongkol, 2017). IT organizations claim that they cannot hire many of the new IT graduates as workers because they lack necessary skills such as IT skills, interpersonal skills, and other soft-skills and researchers concur that high-quality IT students are not developed through learning within a particular curriculum but based on learner-involvement and useful teaching patterns which are the dominant factors (Laurillard, 2002; Leonard, 2000; Meyers & Nulty, 2009; Sogunro, 2015).

The research described in this paper focused on the teaching patterns used in IT education to prepare high-quality IT recruits for the industry through WIL projects. 'Teaching patterns in IT education' was taken to mean the implementation of mechanisms by IT instructors in educating IT students to conduct practical work. Nowadays, the teaching patterns employed in universities have been directly affected by the transformation which has taken place in technology, creating the digital age (Johnson, et al., 2016). In particular, IT instructors have had to abandon traditional pedagogy and adapt their teaching

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patterns to achieve better learning outcomes (Mckenzie, Coldwell-Neilson, & Palmer, 2017). Moreover, besides including both theoretical and practical aspects, teaching needs to focus more on inculcating working skills necessary for future career advancement (Qenani, MacDougall, & Sexton, 2014). Instructors must impart not only foundational knowledge but also foster good learner behaviors including knowledge and skills and abilities required to satisfy the needs of the market (Sogunro, 2015).

Moreover, motivating students in higher education through the employment of approaches following the andragogy principle has been supported and teaching patterns in higher education now make regular use of methodologies derived from adult learning theory (Knowles, 1973; Fornaciari & Dean, 2014). Within adult learning theory, the term *andragogy* represents a vital principle in learning by adults, explaining how adult learning differs from a child's learning (Knowles, 1973). In teaching adults, educators must understand adult learning behavior because adults often have their own study objectives and motivation to learn (Merriam & Brockett, 2011; Wlodkowski & Ginsberg, 2017). Previous studies have proposed enhancing IT students' abilities by using teaching approaches and teaching techniques incorporating the andragogy concept, for example Boud, Cohen and Sampson (1999), Ellis (2007), Fee and Holland-Minkley (2010), Lederer and Raban (2001), Sixsmith and Litchfield (2010), Vihavainen, Paksula and Luukkainen (2011). However, the models and approaches proposed for IT students have usually been constructed based on theory or on classroom experiments, rather than from the experience of real workers in the IT industry. There has only been limited research exploring teaching patterns and their application by experienced IT professionals and there has been a lack of studies investigating particular teaching patterns to act as a guideline for IT instructors. As mentioned above IT professionals are developed based on knowledge and experience. Therefore, in IT education the instructors should learn from experts working in the IT industry and apply the teaching patterns as a means of enabling students to achieve broad-based learning outcomes before embarking on their careers.

This research therefore aimed to explore the teaching patterns adopted by IT experts to enable potential IT workers to achieve successful learning outcomes. The study was conducted based on interviews with IT experts engaged in mentoring new workers. Thematic content analysis was then employed to identify the main themes emerging from the interviews. The research question investigated was:

> What kind of teaching patterns are used by mentors in the IT industry to develop new IT workers?

The findings illustrate how IT professionals enlighten new IT workers and the results will be useful in guiding higher education. IT instructors in universities and other teaching institutions can apply the results as teaching guidelines to help students to gain employment after graduating. The use of the teaching patterns identified in this WIL project is suggested in the discussion section.

LITERATURE REVIEW

Adult Learning Theory and Approaches Derived from it

Adult learning can be explained as a cognitive process that occurs when adults are taught (Merriam & Brockett, 2011). In adult education, understanding adults' learning processes is essential. Instructors who know learners' study objectives will be able to create learner enthusiasm and thereby achieve learning outcomes (Sogunro, 2015).

Based on an andragogical model (Knowles, Holton, & Swanson, 1998) which focuses on how to teach adults, there are six principle assumptions of adult learning:

1. The need to know: Adults often want to know why they need to learn and what the benefits to their life will be. With that knowledge they will cooperate in learning.
2. The learner's self-concept: Adults often have their own needs. They like to take responsibility and need the freedom to manage their learning process. If the learning is contrary to their needs, adults may resist and refuse to cooperate in the learning.
3. The role of the learner's experience: Adults have different abilities and learning styles, depending on their experience. In addition, they need to share their knowledge and experiences with others and when the experience benefits others, adults also need praise or support for their efforts.
4. Readiness to learn: Adults are able to ascertain if a lesson or its content is useful to them and can support their real-life commitments.
5. Orientation to learning: The approach to adult learning should start with real situations or problems. Adults show interest in context because they can match cause and effect and they will be able to see how things will be beneficial to them.
6. Motivation: The most important motivation for adult learning is internal pressure, such as seeking job satisfaction, needing self-esteem, or improving quality of life.

