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Constructing English-medium instruction indicators in the shipping courses of Taiwan's higher education

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Abstract

Purpose – This paper aims to use an analytic hierarchy process (AHP) and combine this with the fuzzy theory to identify key indicators influencing English-medium instruction (EMI) in the shipping courses of Taiwan's higher education.

Design/methodology/approach – Based on a literature review and expert interviews, an evaluation model with 4 indicators and 13 sub-indicators was developed. Questionnaire samples included university English teachers (eight), university shipping teachers (nine) and shipping practitioners (eight).

Findings – Using 25 effective samples, the results found that “teachers' characteristics” is the most important indicator, followed by “syllabus design”, “university resources” and “students' characteristics”. Such a finding could provide valuable teaching and managerial strategies for EMI design in both university and industry sectors.

Research limitations/implications – Expert questionnaire targets have focused on university English teachers, university shipping teachers and shipping practitioners. Other related field experts could be further surveyed and compared in the future studies.

Practical implications – The findings of EMI indicators in the shipping courses could be used for course and material design by shipping companies, shipping authorities and universities. It is expected that these indicators could inform the provision of reasonable teaching resources allocation.

Social implications – This paper provides important guidance for designing EMI in shipping courses. Related stakeholders will be able to understand important concepts regarding designing EMI courses.

Originality/value – First, EMI indicators in the shipping courses have seldom been studied in the past. They are, however, important for both shipping industries and education intuitions. Second, as its method, this paper adopts decision analysis quantitative tool to complement previous qualitative studies regarding EMI studies.

Keywords Courses, Shipping, English-medium instruction

Paper type Research paper



1. Introduction

Taiwan, located in the Asia-Pacific region (between the southwest of Japan and the north of the Philippines), is an island of approximately 36,193 square kilometers (with a total population of approximately 23 million). Over 90% of international trade cargoes (in terms of volume) in Taiwan, are carried by shipping[1]. Understandably therefore, shipping development and education have historically occupied a central and key position in university education in Taiwan. For those students who go on to work in the shipping industry, it is essential they have a strong command of the English language (Pallis and Ng, 2011), as this is the medium in which communication is most commonly undertaken in the shipping industry. However, in Taiwan, Chinese is the first language and English is a second or other language, and there is, thus, a perennial challenge faced by students and lecturers in developing students' English for the shipping industry. One approach to help address this challenge is to deliver university education about shipping in English. Yet, although the need to introduce English learning into the Taiwanese education system has been conducted and emphasised for decades[2], the actual implementation and introduction of such approaches is still in the early stages of development. For Taiwanese universities, the purposes of introducing English-medium instruction (EMI) courses are to:

- improve students' English abilities and strengthen international mobility and employability; and
- attract more international students to attend such courses.

However, there remain a number of implementation barriers and challenges caused by a range of factors such as the learning environment, culture, learning skills, curriculum design and the prevalence of an exam-based learning approach.

In the shipping industry, qualified shipping practitioners (e.g. seafarers, staff in shipping companies, shipping forwarders, shipping agents, ship-broker, port authorities, etc.) must have "good" English abilities (including listening, speaking, reading, writing) (Pallis and Ng, 2011). Therefore, proficiency in English is a prerequisite for employment in the shipping industry. In Taiwan, there are around 12 universities that provide shipping management-related courses, and these can be categorised into foundation courses and specialist courses. Generally, the former includes introductory type courses such as "introduction to maritime management or shipping management", "introduction to trade and shipping" and "introduction to shipping and logistics". The latter cover topics such as "liner shipping management", "bulk shipping management", "port planning and management", "shipping economics", "maritime insurance", "maritime law", "shipping finance", "management of maritime organisations", "shipbroker and chartering management", "shipping and the environment" and also, "maritime technology". The main language of instruction for the majority of these courses continues to be Chinese. Yet, the main language of international shipping operation and management and any shipping information communication (e.g. information announcement in international maritime organisation) is English. Therefore, there are many advantages to add English education in the form of EMI in Taiwanese shipping management-related courses to link international shipping transport-related industries (including insurance, law, international trade, etc.), international education system and other stakeholders (e.g. research organisation, governmental units, etc.).

