
Competency-based diagnosis for interns-quality assessment approach

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Abstract: In order to understand how the advantages of internship programs influence the undergraduates, this study evaluated seniors' experiences with the internship program in marketing and logistics management department at the case university. Through the University Career and Competency Assessment Network (UCAN) system, we used Deming's 'plan-do-check-action' (PDCA) methodology to investigate the relationship between learning outcome, competency assessment, and curriculum improvement. Our study showed that after the internship, students' professional and common competencies were improved and interns were satisfied with the program. In professional competency, students get opportunities for direct learning and experience of product, price, promotion, and place. Among the eight common competencies, the highest score represents the 'responsibility and discipline'. The satisfaction surveys showed that it is very important to offer a rich and sufficient curriculum design. Also, it was found that 'communication expression' and 'job responsibility and discipline' are best achieved by real-world training. This research fulfils objectives of the PDCA cycle and fits teaching and learning quality improvement.

Keywords: internship program; quality assessment; competency diagnosis; curriculum mapping; marketing and logistics management; e-portfolios.

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1 Introduction

Practical training is an essential component of preparing students to become entry-level occupational workers. It provides students with the full professional experience and gives them the opportunity to apply the skills and values learned at school while developing specific knowledge and skills within the practice setting. There are several reports on the advantages of internship programs that make students understand the importance of person-job fit and person-organisation fit (Dessler, 2013). Internship learning represents an essential tool for completing their formal education and conditioning their further career path (Wang and Chen, 2015). There is evidence that interns are better prepared to enter the job market than non-interns (Gault et al., 2000; Hite and Bellizzi, 1986). The internship programs allow students to develop important industry or business administration skills, apply technical skills learned in the classroom to real-world problems, and to understand the difference between theories they learn at school and real-world practice. Alpert et al. (2009) categorised internship benefits into four groups: crossing the gap between classroom and workplace, improving employability, professional development, and improving personal skills. If students complete the

internship program successfully, they will get benefits in early days of their career, such as improved perception of job fit, higher job satisfaction, greater objective success, and greater job stability (Gault et al., 2000; Richards, 1984).

Internships are a source of practitioner input into curriculum development and a forum for student and curriculum assessment (Thiel and Hartley, 1997). However, there has been so far no evidence gathered through scientific inquiry on the students' perceived experiential learning value from the program. Moreover, there is a need to assess continued quality improvement (Rothman, 2007). Different tools have been used for the quality assessment of curriculum and learning performance. There are several reports on the quality of internships in various fields (Cuyler and Hodges, 2015; Horowitz, 1997; Khalil, 2015; Lee and Chao, 2013; Shoefelt et al., 2012). From the theory of total quality management, the Deming cycle comprises four stages: 'plan-do-check-action' (PDCA), which should be repeated over time to ensure continuous learning and improvements in a competency, product or process (Deming, 1993). It provides a relatively logical set of recommendations for analysis and implementation of quality improvement opportunities. Alpert et al. (2009) compared the perspectives of all internship stakeholders- students, academics and company personnel on the goals, structure, and assessment of marketing internships. In order to evaluate the effect of practical training and assess the learning quality, the Deming PDCA method has been applied in this study.

In addition, evaluation of students' competencies in the practice setting is crucial in ensuring that graduating students have developed the professional competencies (Bossers et al., 2002, 2007; Miller et al., 2001). A competency is a combination of knowledge, skills, behaviour and attitude that contribute to personal effectiveness (McCall and Flyers, 1998). Internship programs should be developed with clear educational objectives, curriculum mappings, standardised methods of evaluation and optional improvement cases. In a different study, Dabke (2015) and Jaradat (2017) found significant positive correlations between overall satisfaction with internship experience and professional competency.

In the present study, competency diagnosis was carried out to explore the effect of internship in the 'check' step. Also, the diagnosis was carried out to investigate a relationship between learning outcome, competency assessment and curriculum improvement among undergraduates of a practical training course in marketing and logistics management department at the case university. Therefore, the main objectives of the present study are as follows:

- 1 To assess the students' experiences with the internship program and determine whether their participation in the program helped them to enhance their intended benefits (skills and abilities).
- 2 To find the deficiency in students through 'instruction feedback' to set up a competency development plan.
- 3 To find the correlation among satisfaction, curriculum sufficiency, competency understanding and their performance during internship.

As an outcome, we expect to shorten the competency gap between learning in a classroom and working in the real industry or a business setting.

2 Literatures review

2.1 Quality assessment of learning performance

According to 'total quality management' with quality assessment of learning performance by Wang (2011), this research combined four steps 'PDCA' in the system.

The 'plan' is to set up education goal. 'Do' is to set up curriculum map and core ability. The 'check' is competency diagnosis, and 'action' is curriculum improvement and competency development shown in Figure 1. The details of these steps are as follows:

Step 1 'Plan'

Goal setting theory states that managers can direct the performance of their employees by assigning specific, difficult goals that employees accept and are willing to commit. The educational goal is to develop vocational ethics, social responsibility and professional talents those fit the need of marketing and logistics management. Therefore, the core ability combines professional competency and common competency.

Step 2 'Do'

It has been shown that consideration of learning outcome in a curriculum map can promote curriculum evaluation and quality assurance. Therefore, curriculum mapping is data-driven and competence-driven. In the marketing and logistics management department, there are two career clusters; one is marketing and sales, and the other is logistics and transportation. Students can major in one of the career clusters they are interested in and follow the curriculum map to fulfil the systemic credits.