Knowles et al. (1998) introduced the andragogical process model of teaching based on understanding the characteristics of adult learning and focused on the learner's participation. The process assists the learner in gaining the knowledge and skills they expect, and consists of the following eight steps:

1. Preparing learners: This step prepares learners to understand their own and others' learning styles and to share learning experience with others while undertaking collaborative activities. Also, an instructor may at this stage conduct a small project to encourage learners in the class.
2. Climate: In this step the instructor prepares the learning environment both physical and mental. The physical environment includes the classroom setting, the chairs, light, temperature, and resources for learning. The mental climate is about people and interpersonal factors.
3. Planning: This step involves planning to learn based on learner involvement. Participation in the detailed preparation for the achievement of the class goal increases learner engagement.
4. Diagnosing needs: In this step the learner's needs are analyzed. The instructor may encourage the learner to identify his/her learning objectives, such as what knowledge or competencies she/he wants to improve. Note that if the learner knows his/her goal, she/he will learn without compulsion.
5. Setting objectives: This is the step in which the learner's target is defined. The target should be practical; for example, the learner's objectives may be to increase programming knowledge and skills. Moreover, the objective should be based on the learner's needs.
6. Designing the learning plan: In this step a plan is drawn up based on the learner's needs and aspirations. Problems to be solved should be from the learner's area of interest. Learning methods should encourage learners to achieve their intended goals.
7. Learning activities: This is the operational step. The instructor should facilitate the learning according to the plan including stimulating the learner to solve problems by her/himself.
8. Evaluation: The step in which the learning outcome is assessed. The evaluation criteria may include reaction evaluation, learning evaluation, behavior evaluation, result evaluation and the diagnosis of learning needs.

Application of Andragogical Teaching Patterns in IT Education

Fee and Holland-Minkley (2010) used a problem-based learning approach to increase students' learning performance. The instructor, who was a teacher with practical experience, was involved in the design of the curriculum, and the students who took part in the study were assigned to conduct projects in each subject. Vihavainen et al. (2011) applied the cognitive apprenticeship model with computer science students in a programming course. The process model focused on learning-by-doing activities which helped them to develop strong programing skills capable of being adapted to an advanced level. Ellis (2007) adopted self-directed learning theory in teaching a web-application design and development course. The study employed student-centered tasks; for example, the students were assigned to autonomous teams which were responsible for the detailed design of projects, and a self-evaluation system made the learners appreciate the outcomes they achieved using this methodology. The researchers claimed that the long-term outcome of this approach was an improvement in the students' habits and future work. Lederer and Raban (2001) found that IT students needed to operate independently in their management of the software development process of computer-based projects and Boud et al. (1999) used the peer-learning method to enhance student learning. During peer-learning, students had the freedom to work within their team and knowledge was transferred automatically within the group when the students shared their experience. Meanwhile Sixsmith and Litchfield (2010) promoted the teamwork skills of IT students by conducting a work-ready project and work-ready learning activities within an IT-management curriculum. The details of the method were adapted from previous literature and were based on the instructors' experience. The implementation of the work-ready concept helped the students to improve their collaborative decision-making and problem-solving.

METHODOLOGY

Thematic Content Analysis

Thematic content analysis is a qualitative research methodology that utilizes data in the form of spoken or written texts and by coding the language used, identifies patterns or themes in the texts. The objective of thematic content analysis is focused on the meaning and interpretation of data based on a research interest. This methodology is flexible and useful for answering research questions. In this research, the process of thematic analysis proposed by Braun and Clarke (2006) was adapted to analyze the content of interviews conducted with the sample of IT experts described below.

Population and Sampling

The population sampled in this study was comprised of IT professionals in Thailand working in both IT and non-IT industries with mentoring experience. The participants were selected purposively from Prince of Songkla University's WIL project and were interviewed in relation to the teaching patterns they employ. The sample chosen consisted of 34 IT experts who had joined the WIL project in 2018. Appendix A shows details of the participants and their characteristics. Twenty of the interviewees were, at the time of the interview, working in the IT industry, while the other fourteen were working in non-IT settings, such as in the government sector, the financial sector, or the natural resource and energy sectors. All the participants had worked in various IT related positions for more than five years and over 70 % had at least fifteen years working experience. Therefore, confidence can be placed in the results of the study being derived from experienced IT workers.

Instrument and Reliability

The researcher conducted semi-structured interviews to answer the research question. The interview questions were created based on the STAR (situation, tasks, actions and results) method, which is recognized in the field of human-resource development (Cook, 2009; Dmitrieva, Zaitseva, Kulyamina, Larionova, & Surova, 2014). The questions asked were specified in an interview template, which was then reviewed and validated by three IT academics and three IT professionals. These experts also assessed the questions based on the questionnaire research guide in Denscombe (2010) to ensure that complete, relevant and accurate information would be elicited. Ultimately, after minor comments from the six experts consulted, the contents of the interview template were edited, and the set of interview questions were declared suitable for use.

In summary the questions covered the following four subject areas:

1. Demographic information relating to the interviewee: Position, industry type, working experience, mentoring experience, responsibilities, customer sector.
2. Job assignment and goal expectations: Job details and responsibility of new IT workers; expectations regarding learning outcome of new IT workers.
3. Behavioral-based questions relating to situation, tasks, actions and results, training style, practical activities for new staff, teaching characteristics, teaching processes, teaching methods and evaluation processes.
4. Advantages and disadvantages of teaching patterns: Benefits and obstacles in applying each teaching pattern.

Data Collection

The interviews with the 34 participants were conducted between January and July 2018 and each lasted between one and two hours. The interviews, which were conducted either face-to-face or by telephone, were recorded and transcripts were then prepared and sent to the interviewees to confirm that they represented an accurate record of the conversation.