Introducing EMI in university courses has increased in recent years in East Asia in general (Kedzierski, 2016) and for shipping-related courses in Taiwan (Hu *et al.*, 2008).

However, introducing and implementing EMI teaching has been accompanied by a number of issues. These can be broadly categorised as:

- students often lack sufficient vocabulary and have difficulty fluently expressing their academic thinking;
- course material can be unsuitable (e.g. students have difficulty in learning using English-medium material due to their English ability);
- Chinese and English languages are used interchangeably in texts; and
- there are significant differences in students' levels of English in a class, and teachers find it difficult to adopt a uniform standard in any course assessments (e.g. IELTS (Pilcher and Richards, 2017)).

Arguably, such issues affect both students' learning motivation (Kedzierski, 2016) and also teachers' teaching performances (Poon, 2013).

In addition, subject delivery in EMI presents other issues. These can be issues such as how the subject operates when delivered in "English", and what exactly "English" is defined to be (Richards and Pilcher, 2014; Pilcher and Richards, 2016). In terms of the continually shifting nature of the shipping industry and how academia responds, some research notes the onus to be on the higher education institutions to keep abreast of the latest developments in the industry and to ensure their courses are up to date (Ng *et al.*, 2009). Another issue to explore would be where shipping education training is situated in terms of whether it is situated in a business school or an engineering school, or whether it is standalone (Ng and Yip, 2009). Also, what such a position means for the accreditations it needs (Ng and Yip, 2009). Such issues help give a greater context to current understanding of EMI and are explored in this paper. Although it has been rightly noted in the literature that "a global labour market cannot be regulated by a national policy" (Gekara, 2009, p. 229), it is useful to research and reflect on national policies towards shipping education, especially as it is expected that international guidelines are adhered to and taught in shipping education training (Ng and Yip, 2009).

In terms of methods adopted to research EMI, previous studies have drawn on a wide range. Many studies have been based on reviews of the literature (Hu *et al.*, 2008; Ng and Yip, 2009; Horck, 2010; Mok and Yu, 2011), on surveys (Pallis and Ng, 2011) or on questionnaires (Dinwoodie, 2000; Ng *et al.*, 2009; Fei and Lu, 2015). Notably, the approach to analysis of these surveys in past studies has mainly adopted a qualitative approach or used only basic descriptive statistics. In this paper, to complement this previous EMI research, and obtain more insights into implications for the curriculum design and teaching strategies in the university, a more in-depth and quantitative approach of a fuzzy analytic hierarchy process (AHP) is used. This approach to analysis could help university teachers and related policy-makers to identify the most relevant indicators to develop their teaching strategies and allocate teaching resources in the university.

The remainder of this paper is organised as follows. Section 2 briefly reviews the literature regarding the background and implementation of EMI. Section 3 presents the methodology, and the results are presented and analysed in Section 4. Finally, Section 5 provides discussions and conclusions, and also considers limitations and areas for future research.

2. Literature review

2.1 English-medium instruction-related studies

Much research has noted the changing face of education in the shipping industry (Demirel and Ziarati, 2013). Many countries are adopting EMI and requiring lecturers to teach in English, for example, Italy (Costa and Coleman, 2013), Finland (Hahl *et al.*, 2016), Korea (Kim *et al.*, 2009;

Kim *et al.*, 2014; Lee, 2017) and China (Hu and Lei, 2014). In Taiwan, Huang (2015) used a self-assessment questionnaire to gather 157 student samples to explore student perceptions of the effectiveness of EMI courses. Huang's findings were that most students were motivated to take EMI courses to strengthen their English ability and professional knowledge. In Spain, Dafouz and Camacho-Miñano (2016), using 383 samples of student grades, used accounting as a case to explore the impact of EMI on university student academic achievement. Their results showed no statistical differences across groups, and that the use of EMI did not lower student final academic outcomes. Further, Hellekjær (2009) used 578 Norwegian university students to study their academic English reading proficiency and to draw conclusions regarding the success of their previous English instruction at high school. The results showed that about 30 per cent of the sample had serious difficulties reading in English, while an additional 44 per cent found it more difficult reading in English than reading in their first language. In another study, Kim *et al.* (2014), using 249 Koreans and 61 international students from non-English-speaking countries, found that English proficiency is of fundamental importance for success on EMI courses. Thus, EMI is a much-researched area, something which is entirely reflective of its increased use and prominence worldwide. Yet, the studies reviewed here highlight a number of challenges and key indicators for any research into EMI, which we now consider and expand on here, especially given that they were ones we used in our fuzzy AHP analysis.