Step 3 'Check'

In Taiwan, University Career and Competency Assessment Network (UCAN) system (Figure 2) supports the career clusters' interest survey according to States' Career Clusters Initiative (2005). Besides, the research using UCAN was carried out with the target of competency diagnosis. One is professional competency assessment, and the other is common competency diagnosis. There are eight items in common competencies including 'communication and expression', 'continuous learning', 'interpersonal interaction', 'teamwork', 'problem-solving', 'innovation', 'responsibility and discipline' and 'information technology application'. Besides, professional competencies are according to the career clusters and manifest different career pathways which will be discussed in the next section.

Step 4 'Action'

One can set up quality continuous improvement mechanism through 'instruction feedback' in the UCAN system.

Figure 1 PDCA system (see online version for colours)

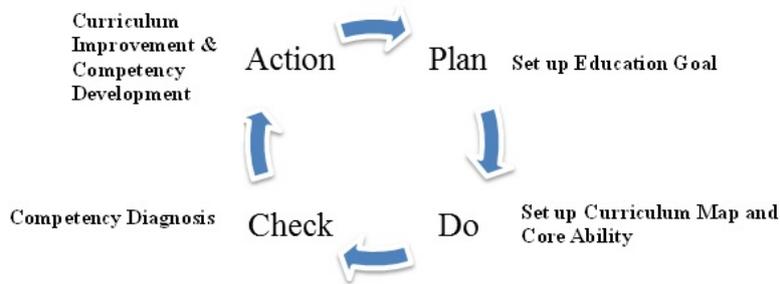
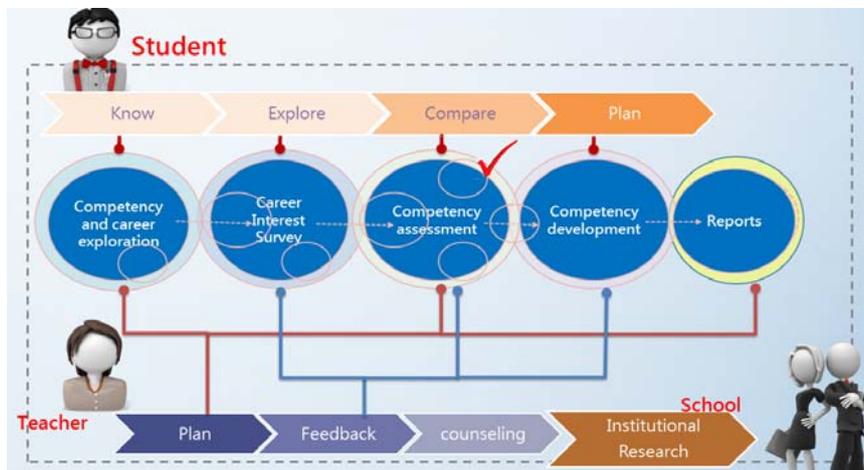


Figure 2 UCAN system (see online version for colours)



Once participants have answered instruction feedback, the system executes two-dimensional analyses to evaluate the course sufficiency and average scores of competency in the x- and y-direction by criterion-referenced. There are in all four quadrants and the negative vector means inadequate resources allocation (x) or insufficient competency (y). Through four quadrants, we can draft a plan of meaningful ‘action’.

- 1 Superior competency: the sufficiency of curriculum and the scores of competency are above average. This kind of competency training performs effectively, and the curriculum is worthy of keeping.
- 2 Post adjustment: the sufficiency of the curriculum is lower than the average, but the scores of competency are above average. The related curriculum is not enough; therefore, the curriculum committee needs to offer multiple options to learners.
- 3 Prior improvement: the sufficiency of curriculum and the scores of competency are lower than the average. It is an important item to be improved in the third quadrant including the addition of curriculum items to increase their competency.

- 4 Optimised adjustment: the sufficiency of the curriculum is better than the average, but the scores of competency are lower than the average. In order to reduce the wastage of resources, the curriculum committee needs to set up a professional competency development plan to add more portions to the lower competency.

Through e-portfolios platform, the outcome of interns' GPA can be known. Through the competency development plan, the learners at a disadvantage can be suggested to redeem the matching course from the curriculum mapping in the second semester. Thus, we expect that the students' employability can be enhanced before they graduate.

2.2 Competency assessment

2.2.1 Common competency

There are eight common competencies of UCAN, and the definitions are listed in Table 1.

Table 1 Common competency

<i>Common competency</i>	<i>Domain of competency</i>
Communication and expression	Through oral, written, etc., to express their ideas to make others understand and try to understand the information conveyed by others.
Continuous learning	Understand the importance of capacity development, and be able to explore, plan and effectively manage their abilities, and maintain the ambition to grow.
Interpersonal interaction	According to different situations, the use of appropriate methods and personal style, interact with others to get involved.
Teamwork	Can actively participate in team tasks, and team members have a good interaction to accomplish the goal jointly.
Problem solving	Can face the situation, identify the problem through the systematic collection and analysis of information and propose solutions.
Innovation	In the context of limited resources, not limited to the existing mode of operation, one can take the initiative to put forward new proposals or ideas, and implement in their work.
Responsibility and discipline	Understand and enforce the responsibilities of individuals in the organisation, and abide by the requirements of ethics, institution, and integrity of the organisation and profession.
Information technology application	Use the information technology tools required by the industry to access, manage, integrate and deliver messages effectively.