Analysis Procedures

The thematic content process was then conducted (Braun & Clarke, 2006). A text analyzer tool was utilized to prepare descriptive statistics and a spreadsheet. Document software tools were used to code the content by themes and categories. The researchers adjusted the results and they were validated by IT experts who deemed the outcome of the analysis to be satisfactory following a triangulation approach (Denzin, 2009; Mathison, 1988).

For the "familiarizing yourself with your data" step the researchers read the thirty-four interview scripts to better understand the IT experts' opinions. Many experts answered the questions based on their experience and the results were not in sequence. Therefore, some interview scripts were re-arranged by interview-question topic to facilitate analysis. Also, the verbal data from the interviews was transcribed into formal word and sentence structure.

The "generating initial codes" step was conducted based on the teaching patterns identified, to reflect the research question. A top-down approach was used, which allowed the researchers to comprehend the participants' opinions and allocate initial broad codes, which was followed by an in-depth analysis.

The codes extracted are shown in Table 1. The meaningful words column reflects the aspects of the IT experts' training experience described during the interview.

TABLE 1: Examples of top-down-approach-driven codes of teaching patterns in thematic content analysis

Sample of participants' opinion	Meaningful words	Coded for
(P5) We separate the training process into three periods, introduction, practice, and evaluation.	three periods	time division
(P9) The IT department teaches new IT workers by firstly introducing the organization then focusing on practice, and assigning a real job, and evaluation.	firstly introducing then…and…	training phase
(P3) The practice involves routine and specific jobs.	routine/specific	job function
(P4) We take care of the two main systems, which are the software used in the organization and that sold to customers.	/software used in organization /sold to customer	system support
(P15) Our work responsibility emphasizes business functions, and new staff should learn both business knowledge and programming techniques.	business function/programming techniques	job function, necessary knowledge
(P10) Mentors will ask about the junior's programming ability because most work is related to writing programs.	programming/writing programs	programming related
(P25) The organization requires technical sales engineers. The training process combines in-depth technical knowledge and sales techniques.	in-depth technical knowledge /sales techniques	specific function
(P14) New staff will be educated using previous customers' problems.	previous customer problem	case study

After allocating codes, the searching for themes step was conducted. There were seven potential categories derived from the interview data. Figure 1 illustrates the possible categories and the codes extracted.

The next step of the thematic analysis process was reviewing themes in which the level 1 and 2 codes were refined. This process reconsidered the evidence from the data by collapsing or splitting the thematic map. For example, Figure 1 included time division and training phase as original themes. But when reconsidering the meaning of the data, the words time and phase had a similar purpose in terms of the IT experts' experience. Therefore, the researchers collapsed the two themes into one meaning which was time. The other themes were reconsidered as well and the revised thematic map is shown in Figure 2.

After critiqued the result, the step of defining and naming themes were done. The researchers considered the theme framework based on the research question. The final main theme, categories, and sub-categories related to teaching patterns are presented in Figure 3.

In the last step, producing the report, the research team reviewed the details to be presented to answer the research question. The results of the analysis are presented in the following section.