2.2 Key indicators influencing English-medium instruction in the shipping courses

Drawing on previous studies (Dalton-Puffer, 2007; Hu, 2007; Pan, 2007; Hellekjær, 2009; Kirkgöz, 2009; Byun *et al.*, 2011; Evans and Morrison, 2011a, 2011b; Tong and Shi, 2012; Costa and Coleman, 2013; Poon, 2013; Başıbek *et al.*, 2014; Goodman, 2014; Huang and Singh, 2014; Kim *et al.*, 2014; Agai-Lochi, 2015; Clegg and Simpson, 2016; Dafouz and Camacho-Miñano, 2016), four indicators are described as follows.

2.2.1 Syllabus design. Syllabus design is here denoted to relate to teaching strategies (e.g. material, textbook, assignments, examination, assessment process) used in the course content. These are key in helping students understand how to learn the subject matter, provide effective learning guidelines and improve levels of English. The content of syllabus design includes learning material, learning strategies and learning assessment (Costa and Coleman, 2013; Poon, 2013; Clegg and Simpson, 2016). In a shipping context, syllabus design includes topics such as introduction to shipping market (including liner and bulk shipping), port operation and management, maritime logistics and networks and so on. Teaching points may differ depending on teachers' area of expertise and interests. Generally, in Taiwan, students have spent much time on reading about shipping, although listening, speaking and writing may need to be further focused on. In terms of assessment, a term project is also conducted in many shipping-related courses. Students are, in addition, expected to make a presentation at the end of the semester.

2.2.2 Students' characteristics. The category of students' characteristics includes students' learning background, their English level, shipping knowledge (e.g. understanding the main components of shipping) and learning habits (e.g. course material preparation and review, and note-taking skills) (Dalton-Puffer, 2007; Byun *et al.*, 2011; Evans and Morrison, 2011a, 2011b; Başıbek *et al.*, 2014; Kim *et al.*, 2014). In terms of students' English knowledge and level, there are many important components. Firstly, students' vocabulary will be essential. Importantly, rather than have a generic vocabulary here that may be useful for an admissions test of English such as the International English Language Testing System, or IELTS (Pilcher and Richards, 2017), what students will need is a vocabulary specific to shipping courses. Moreover, such vocabulary will arguably be underpinned and be intertwined with key subject based elements specific to the shipping subject. In terms of

their grammar, although undoubtedly important, the level of grammar required might be different to that required in an admissions test if the subject takes primacy. Ultimately, students will need to have speaking and lexical ability, but be able to demonstrate these within the subject. Analogously, if students are studying in the subject area of physics, they would need to be proficient in English in the field of physics (Pilcher and Richards, 2016). Further, if students are studying a general admissions test on English such as IELTS, they will need to be proficient in the English for this test, and not for shipping studies (Pilcher and Richards, 2017).

2.2.3 Teachers' characteristics. Teachers' characteristics relate to teachers' background in terms of English level (including listening, speaking, reading, writing, etc.), professional shipping knowledge (including related teaching subjects) and teachers' past experience of EMI teaching (Pan, 2007; Costa and Coleman, 2013; Goodman, 2014; Huang and Singh, 2014; Dafouz and Camacho-Miñano, 2016). As with the students' knowledge of English, in this case, the teachers' knowledge of English will need to be operational within the subject of shipping studies. Similarly, this may involve a different range of vocabulary and knowledge to physics (Pilcher and Richards, 2016) and be different to the English required for a more general test (Pilcher and Richards, 2017) or for conversation and small talk. In other words, teachers' knowledge of English is closely intertwined with their subject knowledge, and provided they are proficient in their subject, this subject knowledge will take primacy over elements such as grammatical accuracy (Richards and Pilcher, 2017). Thus, teachers' level of English is more than sufficient if they can deliver their subject in a lecture and are able to answer questions at the end and during the lecture.