Source: States' Career Clusters Initiative (2005)

2.2.2 Professional competency

Besides, about the professional competency, total occupations are divided into 16 career clusters shown as Table 2 (States' Career Clusters Initiative, 2005). In the marketing and logistics department, there are two career clusters; one is marketing and sales, the other is logistics and transportation. In the first cluster, the career pathways are marketing management, sales, marketing communication, research of market analyses, retail and channel management. These items are different from each index of core ability. The

second cluster includes transportation operation, logistics planning, and management, transportation engineering, transportation planning, and management. Definitions are listed in Table 2.

Table 2 Career clusters

<i>Career cluster</i>	<i>Definition</i>
Agriculture, food, and natural resources	The production, processing, marketing, distribution, financing, and development of agricultural commodities and resources including food, fibre, wood products, natural resources, horticulture, and other plant and animal products/resources.
Architecture and construction	Careers in designing, planning, managing, building and maintaining the built environment.
Arts, A/V technology, and communications	Designing, producing, exhibiting, performing, writing, and publishing multimedia content including visual and performing arts and design, journalism, and entertainment services.
Business, management, and administration	Business management and administration careers encompass planning, organising, directing and evaluating business competencies essential to efficient and productive business operations. Business management and administration career opportunities are available in every sector of the economy.
Education and training	Planning, managing and providing education and training services, and related learning support services.
finance	Planning, services for financial and investment planning, banking, insurance, and business financial management.
Government and public administration	Executing governmental competencies to include governance; national security; foreign service; planning; revenue and taxation; regulation; and management and administration at the local, state, and federal levels.
Health science	Planning, managing, and providing therapeutic services, diagnostic services, health informatics, support services, and biotechnology research and development.
Hospitality and tourism	Hospitality and tourism encompass the management, marketing and operations of restaurants and other food services, lodging, attractions, recreation events and travel related services.
Human services	Preparing individuals for employment in career pathways that relate to families and human needs.
Information technology	Building linkages in IT occupations framework: for entry level, technical, and professional careers related to the design, development, support, and management of hardware, software, multimedia, and systems integration services.
Law, public safety, and security	Planning, managing, and providing legal, public safety, protective services and homeland security, including professional and technical support services.
Manufacturing	Planning, managing and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering.
Marketing, sales, and service	Planning, managing, and performing marketing activities to reach organisational objectives.

Table 2 Career clusters (continued)

<i>Career cluster</i>	<i>Definition</i>
Science, technology, engineering, and mathematics	Planning, managing, and providing scientific research and professional and technical services (e.g., physical science, social science, engineering) including laboratory and testing services, and research and development services.
Transportation, distribution, and logistics	Planning, management, and movement of people, materials, and goods by road, pipelines, air, rail and water and related professional and technical support services such as transportation infrastructure planning and management, logistics services, mobile equipment and facility maintenance.

2.3 Curriculum map

Curriculum mapping is data-driven and competency-driven. According to Harden (2001) curriculums are complex mixes of “educational strategies, course content, learning outcomes, educational experiences, assessment, the educational environment and the individual students’ learning style, personal timetable and program of work”. Curriculum maps are integrated with statements of educational objectives, learning activities, curriculum materials, assessment, and assisted equipment and learning outcomes. According to Willett’s (2008) empirical study of the implementation of curriculum mapping in Canada and the UK, many higher education institutes are moving towards outcome-based education models. In our study, we followed the curriculum map to detect the competency to set up competency development plan for improving inadequate competencies in different career clusters.

2.4 E-portfolios

These provide an educational context, especially on their potential to address the gaining of generic tertiary education skills and attributes (Aziz et al., 2010). E-portfolio is a site of learning (Akcil and Arap, 2009; Stefani et al., 2007) and as encouragement of student reflection on learning (Doig et al., 2006). In e-portfolios, one can check the scores of each subject in different semesters. If we find a learner has a lower score than the average in one career cluster in the first semester, then the instructor can suggest the student redeem the relevant courses in the same career cluster in the second semester to shorten his or her competency gap.

3 Methodology

Competency scores were analysed in descriptive statistics and two-dimensional analyses. Also, inferential statistics were counted including paired t-test, correlation, and data mining (decision tree), etc.

3.1 Samples and procedures

The research using UCAN system was carried out in marketing and logistics department at the case university in Taiwan. There were 120 interns in the department. They had to

answer the professional competency diagnosis questionnaire (career pathways in marketing management) and common questionnaires in this study. However, finally, only 88 participants answered the professional competency diagnosis, while 57 interns filled common competency evaluation online before and after the internship at the same time. Therefore, we carried out pair t-test to detect the trend of the same target.

The survey includes data from full-time interns for six months in the first semester. In common competency questionnaire, there were 52 items in professional competency diagnosis and the survey of instruction feedback; there were about 20 items in one career pathway according to different career clusters. Since the practical training lasted for one semester (from August 2016 to January 2017), hence, data were collected during two periods (Before the practical training in June 2016 and after the practical training in January 2017).

After the practical training, 99 interns participated in the satisfaction questionnaire. In addition, GPA and satisfaction data of the internship were collected at the end of January 2017. The correlation coefficient of satisfaction degree, sufficiency of courses, understanding levels of competency and GPA of the practical training were deducted to discover the quality of learning performance.

3.2 Measures and variables

Measures and variables were same for common competency for all the different departments. However, for professional competency, these depended on each career cluster.