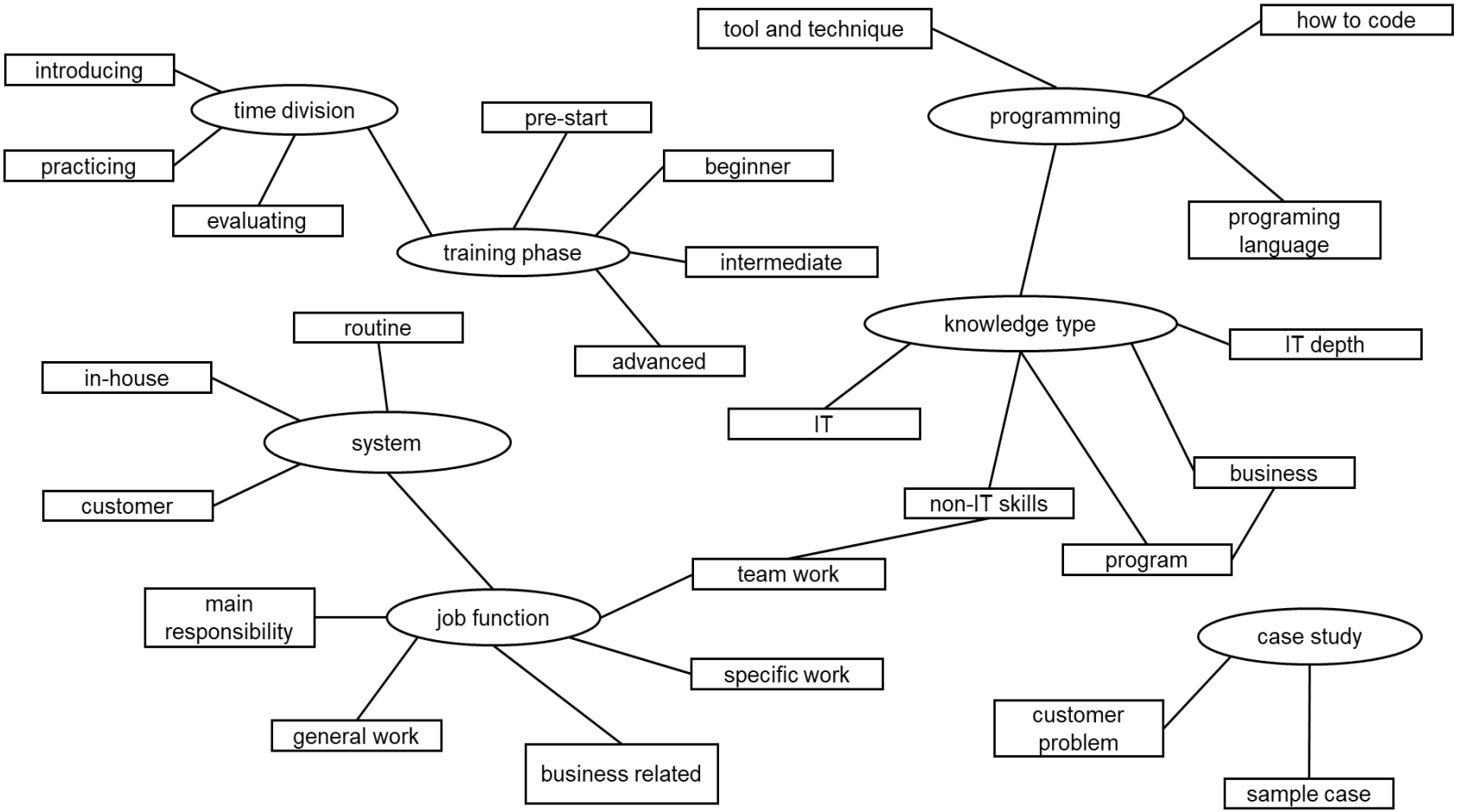

FIGURE 1: Initial thematic map of teaching patterns in the IT industry

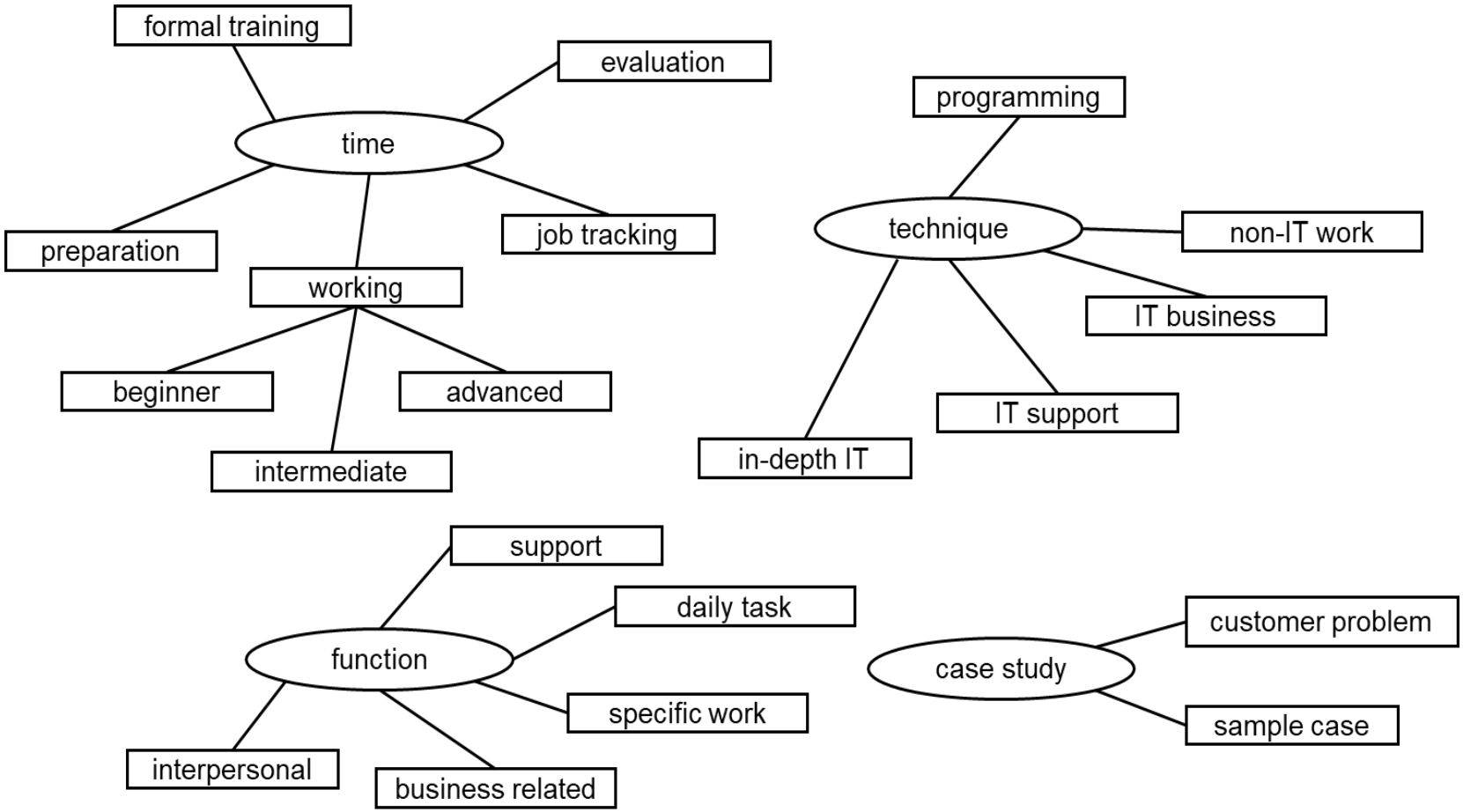

FIGURE 2: The thematic map of teaching patterns in the IT industry after analysis process