2.2.4 University resources. The category of university resources includes useful learning and teaching resources provided by the university and also possible incentives for students and teachers. In this paper, as in past studies (Hu, 2007; Hellekjær, 2009; Kirkgöz, 2009; Costa and Coleman, 2013; Tong and Shi, 2012; Agai-Lochi, 2015), university resources include classroom facilities, availability of resources, incentives for teachers and incentives for students. Resources could relate to facilities such as translation tools, microphones, recorders and standard teaching-related technology, but also human resources such as support staff in the form of academic advisors. Incentives for teachers could relate to aspects such as opportunities to attend overseas courses, salary increases and favourable workload calculations. For students, incentives could relate to employability, in that they can add their experience to a curriculum vitae, and it can help improve their attractiveness to employers.

After these four indicators and their sub-indicators were developed, face-to-face personal interviews with senior shipping practitioners[3] were implemented to ensure the content validity of the questionnaire.

3. Methodology

AHP is a multi-indicator decision-making method and is used to solve complex problems (Saaty, 1980; Yang *et al.*, 2014). However, classical AHP may not accurately represent the ideas of the decision makers. Consequently, Zadeh (1965) defined a fuzzy set as a class of objects with a continuum of grades of membership ranging between zero and one. Based on Zadeh (1965), fuzzy linguistic variables and corresponding fuzzy triangular numbers can be used for comparison amongst the elements included and help solve vague and uncertain problems in decision-making. Therefore, fuzzy logic, using fuzzy pairwise comparison matrices, is intended to reduce the uncertainty of the AHP method (Chang, 1996). In this paper, we used a two-stage methodology to conduct fuzzy AHP to identify the key indicators and sub-indicators. Firstly, we used the AHP method to identify indicator and sub-indicator weights using expert choice 11.5 software. Secondly, we introduced the fuzzy set theory with

triangular fuzzy numbers (Zadeh, 1965; Buckley, 1985) and combined this with our AHP analysis results. A triangular fuzzy number, as it is used as the member function in fuzzy AHP, is expressed in Figure 1. Its membership function is defined by the triplet (l, m, u), as in equation (1) (Zadeh, 1965):

$$U_{M(x)} = \begin{cases} \frac{(x-l)}{(m-l)}, & l \leq x \leq m \\ \frac{(u-x)}{(u-m)}, & m \leq x \leq u \\ 0, & \text{others} \end{cases} \quad (1)$$

where $M(x)$ is a triangular fuzzy number, m is the highest possible value of the fuzzy number and $U_{M(x)}$, l and u respectively represent the lower and upper bounds.

The operational laws for $M1 = (l_1, m_1, u_1)$ and $M2 = (l_2, m_2, u_2)$, as two fuzzy numbers, are:

$$M1 + M2 = (l_1 + l_2, m_1 + m_2, u_1 + u_2) \quad (2)$$

$$M1 \times M2 = (l_1 \times l_2, m_1 \times m_2, u_1 \times u_2) \quad (3)$$

$$\beta \times M_1 = (\beta l_1, \beta m_1, \beta u_1), \beta > 0, \beta \in R \quad (4)$$

$$M^{-1} = (l, m, u)^{-1} = \left(\frac{1}{u}, \frac{1}{m}, \frac{1}{l} \right) \quad (5)$$

Such a method is designed to provide decision support for uncertain valuations and priorities and also to overcome the inability of AHP to represent linguistic variables (Kabir and Hasin, 2011; Chiu et al., 2014; Nazari et al., 2017).

Questionnaire samples for this paper were collected from the perspectives of three groups key to EMI: university English teachers, university shipping teachers and shipping practitioners. All samples in the questionnaires were recruited by the method of convenience and snowball sampling (Bryman, 2015), as the experts who are familiar with EMI teaching in the shipping courses of higher education are not easily found in Taiwan. Before sending the questionnaire, the backgrounds of potential participants in the samples (including university English teachers (12), university shipping teachers (12) and