Table 3 Career pathway

<i>Career pathway</i>	<i>Code</i>	<i>Definition</i>
Marketing management (A)	A1	Carry out routine operations and marketing management, and communication to ensure communication with relevant units operating smoothly
	A2	Use and evaluate information related to the market, and develop the overall marketing strategy
	A3	Work out the price and to adjust the price to maximise the value of the pursuit of profits and customers
	A4	Develop product or service strategy to respond to market demand
	A5	Propose channel strategy to reduce costs and gain the maximum benefit
	A6	Develop promotional strategies related products, services, and image to achieve ideal results
Market analyses (B)	B1	Design quantitative or qualitative marketing research activities
	B2	Conduct all kinds of research and marketing operations
	B3	Conduct quality assurance of research related to marketing, and management of information security
	B4	Support marketing research, analysis, and recommendations according to the results

Table 3 Career pathway (continued)

<i>Career pathway</i>	<i>Code</i>	<i>Definition</i>
Retail and channel management (C)	C1	Implement access management
	C2	Help dealers and retail distributors, sales activities
	C3	Provide sales training for distribution distributors
	C4	Plan and execute the access strategy for the goods
	C5	Evaluate sales-related information to assist in making decisions and management of sales
	C6	Develop and implement the merchandise import and export management process
Logistics planning and management (D)	D1	Establish the perfect management of material planning, as well as the formulation of the program
	D2	Implement logistics and transportation planning and management, then establish efficient logistics and transport network
	D3	Implement storage planning and management, know the concept of warehouse well to reduce the cost of waste
	D4	Perform inventory management to help control costs and improve operational efficiency
	D5	Execute information management
	D6	Plan efficient production management
	D7	Develop a demand-based procurement program
	D8	Develop strategic analysis of the company's logistics and customer needs, to provide a systematic planning and management

In the marketing and logistics management department, there were two career clusters; one is marketing and sales, the other is logistics and transportation. In marketing clusters, the career pathways were marketing management, research of market analyses, retail and channel management. In the logistics and transportation pathways, it only included logistics planning and management.

Indexes of the career pathway are as follows: six in marketing management (coded A); four in research of market analyses (coded B); six in retail and channel management (coded C); and eight in logistics planning and management (coded D). All the definitions are listed in Table 3.

About the assessment of professional and common competency defined as below, students were asked to use a 5-point (from 1 to 5) 'Likert scale' to rate in the survey:

- 1 I cannot finish it and learning it is difficult.
- 2 I cannot finish it, but maybe I can learn by working hard.
- 3 I cannot finish it, but can learn it well by working hard.
- 4 I can finish it, and it will be better.
- 6 I can finish it and can do it perfectly.

3.3 Satisfactory questionnaire

The satisfactory questionnaire was run during the investigation period after the end of the first semester of seniors. There were 13 quantitative questions, with a score of five points (very agree with five points, agree with four points, three points in general, do not agree with two points, do not agree with one point), including : ‘help me to absorb new ideas and expand my horizons’, ‘provide me with the opportunity to apply further knowledge’, ‘help me improve my professional skills’, ‘help me familiar with the workplace ecology’, ‘help me promote my ability to think independently and solve problems’, ‘help me to cultivate my spirit of independence and responsibility’, ‘help me to build good interpersonal relationships’, ‘help me understand the needs of the industry’, ‘help me to cultivate my team spirit’, ‘be satisfied with the guidance of the internship counsellor’, ‘I am satisfied with the practice of the out-of-school internship’, ‘I am satisfied with the internship trainer’ and ‘I am very much satisfied with the internship program’.

After the questionnaire was answered, we did correlation analysis and data mining on the effect of the internship.

4 Results

In the present study, two-dimensional analysis and paired t-test in common and professional competencies were carried out. From the ‘satisfaction survey’, we explored the correlation among satisfaction, curriculum sufficiency, competency understanding and their internship performance. Also, the CHAID decision tree was used to analyse the numerical model among the eight common competency diagnostic scores and satisfaction. The results are described as below.

4.1 Descriptive statistics

4.1.1 Common competency

It was found that the superior competency and sufficiency of the curriculum increased after the internship. Real-world learning has a positive relationship with the common competency (Table 4).

Table 4 Two-dimensional analysis of common competency (see online version for colours)

<i>Grade</i>	<i>Index</i>	<i>Course sufficiency (X-max 5)</i>	<i>Average score of competency (Y-max 5)</i>	<i>Two-dimensional analysis</i>
3	Communication and expression	3.58	3.74	III
	Continuous learning	3.62	3.79	III
	Interpersonal interaction	3.63	3.98	II
	Teamwork	4.03	3.94	I
	Problem solving	3.62	3.65	III
	Innovation	3.46	3.66	III

Notes: I – superior competency; II – post adjustment; III – prior improvement; IV – optimised adjustment.

Table 4 Two-dimensional analysis of common competency (continued) (see online version for colours)

<i>Grade</i>	<i>Index</i>	<i>Course sufficiency (X-max 5)</i>	<i>Average score of competency (Y-max 5)</i>	<i>Two-dimensional analysis</i>
3	Responsibility and discipline	3.76	4.04	I
	Information technology application	3.38	3.85	III
4	Communication and expression	3.71	4.01	II
	Continuous learning	3.76	3.98	I
	Interpersonal interaction	3.90	4.11	I
	Teamwork	4.20	4.10	I
	Problem solving	3.86	3.78	IV
	Innovation	3.52	3.80	III
	Responsibility and discipline	3.94	4.19	I
	Information technology application	3.62	4.03	II
	<i>Average</i>		3.72	3.91

Notes: I – superior competency; II – post adjustment; III – prior improvement; IV – optimised adjustment.

The ‘innovation’ score was lower than the average, and the priority of the curriculum adjustment in the follow-up curriculum map was required. The students thought that their ‘problem-solving ability’ was inadequate and they required follow-up counselling. Students entered the workplace and followed the rules regularly. It is clear that ‘job responsibility and discipline’ was upgraded, and ‘teamwork’ was the highest common competency after the internship training.