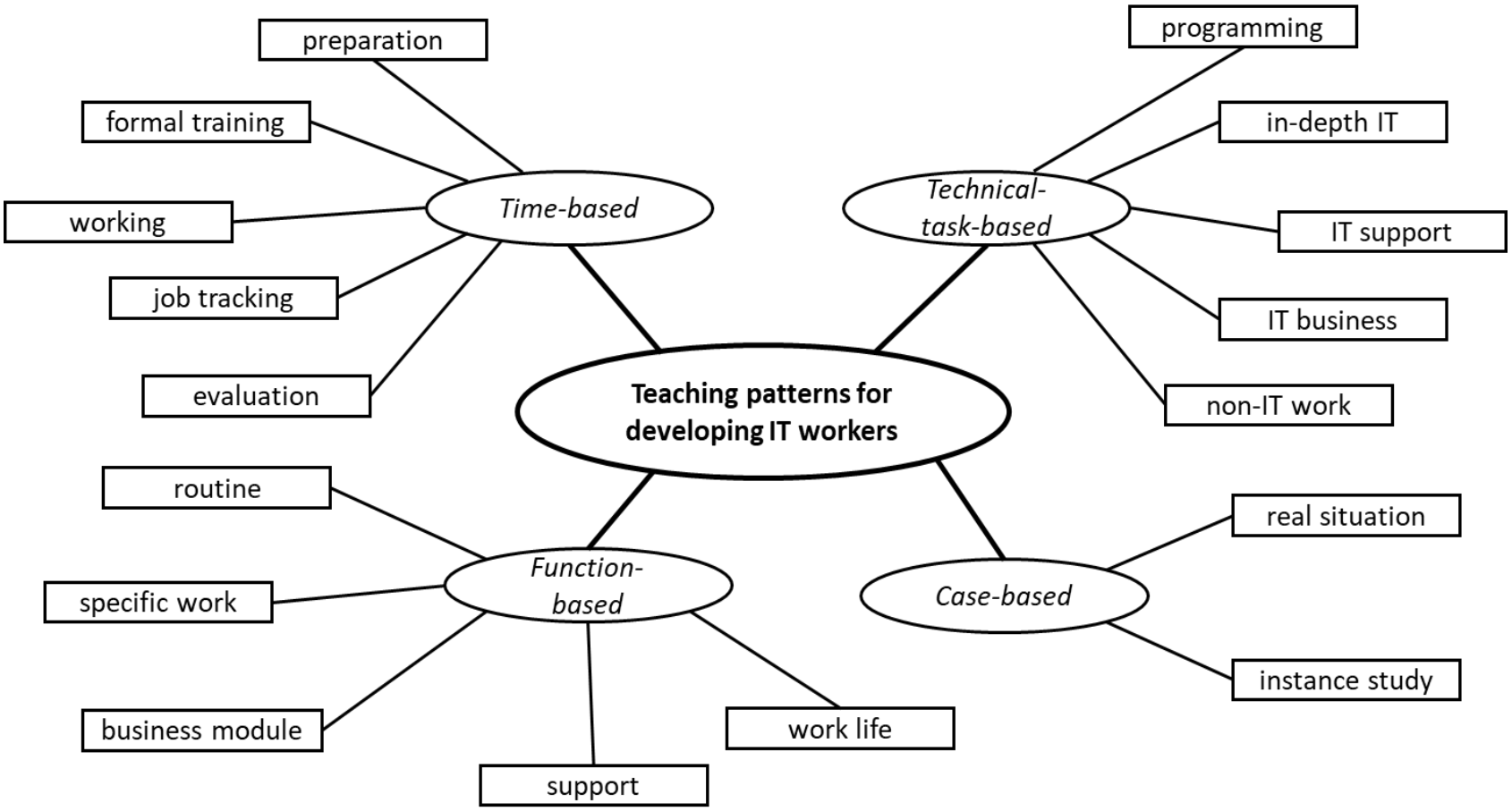

FIGURE 3: The four categories of teaching patterns in the IT industry

RESULTS

The main theme detected was *teaching patterns for developing IT workers* of which four were identified: time-based, function-based, technical-task-based, case-based. Most of the answers from the IT experts were similar: Experienced mentors favored a style of teaching patterns based on trial and error. During the training period, the mentors often integrated various teaching methods to guide a learner.

The four patterns that the IT experts used when teaching new staff were designated as time-based, function-based, technical-task-based, and case-based. From the contents of the interviews, the time-based model was the most popular followed by the function-based and technical-task-based models. The least favored model was the case-based model. The IT experts preferred to teach learners based on job responsibilities.