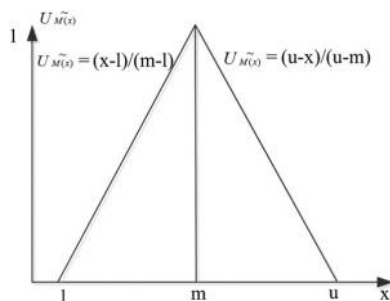


Figure 1. A Triangular fuzzy number

shipping practitioners (12)) were reviewed to ensure they were appropriately experienced and qualified to answer our questionnaire. Then, we made contact with these potential participants to enquire whether they could participate in the survey by email or telephone. In the questionnaire survey, questionnaire participants were individually asked to respond to a series of pairwise comparisons to establish the relative importance of the different elements. A nine-point rating scale[5] was designed to measure the participants' perceptions of what the relative importance of each pair of indicators (sub-indicator) in the same hierarchy was. Scale number "1" means equal importance and scale number "9" extreme importance.

Based on Saaty (1980), a consistency index (CI) was used to capture any inconsistencies within judgments in each aggregate pair-comparison matrix, as well as in the overall decisions structures. Then, a consistency ratio (CR) was used to measure how a given matrix compared to a purely random matrix in terms of the CI. The CI and CR were formulated as follows:

$$CI = \frac{\theta_{\max} - n}{n - 1} \quad (6)$$

$$CR = \frac{CI}{RI} \quad (7)$$

where CI is the consistency index; θ_{\max} is the maximum eigenvalue; n is the number of elements in the judgement matrix; RI is the consistency index of a randomly generated reciprocal matrix from the nine-point scale, with forced reciprocals. For matrixes larger than 3×3 , a value of the $CR \leq 0.1$ is considered acceptable, while larger values of the CR require the decision-maker to revise their judgements (Saaty, 1980). Based on Section 2.2, four indicators (including syllabus design, students' characteristics, teachers' characteristics and university resources) and 13 sub-indicators were developed (see Table I).

4. Results

4.1 Data collection

With regard to our personal interviews, questions included those such as "What do you think about the English Medium Instruction in the shipping courses of Taiwan's higher education?", "Do you have any suggestions to improve English Medium Instruction in the shipping courses of Taiwan's higher education?", "Could you provide your comments or feedback about our initial questionnaire content?" Based on interviewees' response on the content, we further asked follow-up questions, which were important and related to our research topic. The use of interviews in this way allowed us to explore in depth (Silverman, 2010) with experts whether our intended questionnaire content was appropriate and in line with our conclusions from the literature and our own experience of the key aspects related to EMI teaching in shipping management courses. We considered that interviews at this stage were most appropriate to explore these aspects, as they allowed for dialogue (Bakhtin, 1981) and negotiation, and this in turn allowed us to focus and strengthen our questionnaire.

Questionnaires were sent to 36 participants (including university English teachers (12), university shipping teachers (12) and shipping practitioners[6] (12)) in Taiwan on 22 February 2017[7]. In this survey, university English teacher and university shipping teacher samples consisted of individuals who all have experience in EMI teaching in general universities in Taiwan. With regard to shipping practitioners, they all came from shipping

Indicator	Sub-indicator	Description	Sources
Syllabus design (A)	Course material (A1)	Textbook, shipping practice news, scene conversation simulation	Costa and Coleman (2013)
	Learning strategies (A2)	Suitable subjects and implementation processes to attract student's interest and motivation	Poon (2013)
	Learning assessment (A3)	Providing effective assessment tools and inspectors/examination authorities to maintain equitable assessment method	Clegg and Simpson (2016)
Students' characteristics (B)	Students "English" level (B1)	Vocabulary, speaking (oral), grammar, lexical abilities	Byun <i>et al.</i> (2011), Dalton-Puffer (2007), Kim <i>et al.</i> (2014), Başibek <i>et al.</i> (2014)
	Student's shipping knowledge (B2)	Ship, port, cargo, charter contract, shipping company, agency, freight forwarder, etc.	Byun <i>et al.</i> (2011)
	Learning habits (B3)	Student's learning motivation, learning preparation and review, notes-taking skill, etc.	Byun <i>et al.</i> (2011), Evans and Morrison (2011a, 2011b)
Teachers' characteristics (C)	Teachers "English" level (C1)	Vocabulary, speaking (oral), grammar, lexical abilities	Pan (2007), Costa and Coleman (2013), Goodman (2014)
	Teacher's shipping knowledge (C2)	Teacher is familiar with teaching subjects regarding shipping-related fields	Huang and Singh (2014)
	Teacher's past experience with EMI teaching (C3)	The experience of teaching EMI courses, teaching skill, classroom management	Dafouz and Camacho-Miñano (2016)
University resources (D)	Classroom facilities (D1)	Learning environment (e.g. location, space, computer (Web) facilities, etc.)	Costa and Coleman (2013)
	Availability of assistance (D2)	Administration staff, language centre (tutor hour), library resources (e.g. video, newspaper)	Hellekjær (2009); Kirkgöz (2009), Agai-Lochi (2015)
	Incentives for teachers (D3)	Overseas training, course subsidies, salary increases and favourable workload calculation	Hu (2007), Tong and Shi (2012)
	Incentives for students (D4)	Employability knowledge of international shipping language, improving English abilities	Costa and Coleman (2013)