4.1.2 Professional competency

In our study, we could count the mean (average) of two career pathways (marketing management and logistics planning and management) between the junior and the senior students in our university. Also, two-dimensional analyses could detect the scores of curriculum sufficiency and average competency.

After the internship, the results in Table 5 show that D1 ‘Establish the perfect management of material planning, as well as the formulation of the program’ needs to be improved (disadvantageous/insufficient course) in priority’. D2 ‘Implement logistics and transportation planning and management, then establish efficient logistics and transport network’, D3 ‘Implement the planning and management of warehousing, know the concept of warehouse well to reduce the cost of waste’, belonging to inferior competencies are optimised to adjust the competency. The other competencies of seniors were significantly improved. Obviously, the internship has contributed a lot to professional competencies.

Table 5 Two-dimensional analysis of professional competency (see online version for colours)

<i>Grade</i>	<i>Career pathway</i>	<i>Code</i>	<i>Course sufficiency (X-max 5)</i>	<i>Average score of competency (Y-max 5)</i>	<i>Two-dimensional analysis</i>
3	Marketing management	A1	3.45	3.82	I
		A2	3.41	3.39	III
		A3	3.39	3.60	III
		A4	3.57	3.52	IV
		A5	3.41	3.48	III
		A6	3.52	3.81	I
	Research on market analyses	B1	3.17	3.50	III
		B2	3.41	3.64	II
		B3	3.33	3.68	II
		B4	3.39	3.25	III
	Retail and channel management	C1	3.27	3.51	III
		C2	3.29	3.68	II
		C3	3.20	3.58	III
		C4	3.35	3.53	III
		C5	3.43	3.62	I
		C6	3.17	3.45	III
	Logistics planning and management	D1	2.98	3.09	III
		D2	3.03	3.10	III
D3		3.17	3.09	III	
D4		3.16	3.48	III	
D5		3.14	3.32	III	
D6		3.19	3.20	III	
D7		3.14	3.29	III	
D8		3.15	3.26	III	
4	Marketing management	A1	3.65	4.00	I
		A2	3.68	3.68	I
		A3	3.60	3.76	I
		A4	3.76	3.81	I
		A5	3.62	3.69	I
		A6	3.71	3.99	I
	Research on market analyses	B1	3.52	3.75	I
		B2	3.60	3.81	I
		B3	3.66	3.85	I
		B4	3.62	3.69	I

Notes: I – superior competency; II – post adjustment; III – prior improvement; IV – optimised adjustment.

Table 5 Two-dimensional analysis of professional competency (continued) (see online version for colours)

<i>Grade</i>	<i>Career pathway</i>	<i>Code</i>	<i>Course sufficiency (X-max 5)</i>	<i>Average score of competency (Y-max 5)</i>	<i>Two-dimensional analysis</i>
4	Retail and channel management	C1	3.55	3.80	I
		C2	3.60	3.92	I
		C3	3.52	3.91	I
		C4	3.63	3.82	I
		C5	3.68	3.81	I
		C6	3.51	3.87	I
	Logistics planning and management	D1	3.35	3.53	III
		D2	3.43	3.45	IV
		D3	3.43	3.49	IV
		D4	3.49	3.89	I
		D5	3.57	3.73	I
		D6	3.50	3.65	I
		D7	3.43	3.70	I
		D8	3.46	3.65	I
	<i>Average</i>			3.42	3.61

Notes: I – superior competency; II – post adjustment; III – prior improvement; IV – optimised adjustment.

4.2 Paired *t*-test

4.2.1 Common competency

After the internship, the eight common competencies showed increasing trends. The correlations of interpersonal interaction (0.38) and continuous learning (0.31) were significantly different ($p < 0.05$). Internship learning was helpful for the diagnosis of common competency. In the workplace, interns are able to contact their bosses, colleagues, and consumers, hence interpersonal interaction is more significant and direct.

In the test of the paired samples in Tables 6–7, it was found that the mean scores of all the common competencies of the internship were higher than those before the internship, and there was a level of significant difference. Thus, internship in the technical and vocational education is very important. The ‘job responsibility and discipline’ had the highest mean score among all the competencies. While ‘innovation’ and ‘problem-solving’ showed comparatively lower scores necessitating a higher proportion in the curriculum map.

Table 6 Paired statistics of common competency

<i>Test</i>		<i>Mean</i>	<i>N</i>	<i>Deviation</i>	<i>MSE</i>
1	Communication and expression ⁴	4.05	57	0.46	0.06
	Communication and expression ³	3.76	57	0.46	0.06
2	Continuous learning ⁴	4.03	57	0.54	0.07
	Continuous learning ³	3.77	57	0.50	0.07
3	Interpersonal interaction ⁴	4.19	57	0.57	0.08
	Interpersonal interaction ³	3.98	57	0.58	0.08
4	Teamwork ⁴	4.18	57	0.49	0.06
	Teamwork ³	3.94	57	0.42	0.06
5	Problem solving ⁴	3.95	57	0.57	0.08
	Problem solving ³	3.66	57	0.50	0.07
6	Innovation ⁴	3.87	57	0.55	0.07
	Innovation ³	3.62	57	0.47	0.06
7	Responsibility and discipline ⁴	4.30	57	0.51	0.07
	Responsibility and discipline ³	4.09	57	0.52	0.07
8	Information technology application ⁴	4.18	57	0.56	0.07
	Information technology application ³	3.85	57	0.49	0.06