Time-Based Pattern

The objective of the time-based pattern was to gradually familiarize new employees with their job. Mentor controlled the time and master the content of the lesson. The typical process involved teaching from simple to complicated tasks. For example, some IT experts separated periods into early term, medium term and follow up term. Some IT experts said that this model reduced the pressure on new employees. The time-based stages suggested by the IT experts are described in Table 2.

TABLE 2: Time-based teaching pattern used by IT professionals

Period	Descriptions
Period A: Formal training	Activity organized by human resource department, sometimes called an orientation day. All new staff are informed regarding the organization, its vision, strategy, and their role in it.
Period B: Preparation	Preparation of new IT workers before performing their job. Explaining working task; new workers are given a task based on already completed work and allowed to practice with a real case. The focus is on routine work rather than ad hoc or difficult work.
Period C: Working	Actual work process. The mentor will assign a task to the new worker. The degree of difficulty of work tasks will increase with the variety and challenge of tasks during this period.
Period D: Job tracking	The job follow-up stage. The mentor often assesses the new worker based on their work product and working style. Experience can be shared to support successful working.
Period E: Evaluation	The process of assessing whether new employees can work with their team. The mentor will inform the new worker in detail about the evaluation result.

Function-Based Pattern

The interview results suggest that this model is suitable for IT jobs related to business functions, such as sales and marketing, finance, or health and safety. The purpose of this model was to foster business knowledge and problem-solving techniques concurrently in new workers. The learning process was primarily separated into functions. Some IT experts divided their function-based teaching into routine functions such as daily supporting tasks and functions including ad hoc tasks. Table 3 illustrates the process tasks that the IT experts used in their mentoring system.

TABLE 3: Function-based teaching pattern used by IT experts.

Functions	Descriptions
Function A: Routine work	Routine work can mean daily jobs or tasks that employees perform every day. Most jobs have a workflow direction. New staff can study previous cases and apply the lessons-learned to their assignments.
Function B: Specific work	Specific work can mean difficult tasks or ad hoc tasks. The performance of this kind of work needs in-depth IT skills. New staff will be assigned specific responsibilities depending on the mentor's decision.
Function C: Business module	Jobs will be given by business modules such as sales and marketing, finance and accounting, or inventory. Knowledge is learned and working procedures are performed by new staff.
Function D: Support	Work tasks that focus on customer service including in-house support. These tasks require both IT skills and soft skills, such as communication and presentation skills, and adaptability.
Function E: Work life	Topics which are not part of the workload, such as the IT-professional career path and how to work with different people. Work life topics can help new staff to relax and be happy in their jobs.

Technical-Task-Based Pattern

IT experts whose jobs focused on specific tasks, such as programming, sales or graphic design, often used this teaching pattern. The model's objective was to teach in-depth knowledge and tasks directly. Mentors will differentiate task types based on the main job responsibility. For example, for important jobs, such as selling IT technology and software to customers, junior workers should have both IT knowledge and marketing techniques and the mentor will train the junior worker for the two main tasks: IT and marketing. During training, the junior worker might be asked to deal with the customer by her/himself. All the IT experts who employed this pattern believed that experience from real situations would increase the new employee's confidence. The various aspects of the technical-task-based pattern used by the IT experts are shown in Table 4.

TABLE 4: Technical-task-based teaching pattern used by IT experts.

Technical	Description
Technical A: Programming	Tasks focused on the ability to code in any programming language. Database and management systems are introduced. Tasks performed by new workers will start at the beginner level and will gradually progress to specialized programs.
Technical B: In-depth IT	The tasks under this heading relate to specialized technology such as artificial intelligence, robotics or so called, big data. This kind of task requires in-depth knowledge and experience to be taught by the mentor.
Technical C: IT support	This type of function is often found in companies that sell specialized technology or software. The job requires in-depth technical knowledge to solve customer problems.
Technical D: IT business	Combined tasks that require both IT and business skills to perform. These tasks may pertain to technical sales or sales engineer positions as well as other related areas.
Technical E: Non-IT works	Work is focused on soft skills such as the skills necessary to deal with customers, negotiations, communication and bargaining.

Case-Based Pattern

Software development experts favored the case-based teaching pattern. The objective of the learning process is first, to identify problems and then to teach based on them. The cases used can be either real problems or hypothetical examples. In this process the mentor outlines a problem to the new worker, who is then allowed to solve it by her/himself. The mentor always guides the junior worker on how to solve the problem the first time. While working, the mentor will introduce aspects of the job and its responsibilities. However, when dealing with real customers, the IT experts suggested that they would work closely with the junior worker. The findings related to the case-based pattern are summarized in Table 5.

TABLE 5: Case-based teaching pattern used by IT experts.

Cases	Description
Type A: Real situation	A task is based on a real situation not something hypothetical. The mentor uses the real problem as the basis and then teaches other related topics and skills. The concern with using real cases was that there might be errors in the actual work.
Type B: Instance study	Sometimes called a case study. The tasks used by the mentor to train new staff are simulated, possibly based on a real problem which has already been solved. The mentor uses the sample problem as a case study. New workers can try to solve the problem by using whatever methods they think may be appropriate.