Table I.
Key indicators and sub-indicators influencing EMI courses

companies in Taiwan. By 27 February, 2017, 28 questionnaires had been received. For each questionnaire, CI was tested to confirm the consistency of its pairwise comparison matrix. The results showed that three questionnaires were highly inconsistent ($CI > 0.1$) (Saaty, 1980), and these were consequently discarded. Thus, the overall response rate was 69.4 per cent (= 25/36). The profiles of the 25 participants' characteristics (including eight university English teachers, nine university shipping teachers and eight shipping practitioners) are shown in Tables II, III and IV. The results show that most of the participants were senior experts with at least 10 years working experience in university or shipping industries, thus highlighting the reliability of the survey findings.

4.2 Fuzzy analytic hierarchy process analysis

In this paper, the fuzzy extent values of indicators and sub-indicators are shown in Table V. In Table VI, all CR values are less than 0.1, and thus fit the consistency test (Saaty, 1980; Kabir and Hasin, 2011). The local weights of each indicator and sub-indicator are shown in Table VI. The results indicate that teachers' characteristics (0.262) is the most important indicator influencing the implementation of EMI, followed by syllabus design (0.256), university resources (0.244) and students' characteristics (0.239). With regard to sub-indicators, learning strategies (0.350), students' "English" level (0.386), teachers' "English" level (0.374) and availability of assistance (0.347) were perceived to be the most important sub-indicators with respect to each indicator in relation to syllabus design, students' characteristics, teachers' characteristics and university resources, respectively.

Further, the global weights were synthesised from the second level and were arrived at by multiplying the local weights and the corresponding indicator in the level above, and then adding them to each element in a level according to the indicator affected. The results show that the three most important indicators influencing the implementation of EMI are teachers' "English" level (0.0979), students' "English" level (0.0923) and learning strategies (0.0894).

Samples	Range	Frequency	(%)
Job title	Professor	2	25
	Associate professor	5	62.5
	Assistant professor	1	12.5
	Sub-total	8	100
Age (years)	Under 40	1	12.5
	41-50	2	25.0
	51-60	4	50.0
	Above 60	1	12.5
	Sub-total	8	100
Educational level	PhD	8	100
	Master	0	0
	Bachelor	0	0
	Sub-total	8	100
Seniority	10-15	1	12.5
	16-20	2	25
	21-25	4	50.0
	Above 26	1	12.5
	Sub-total	8	100

Table II.
Profiles of the
university English
teachers' samples

Samples	Range	Frequency	(%)
Job title	Professor	3	33.3
	Associate professor	4	44.4
	Assistant professor	2	22.2
	Sub-total	9	100 ^a
Age (years)	Under 40	1	11.1
	41-50	5	55.5
	51-60	3	33.3
	Above 60	0	0
	Sub-total	9	100.0 ^a
Educational level	PhD	9	100
	Master	0	0
	Bachelor	0	0
	Sub-total	9	100
Seniority	10-15	2	22.2
	16-20	3	33.3
	21-25	2	22.2
	Above 26	2	22.2
	Sub-total	9	100 ^a