Table 7 Paired t-test of common competency

<i>Test</i>	<i>Difference of paired variance</i>					<i>t</i>	<i>df</i>	<i>Sig (2-tailed)</i>
	<i>Mean</i>	<i>S.D.</i>	<i>Std. error mean</i>	<i>95% confidence interval of the difference</i>				
				<i>Lower</i>	<i>Upper</i>			
1	0.29	0.63	0.08	0.13	0.46	3.50	56	0.00**
2	0.26	0.61	0.08	0.10	0.43	3.24	56	0.00**
3	0.21	0.64	0.08	0.04	0.38	2.45	56	0.02*
4	0.24	0.60	0.08	0.08	0.40	3.02	56	0.00**
5	0.30	0.67	0.09	0.12	0.47	3.31	56	0.00**
6	0.25	0.67	0.09	0.07	0.43	2.82	56	0.01*
7	0.21	0.66	0.09	0.04	0.39	2.45	56	0.02*
8	0.33	0.76	0.10	0.12	0.53	3.25	56	0.00**

Notes: ** $p < 0.01$; * $p < 0.05$.

4.2.2 Professional competency

There were significant positive correlations ($p < 0.05$) between the two aspects ($p < 0.05$) in the product (0.267) and the workplace (0.218). Moreover, the correlation between the two professional competencies was higher than the professional competency scores before the internship. In the paired t-test (Tables 8–9), in addition to the internal communication and work, the other five professional competencies have shown significant growth after the practical training.

Table 8 Paired statistics of professional competency

<i>Test</i>	<i>Mean</i>	<i>N</i>	<i>Deviation</i>	<i>MSE</i>
1 Internal communication and work4	3.97	88	0.54	0.06
Internal communication and work3	3.80	88	0.69	0.07
2 External market information4	3.68	88	0.64	0.07
External market information3	3.34	88	0.67	0.07
3 Price4	3.78	88	0.73	0.08
Price3	3.54	88	0.81	0.09
4 Product4	3.78	88	0.61	0.07
Product3	3.50	88	0.65	0.07
5 Place4	3.68	88	0.72	0.08
Place3	3.44	88	0.77	0.08
6 Promotion4	3.97	88	0.62	0.07
Promotion3	3.78	88	0.59	0.06

Table 9 Paired t-test of professional competency

<i>Test</i>	<i>Difference of paired variance</i>					<i>t</i>	<i>df</i>	<i>Sig (2-tailed)</i>
	<i>Mean</i>	<i>S.D.</i>	<i>Std. error mean</i>	<i>95% confidence interval of the difference</i>				
				<i>Lower</i>	<i>Upper</i>			
1	0.18	0.84	0.09	0.00	0.35	1.97	87	0.05
2	0.34	0.87	0.09	0.15	0.52	3.63	87	0.00**
3	0.24	1.09	0.12	0.01	0.47	2.06	87	0.04*
4	0.28	0.77	0.08	0.12	0.44	3.44	87	0.00**
5	0.24	0.93	0.10	0.04	0.44	2.40	87	0.02*
6	0.18	0.77	0.08	0.02	0.35	2.20	87	0.03*

Notes: ** $p < 0.01$; * $p < 0.05$.

4.3 Internship satisfaction

From the satisfaction survey (Table 10), the mean value of all items was 4.31. The item "I think the extracurricular practice program will help me cultivate my independence, responsible spirit" received the highest score of 4.48. This is consistent with the highest mean score of 'job responsibility and discipline' in common competency.

Table 10 Satisfaction

<i>Items</i>	<i>Mean</i>
Help me to cultivate my spirit of independence and responsibility	4.48
Help me familiar with the workplace ecology	4.45
Help me to build good interpersonal relationships	4.42
Help me to cultivate my team spirit	4.38
Be satisfied with the guidance of the internship counsellor	4.37

Table 10 Satisfaction (continued)

<i>Items</i>	<i>Mean</i>
Help me to absorb new ideas and expand my horizons	4.30
I am satisfied with the internships and internships	4.30
I am very satisfied with the internship program	4.28
Help me understand the needs of the industry	4.27
Help me promote my ability to think independently and solve problems	4.23
I am satisfied with the practice of the out-of-school internship	4.20
Provide me with the opportunity to apply further knowledge	4.17
Help me improve my professional skills	4.12

4.4 Correlation

From 99 interns who filled the satisfaction questionnaire, we tried to explore the correlation among satisfaction, curriculum sufficiency, competency understanding and their internship performance. It was found that the higher the common competency of satisfaction, the higher their internship scores would be (in Table 11). There is a significant positive correlation between the common competency and the sufficiency of the common competency. The correlations among satisfaction, the understanding of the course and sufficient contents are significantly positive. Therefore, it is very important to have a rich curriculum design.