DISCUSSION

The research question presented in the introduction: What kind of teaching patterns are used by mentors in the IT industry to develop new IT workers? is discussed in this section. The results of the analysis of the interview data relating to the teaching patterns favored by the IT experts suggest that the andragogy concept was used to develop new IT workers. The findings show that the IT experts took account of the assumptions underlying adult learning: the need to know, the learner's self-concept, the role of learner experience, readiness to learn, orientation to learning and motivation (Knowles, 1973). When mentoring, the IT experts firstly took account of the learner's background and the job objectives, then tailored their teaching style to increase learner motivation and working performance.

The four teaching patterns employed in the IT industry were consistent with an andragogical process model (Knowles et al., 1998). The 34 experts created an appropriate working environment, which included team collaboration as its framework. Good preparation affects new workers' feelings (Jain & Kaur, 2014). The mentors provided necessary information about the team and individual responsibilities while introducing new employees to the corporate mission. Shared experiences and needs were communicated between the mentor and the learner at this step. The mentor identified the purpose of learning before commencing teaching. The IT experts believed that learning occurs when a learner realizes why she/he needs to know something that will benefit her/his life or career (Knowles, 1973). The teaching patterns and activities used encouraged new IT workers to appreciate the relevance of their tasks and to recognize the direction of their career growth. Thus, the motivation to learn was encouraged by the mentor. Within the patterns, learning can be evaluated based on action (Schunk, 1991) and learning success in the digital age can be defined as a person achieving their work goals within their working experience under different situations (Adamson, Doherty, & Viney, 1998; Gunz & Heslin, 2005; Judge, Cable, Boudreau, & Jr., 1995). It was notable that all the IT experts assessed junior workers along various dimensions such as work results, actions, and soft skills (e.g., attitude and interpersonal skills).

In terms of career suitability, based on the interview contents, the function-based pattern was preferred for non-programming jobs, such as IT support, IT consulting and testing because the main job characteristics were more concerned with the business. Teaching by functions helped to improve the learner's business skills as well as their IT skills. In contrast technical-task-based and case-based patterns were preferred for programming jobs, IT technical and specialized work. The IT experts specializing in software development first covered basic programming languages then linked them to problem solving through in-depth programming. The time-based pattern can, however, be used for any IT job since the IT experts believed that this pattern was easy to understand and implement.

One significant observation was that teaching with the patterns used by the IT experts fostered the learner's self-directed learning skills (Grow, 1991). The mentor's role was thus that of facilitator rather than teacher because in the IT industry, ability is best constructed from one's own experience. This perspective was also identified by Ellis (2007) who suggested that self-directed learning skills are necessary for IT students and their future work. The suitability of a mentor for her/his role will promote other learner skills beyond purely academic knowledge as was also found by Vihavainen et al. (2011) who recommended promoting student activities which inculcate skills outside of IT, such as working-life skills, while studying.

The Application of Andragogical Teaching Patterns in WIL

The implementation of WIL combines both main processes and support processes (Siddoo et al., 2018). The teaching patterns identified in this research can be suitably applied in WIL supporting operations, that is as teaching approaches or as practice methods either as a facet of curriculum design or based on their adoption by instructors. Figure 4 presents the implementation guidelines, the objective of which is to increase IT students' abilities in both IT and non-IT skills before they commence work. The WIL process roles are those of the instructor as facilitator and the student as learner. The process combines five steps. The success of each activity depends upon instructor and student collaboration. The learning goal is determined by the career interest of the student (Debuse & Lawley, 2009). The learning goal can for example be career competency, or career work target (VahidGarousi, KaiPetersen, & BarisOzkan, 2016). Next, the instructor and the student have to jointly adapt the class in order to achieve the learning goal, including climate setting, which is the creation of an environment that supports the training system. The climate includes both the physical and mental environment (Chandrasekar, 2011). After drawing up a learning plan and creating suitable atmospheres, learning is conducted based on the training system. The learning outcome is evaluated in the evaluation step and the instructor and student use the assessment result as a lesson-learned in reconsidering the learning goal and class design.

As shown in Figure 4, the teaching patterns identified in this study can be used in any of the steps in the WIL implementation process. In the learning goal step, the teaching patterns support the instructor by allowing him to take into consideration the student's career interest as well as in facilitating his/her planning of the class layout and teaching direction. In the class design step, teaching patterns are a design tool. The instructor can adopt the teaching patterns which match the student's career goal and apply components of the pattern in order to achieve the learning goal. The student can also be involved in class design, which creates a learning ecology, through which their career goal can be achieved based on the teaching patterns adopted. Each teaching pattern requires a different learning environment and creating a suitable learning environment will facilitate the instructor's role and promote the learner's motivation (Chandrasekar, 2011). In the training system stage, the teaching patterns will help to develop student talents. The instructor can directly use teaching patterns or adapt the methods as

appropriate. After completing the class, the instructor and student jointly conduct the assessment process. Teaching patterns and their components help the participants to determine the meaning of success. Moreover, the training experience should be a sharing process and the results of the evaluation will allow the instructor to adjust her/his teaching method and allow the student to improve her/his performance.