Table III.
Profiles of the
university shipping
teachers' samples

Note: ^aRound-up figures to an approximate

Samples	Range	Frequency	(%)
Job title	President/Director	1	12.5
	Senior Deputy Director	3	37.5
	Division Director	3	37.5
	Supervisor	1	12.5
	Sub-total	8	100
Age (years)	Under 40	0	0
	41-50	3	37.5
	51-60	3	37.5
	Above 60	2	25.0
	Sub-total	8	100.0 ^a
Educational level	PhD	1	12.5
	Master	4	50.0
	Bachelor	3	37.5
	Sub-total	8	100
Seniority	10-15	2	25.0
	16-20	2	25.0
	21-25	2	25.0
	Above 26	2	25.0
	Sub-total	8	100 ^a

Table IV.
Profiles of the
shipping
practitioners'
samples

Note: ^aRound-up figures to an approximate

5. Discussions and conclusions

The above results show the relative importance of factors in the implementation of EMI in a Taiwanese context. Using 25 effective samples, teachers' characteristics are shown to be the most important indicator, closely followed by syllabus design, university resources, and

Indicator	Fuzzy extent value			Sub-indicator	Fuzzy extent value		
Syllabus design	0.162	0.254	0.420	Course material	0.218	0.360	0.544
				Learning strategies	0.213	0.383	0.537
				Learning assessment	0.184	0.257	0.544
Students' characteristics	0.149	0.233	0.399	Students' "English" level	0.217	0.394	0.679
				Students' shipping knowledge	0.129	0.268	0.545
				Learning habits	0.217	0.337	0.553
Teachers' characteristics	0.149	0.278	0.428	Teachers' "English" level	0.215	0.395	0.591
				Teachers' shipping knowledge	0.211	0.325	0.444
				Teachers' past experience with EMI teaching	0.211	0.279	0.537
University resources	0.138	0.235	0.423	Classroom facilities	0.186	0.282	0.365
				Availability of assistance	0.145	0.242	0.356
				Incentives for teachers	0.214	0.266	0.367
				Incentives for students	0.145	0.209	0.362

Table V.
Fuzzy extent value of sub-indicators

Indicator	Local weights	CR	Sub-indicators	Local weights*	Global weights**	Rank
Syllabus design	0.256	0.0172	Course material	0.346	0.0886	4
			Learning strategies	0.350	0.0894	3
			Learning assessment	0.304	0.0778	8
Students' characteristics	0.239	0.0345	Students' "English" level	0.386	0.0923	2
			Students' shipping knowledge	0.282	0.0675	9
			Learning habits	0.331	0.0792	7
Teachers' characteristics	0.262	0.0005	Teachers' "English" level	0.374	0.0979	1
			Teachers' shipping knowledge	0.305	0.0799	6
			Teachers' past experience with EMI teaching	0.320	0.0838	5
University resources	0.244	0.0080	Classroom facilities	0.266	0.0647	11
			Availability of assistance	0.347	0.0576	12
			Incentives for teachers	0.270	0.0657	10
			Incentives for students	0.228	0.0555	13

Table VI.
Fuzzy AHP results

Notes: *Local weight is derived from judgement with respect to a single indicator; **Global weight is derived from multiplication by the weight of the indicator

students' characteristics. Arguably, all these indicators are key and must all be in place, but the lead indicator needs to be the teachers' characteristics. This being the case, it is arguable that the other factors play a supporting role. Thus, institutions in Taiwan arguably need to help support teachers in their approaches and roles, possibly through providing incentives,

but also through providing assistance and resources. This strategy is confirmed by the second-level results. These show that teachers' "English" level is the key factor, closely followed by students' "English" level and learning strategies. Arguably, this would suggest that participants in the samples felt that students needed to have both a good level of English and also a good range of learning strategies to be able to help them understand the content, particularly when their level of English did not enable them to do so.

With regard to improving teachers' English level, it is suggested that professional English teachers in the university can work alongside subject lecturers on EMI courses. For example, English teachers can help guide students' communication in the subject regarding their assessments and term projects. Non-English professional EMI teachers could gradually improve their English teaching skills over time and by considering the guidance given to their students by the English teachers. In addition, university authorities could provide incentives (e.g. extra teaching pay) to invite more English teachers to join EMI programmes and to work alongside subject lecturers. We would suggest that such teachers have some of their time allocated to being part of the shipping department and gain familiarity and confidence with the subject context. Although there are cost implications with these suggestions, we would argue that their benefits in terms of improved student work and learning and lecturer confidence and ability more than compensate for any costs.