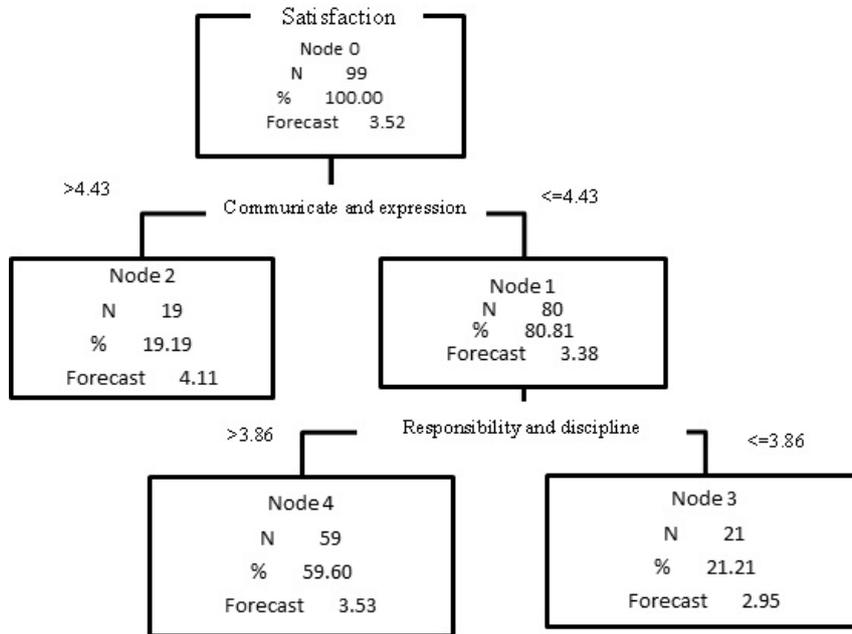
Table 11 Correlations

<i>Item</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
1 Internship scores	1	0.209*	-0.015	0.135
2 Satisfaction	0.209*	1	0.534**	0.256*
3 Sufficiency	-0.015	0.534**	1	0.364**
4 Understanding	0.135	0.256*	0.364**	1

Notes: ** $p < 0.01$; * $p < 0.05$.

4.5 Decision tree analysis

This study further used the CHAID decision tree to analyse the numerical model among the eight common competency diagnostic scores and satisfaction. It was found that the common competencies which influence satisfaction of internship are 'communication and expression' and 'job responsibility and discipline' (Figure 3). In the internship, higher the 'communication and expression' or 'job responsibility and discipline', the higher would be the satisfaction. Therefore, before internship, the communication expression and work attitude should have a higher focus on campus, so that students can enhance their satisfaction, internship performance, and employability after graduation.

Figure 3 CHAID decision tree

4.6 Optimised adjustment of curriculums

4.6.1 Survey of instruction feedback and competency development plan

In marketing clusters, the career pathways are marketing management, sales, research of market analyses, retail and channel management. The items are different from each index of core abilities. In the ‘logistics and transportation’, the career pathway is logistic planning and management. In the two-dimensional analysis, the scores of professional competency are above average. Therefore, in the curriculums of ‘international marketing management’ and ‘social marketing’, it is not necessary to adjust their original core competencies. It only needs to strengthen the remedy in these professional courses to enhance interns’ employability. For example, in the case of professional competency, it was found that the scores of 11 interns in the marketing and sales were less than 3.5. These interns were recommended to study the ‘international marketing management’ and ‘social marketing’ in the marketing management module in the second semester (February to June 2017). Later, it was found that all these interns successfully passed these two courses indicating that it is possible to shorten the skill gap before graduation.

4.6.2 Common competency

From the survey of instruction feedback, it was found that ‘innovation’ was insufficient in the common competency in the two-dimensional analysis. Therefore, it must be given priority to improving this ability. In the second semester of seniors, the curriculum ‘presentation of marketing and logistics practical seminar’ needs to increase the proportion of innovation to improve interns’ innovation as shown in Table 12.

Table 12 Optimised adjustments in the course of presentation of marketing and logistics practical seminar

<i>Core ability</i>	<i>Indicator</i>
Professional competency of marketing	The implementation of various types of marketing research operations, and analysis and recommendations
Good business ethics, work attitude, and teamwork	Teamwork Interpersonal interaction
Problem-solving, continuous learning and Innovation	Problem solving Innovation*
Communication and expression and vocational language	Communication and expression

Note: *New indicator suggested as a result of the research findings of this study.

Also, it was found that 24 interns who had the poor common competency of innovation were recommended to study remedy courses clustered in innovation in the second semester of seniors. After the evaluation, ‘presentation of marketing and logistics practical seminar’, results showed that the odds rate was 100% and the competency could be improved prior to graduation.

Therefore, the optimised curriculums’ adjustment in the curriculum map can help students plan career blueprint and shorten the gap between learning in classrooms and working in the real world.

Table 13 Optimised adjustments in the course of global logistics management

<i>Core ability</i>	<i>Indicator</i>
Professional competency of marketing	Using and evaluating market-related information to develop an overall marketing strategy
Professional competency of logistics chains	Planning and implementation of logistics strategy The perfect management of the establishment of material planning, and the development of the order plan* The implementation of logistics and transport planning and management, the establishment of efficient logistics and transport network* The implementation of storage planning and management, knowledge of the concept of the warehouse to reduce the cost of waste*
Good business ethics, work attitude, and teamwork	Interpersonal interaction
Communication and expression and vocational language	Communication and expression

Note: *New indicators suggested as a result of the research findings of this study.

4.6.3 Professional competency

From the survey of instruction feedback, the item “the perfect management of the establishment of material planning, and the development of the order plan” should be given priority to improving logistics planning and management cluster. The item

“implementation of logistics and transport planning and management, the establishment of efficient logistics and transport network”, “implementation of storage planning and management, knowledge of the concept of the warehouse to reduce the cost of waste” were inferior competencies. Therefore, these are an optimised adjustment. It is our suggestion for curriculum committee to re-adjust the professional competencies indicators in the course of ‘global logistics management’ to strengthen the skill of ‘material planning’, ‘warehouse plan’ and ‘logistics transport network’ as shown in Table 13.

In our study, 16 students who had the poor professional competency of logistics planning and management were recommended to study remedial courses in the second semester in senior grades. After studying the course of ‘global logistics management’, we found that the odds rate was 100% and the professional competency could be improved prior to graduation.