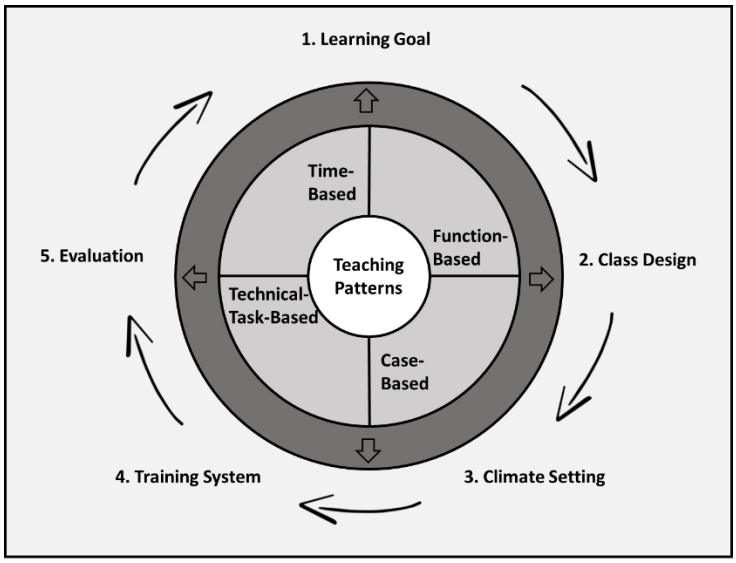

FIGURE 4: The application of teaching patterns in WIL implementation guidelines

CONCLUSION AND FUTURE WORK

This research investigated the teaching patterns employed by IT experts involved in mentoring new IT workers. The descriptions used in each teaching pattern were also explored. The time-based model was generally selected when mentoring new IT workers. However, some of the IT experts chose the function-based model for IT jobs related to the IT business rather than programming, while the technical-task-based model was favored for programming. Finally, the case-based model was suitable for jobs involving customer problems and programming.

Based on the results of the thematic content analysis conducted in this study, within the IT industry there was no single pattern that met all the needs of developing new IT workers. All types of teaching patterns had their purpose. The approaches used to teach junior workers depend on many factors such as the mentor's background and knowledge, learner involvement and the environment (Craig, Allen, Reid, Riemenschneider, & Armstrong, 2013; Felder & Silverman, 1988; Jain & Kaur, 2014).

However, the findings demonstrate the relevance of adult learning theory. In real working situations, teaching new graduates as adults is the most suitable approach. The results of this research will encourage the use of the patterns identified in this study in WIL projects, as teaching strategies and in the design of curriculums employed in academic situations, because they have been found to be the most effective by the IT experts who participated in this study. The university may modulate the teaching policy by study this research result. Establishing a proactive plan to contact the industry in bringing the knowledge they have with the teachers or even welcome industry to join coaching students before graduation should be concerned. Applying research results in the early stages can begin by

inserting teaching patterns in the classroom or creating a short training course for students in the cooperative education program. After learning the patterns, the university may tailor the patterns that suit for all participants to the course or subject that required IT capabilities. The limitation of the research was that the context was confined to Thailand and the participants were recruited only from one university's WIL project. The expansion of the study area and sample employed in future work would extend the applicability of the results.

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APPENDIX A: Interviewee lists

Participant	Position	Industry type	Working experience (years)	Mentoring experience (years)
P 1	IT Manager	IT	17	Yes (> 5)
P 2	Senior System Administrator	IT	17	Yes (> 5)
P 3	Senior IT Staff	Non-IT	20	Yes (> 5)
P 4	Senior System Analyst	IT	10	Yes (> 5)
P 5	IT Manager/Founder	IT	15	Yes (> 5)
P 6	IT Manager	IT	20	Yes (> 5)
P 7	System Engineer	IT	10	Yes (> 5)
P 8	Senior Programmer	IT	10	Yes (> 5)
P 9	Senior System Administrator	Non-IT	17	Yes (> 5)
P 10	Senior Programmer	Non-IT	10	Yes (> 3)
P 11	Assistant Vice President	Non-IT	20	Yes (> 5)
P 12	IT Specialist	IT	18	Yes (> 5)
P 13	IT Specialist	IT	18	Yes (> 5)
P 14	IT Project Manager	IT	20	Yes (> 5)
P 15	Senior Graphic Designer	IT	12	Yes (> 5)
P 16	Project Manager	IT	12	Yes (> 5)
P 17	Computer Technical Officer(expertise)	Non-IT	20	Yes (> 5)
P 18	Chief of Board of Directors Section	Non-IT	20	Yes (> 5)
P 19	Senior System Analyst	IT	20	Yes (> 5)
P 20	IT manager	IT	8	Yes (> 5)
P 21	Software Engineer	Non-IT	15	Yes (> 5)
P 22	Senior System Analyst	Non-IT	18	Yes (> 5)
P 23	Senior System Analyst	Non-IT	17	Yes (> 5)
P 24	Senior System Analyst	Non-IT	17	Yes (> 5)
P 25	IT Technical and Sale Engineer	IT	17	Yes (> 5)
P 26	IT Manager	Non-IT	17	Yes (> 5)
P 27	Founder	IT	20	Yes (> 5)
P 28	IT manager	Non-IT	21	Yes (> 5)
P 29	Senior Tester	Non-IT	17	Yes (> 5)
P 30	Sale Manager	IT	15	Yes (> 5)
P 31	Senior Programmer	IT	5	Yes (> 3)
P 32	Senior Graphic Designer	IT	15	Yes (> 5)
P 33	Senior Programmer	IT	5	Yes (> 3)
P 34	IT Manager	Non-IT	10	Yes (> 5)