With regard to low global weights ranking, four sub-indicators (classroom facilities, availabilities of assistance, incentives for teachers and incentives for students) are viewed as being relatively unimportant indicators. Such a result might be attributed to the fact that some experts think university resources are a prerequisite for EMI, and this could have affected their decision identification when completing the questionnaires. Such a situation constitutes a limitation to our study and is an aspect that could be investigated in future research.

Arguably, our results suggest that EMI needs to be given more space and time than subject instruction in the first language, and that this in turn needs more support from the teachers and students. This clearly has implications in terms of resources and time. Firstly, from a timetabling perspective, it is arguable that EMI needs to be given more space in the timetable. This could either be done on a weekly basis by according more time to each lesson or it could be done over a lengthier time by extending the number of weeks of the course. Our results suggest that, given the importance of learning strategies, a key factor for the students and the teachers to help in explaining the concepts may be to allow more time for questions and answers at the end of the session to allow for dialogue.

Interestingly, our results do not show that shipping knowledge was considered to be a key factor. This could be because such knowledge is taken for granted, or it could be because the focus of the study was on EMI. If the latter is the case, it could be assumed that participants in the samples felt that when they were responding in relation to questions about "English" level, they were doing so with the perception that this "English" related to the ability to express themselves in the subject area in "English", i.e. their ability to deliver subject knowledge in "English".

Further research would be useful to study aspects such as how participants felt about assessments being conducted in English, about students' perceptions of EMI, about how the effectiveness of such programmes in delivering knowledge can be judged or more specific research about the type of support that would help students and teachers deliver EMI. It is possible, we would argue, that such questions are key for any policy makers, particularly if the policy of introducing EMI has the implications in terms of resources and timetabling that our results suggest. We note, however, that, to be successful, such a change to EMI will indeed require support and assistance as our results suggest, but that, given this, it will help

develop Taiwan's graduates for employability and help Taiwan recruit more international students to study there. Indeed, it is arguable that the costs of implementing EMI could be offset by these benefits.

Notes

1. Ministry of Transportation and Communication, Taiwan. www.motc.gov.tw/en/home.jsp?id=154&parentpath=0
2. For example, when a student graduates from senior high school (at about 18 years old) in Taiwan, they have learnt English for six years, if it is assumed their junior high school has had some form of English education. In recent years, most public elementary schools in Taiwan have started English language education classes when students are 10 years old. Also, some private elementary schools have started to introduce English education or bilingual Education (Chinese and English).
3. We interviewed two directors. One worked for Evergreen Marine Corp. and one worked for Yang Ming Marine Transport in Taiwan. These two companies are the number one and number two shipping companies in Taiwan, and their global rankings were, respectively, sixth and eighth as of September 2017 (Alphaliner, 2017). These directors each have more than 30 years' practical working experience and have been continuously engaged with university education over this time. Based on these background data, it is believed that these experts constitute effective interview samples. Expert interviews were conducted in December 2016. Interviews took place in interviewees' offices and used several questions (e.g. "What do you think about the English Medium Instruction in the shipping courses of Taiwan's higher education", "Do you have any improvement suggestions to enhance English Medium Instruction in the shipping courses of Taiwan's higher education", "Could you provide your comment or feedback about our initial questionnaire content") and questionnaire content formed the focus for ensuring the content validity of the questionnaire. We revised our questionnaire based on interviewees' comments and feedback, in terms of what aspects were considered common, core and important. Each interview averaged 40 min in length.
4. They were required to have EMI experience of shipping courses in universities in the past three years.
5. The nine-point rating scale is widely used in the AHP or fuzzy AHP-based studies (Chiu *et al.*, 2014; Kabir and Hasin, 2011). Such a scale was introduced by Thomas Saaty (1980), the original developer of AHP.
6. These companies include Evergreen Marine Crop. Ltd., Yang Ming Line, Wan Hai Lines, T.S. Line, Chinese Maritime Transport Ltd., COSCO Shipping, NYK Line, Cheng Lie Navigation (CNC) Line, Orient Overseas Container Line and Taiwan Navigation Corp. Ltd.
7. In the first page of the questionnaire, it was stated that the EMI shipping courses considered are shipping management-related courses.

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Further reading

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