5 Discussion

5.1 Common competency

This study finds that the common competency of ‘innovation’ and ‘problem-solving’ can be classified as a competency of priority improvement in the two-dimensional analysis. Although ‘problem-solving’, ‘continuous-learning’ and ‘innovation’ are the core abilities of the internship, however, ‘innovation’ is the necessary and critical trend in the ever present globalised, dynamic, diverse job market (Rubens et al., 2018; Chen and Chen, 2010). Therefore, it is recommended to increase the training skill in ‘creative problem solving’ (CPS).

5.2 Professional competency

In the career cluster of logistics planning and management, item ‘establish the perfect management of material planning, and order development of the program’ was given priority for the improvement due to inferior competencies/inadequate course. Also, “implement logistics and transportation planning and management, establish efficient logistics and transport network”, “warehouse planning and management, master the warehouse profile to reduce the cost of waste” was the optimal adjustment competencies. In the vocational area, human resource managers need to pursue appropriate strategies to enhance the professional competency (Abbas et al., 2017). As management-related skills and knowledge have been rated as the most important group, it is paramount that educators and trainers continue to focus their curriculum development and teaching schemes on areas which are perceived as critical to logistics professionals (Thai, 2012). The article by Brignon and Ravestein (2015) showed capitalising students’ agreements for further use in teaching and questioning their own practices can enhance the development of their professional identity. Therefore, the curriculum committee at a school must give priority to design and add these portions of career pathways to enhance professional competencies prior to graduation.

5.3 Satisfaction

The item 'I think the out-of-school internship program will help me cultivate my spirit of independence and responsibility' is similar to learning independently (Alpert et al., 2009; Jackel, 2011; Meredith and Burkle, 2008) and career development and responsibility (Eyler, 1993; Hursch and Borzak, 1979; Williams, 1990) in the survey questionnaire part 'satisfaction'. The correlations of interpersonal interactions were significantly different such as public relations benefits can accrue, particularly as a result of positive word-of-mouth from interns (Christopher et al., 1991; Pianko, 1996). In addition, the correlations among 'satisfaction', the 'understanding of the course' and 'sufficient contents' were significantly positive. Similar to these results, it was reported that in order to improve the quality of internships, stakeholders should pay special attention to the 'learning content' (Agoston et al., 2017). Therefore, it is advisable that employers should discuss with curriculum committee when designing the content of internship programs and curriculum mapping.

5.4 Organisational change management

Sirkin et al. (2005) revealed a consistent correlation between the outcomes (success or failure) of change programs and four hard factors: project *duration (D)*, *performance integrity (I)*, the *commitment (C)*, and the additional *effort (E)*, together designated as DICE. The DICE framework led managers to take steps to increase the possibility of success before they started the change. About *duration*, competency diagnosis was carried out in our research to explore the effect of the internship by the department periodically. Also, from the survey of instruction feedback and competency development plan, interns were recommended to study remedial courses in the second semester (*effort*). The instructor and the students devoted more efforts towards competency training (*commitment*). The results showed that these interns finally passed the evaluation and accomplished competency development (*integrity*). Thus, the optimised curriculums' adjustment in the curriculum map can help students plan career blueprint and achieve the good milestones before entering the job market.

6 Conclusions

The present research builds a good quality assessment in the 'PDCA' learning cycle and has a focus on whether students' learning outcomes meet the core competency. Through the diagnosis of professional competencies and common competencies, we can understand the sufficiency and employability of different career pathways in the curriculum mapping. We can analyse the scores of individual students, and use e-portfolios to redeem their inferior learning situations. Besides, from the survey of instruction feedback, the curriculum committee can re-adjust the common and professional competencies if there is an insufficiency of career clusters in the curriculum map. It is hoped that the findings of this study can improve inadequate training for the current industrial internship program. Also, the gap between academic learning in campus and practical training in the workplace can be shortened.

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Appendix

Table A1 Curriculum map in department of marketing and logistics management

Module	Career pathway	2013-Sep	2014-Feb	2014-Sep	2015-Feb	2015-Sep	2016-Feb	2016-Sep	2017-Feb
Marketing management module	Market analysis			Statistics (1)	Statistics (2)	Marketing research	Marketing and logistics practical seminar (2)	Practical training	Presentation of marketing and logistics practical seminar
	Marketing management	Economics Management	Logistics management Economics Management Marketing management	Service marketing and management Introduction to civil law Integrated marketing communication	Marketing and logistics planning practice Communication strategy and management Introduction to business law E-commerce and online marketing	Marketing and logistics practical seminar (1) Financial management Strategic marketing Analysis of industry trends Price decision analysis Business district research and development store strategy Marketing research Human resource management	Statistical analysis and application Chain enterprise management Business management Entrepreneurship planning and management Supply chain management Marketing and logistics Business development management	Global operations management Social marketing International marketing management	

Table A1 Curriculum map in department of marketing and logistics management (continued)

<i>Module</i>	<i>Career pathway</i>	2013-Sep	2014-Feb	2014-Sep	2015-Feb	2015-Sep	2016-Feb	2016-Sep	2017-Feb
Marketing management module	Retail and channel management		Logistics management (1)	Logistics management (2)	Path management	Business district research and exhibition strategy	Supply chain management		
			Job management	Retail Management	Introduction to business law Store management		Chain enterprises management Entrepreneurship planning and management Business development and management Business management		
Logistics and chain management module	Logistics operation management		Logistics management (1)	Logistics management (2)	Marketing and logistics management information system	Financial management	Supply chain management		Global operations management
			Data collection and software application		Purchasing and inventory management				
			Job management		Purchasing and inventory management				