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STRUCTURE REARRANGEMENT OF AN INTRODUCTORY COURSE FOR GENERAL SHIPPING EDUCATION

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ABSTRACT

A literature on maritime education is at the corner side, comparing with large amount of works on business and management topics. However, the importance of forming and updating a maritime education system should not be neglected, leaving a research gap for academic discussion. This paper is a continuation of an introductory course design study in a maritime university (Wang, Zhang, Ge, & Chao, 2021). In the last paper, we deal with the content selection problem for general shipping education. The content of shipping education relies heavily on the practice. Evolved with the internal and external environment change of shipping industry, the structure of the course designed before cannot fully comply with the industrial requirements. This paper aims to rearrange the course structure by increasing the student and practitioner engagement, where the student preference and industrial requirements are both considered. The Entropy-TOPSIS model is applied to evaluate the contents of each module. It is shown that students and practitioners are very sensitive to the different modules; the common and divergent perspectives were identified. Finally, the proportion of each content was adjusted accordingly based on the results of the measurement. The main contribution is to provide a possible solution for the course reform of general shipping education.

Contribution/Originality: This study is one of very few studies which have investigated the curriculum design of general shipping education. The primary contribution is providing a method for structural rearrangement with the engagement of students and practitioners, which enhance its reliability and applicability.

1. INTRODUCTION

The shipping industry handles over 80% cargoes of the world trade. Tens of thousands of ships shuttled around global ports to delivery billions of tons of goods bounded up with people's daily life. In contrast to the large demand, the supply side legs behind that education cannot keep pace with the evolving requirements of industry and society.

Maritime education has a worldwide layout that professional colleges and academies appeared in the North America, Europe and Asia, where the United States and Europe is relatively developed. The maritime education can be dated back to 1874, followed with the foundation of the State University of New York (SUNY Maritime College), institutions such as the Massachusetts Maritime Academy, Maine Maritime Academy, Great Lakes Maritime Academy, Texas A&M Maritime Academy, California Maritime Academy, set up majors related to international trade and transportation with traditional courses as international business, transportation

management, and maritime operations. Graduates are qualified for onshore and offshore positions. Similarly, some higher education institutions in Europe offered course in maritime business, shipping finance and transportation law, such as Liverpool John Moores University (UK) and World Maritime University (Sweden). Follows the idea that diversity makes the university stronger, the Australian Maritime College has a diverse curriculum to enable students to adapt to the ever-changing shipping industry. This major combines the core content of shipping management such as law, finance, market, economy, and supply chain management. Higher education institutions in Asia that have shipping management and related majors mainly are Amity University (India), Ho Chi Minh City University of Transport (Vietnam) and Maritime Universities in China (Shanghai & Dalian). Their courses are designed to train students to engage in the logistics and shipping industry, so that students have basic knowledge of shipping business.

Judging from the professional curriculum settings of various institutions, they both have courses in the shipping business, shipping law, shipping insurance, shipping logistics, shipping economics, shipping agency, and shipping management. However, since the industry focus and people's preference is changing, current curriculum system should keep up with the evolution and adapt to the new requirements in designing the shipping courses (Pallis & Ng, 2011). For example, multimodal transportation, cruises shipping, and other courses reflecting the latest shipping development are still relatively scarce. Not only are industry needs updated, but students' interest in learning is also constantly changing. Given the development of the modern shipping industry, the shipping management profession needs to pay attention to new changes, track the development of its curriculum, and adjust the content and proportion of the curriculum at any time. (Ng, Koo, & Ho, 2009) reviewed the maritime program for both ship officers and onshore managers in Hongkong Polytechnic University, whose quality assurance mechanism is based on the regular review from different sectors of the shipping industry. Therefore, the change environment and emerging needs can be introduced in time.

Based on a general course at the maritime university (see content details in Appendix A, further refer to Wang et al. (2021). We proposed a structure rearrangement method in shipping management to narrow the gap between general shipping education and industry requirements, and facilitate the learning experience of students. Questionnaire surveys are conducted among students with diverse background and practitioners in the shipping industry. In order to avoid the subjective preference, the Entropy-TOPSIS is applied in evaluating the content of the designed course. Finally, the course structure is rearranged.

According to the subject selection, section 2 presents the structure rearrangement of the course with the questionnaire survey and an Entropy-TOPSIS model was applied to perform its evaluation. Section 3 discusses the results of the measurements and Section 4 presents the conclusions.

2. STRUCTURE REARRANGEMENT

Course design is not a one-way output of the teacher's knowledge; rather, student engagement should also be considered as they are the main audience of the class (Kezar & Kinzie, 2006). Axelson and Flick (2010) defined "student engagement" as the extent to which students are cognitively, behaviorally, and/or emotionally involved and connected to the class (Erduran & Msimanga, 2014). Plenty of studies have declared the significant link between student engagement and quality of higher education (Coates, 2005; Kahu, 2013; Kuh, 2009). In the course of general shipping education, students were invited to participate in course designing, thus increasing student engagement in the cognitive and psychological realms.

Furthermore, Shipping Management, as a specific subject, is focused more on social practice. Practitioner engagement is also introduced in the process of course designing to achieve vocational ability, facilitating the authenticity of course designing (Josh, Bouillion, Lento, & Gomez, 2001; Sun, 2018). What faculty really matters for vocational development or promotion in our shipping industry? Practitioners from different sectors of the shipping industry were invited to share their perspectives based on their practical experiences.

According to the feedback we obtained from both students and practitioners, we made adjustments to the content structure by coordinating and integrating the student and practitioner engagement as far as possible. Then, we designed a questionnaire for the students of the pilot class and the alumni to answer. Then a classical model, the Entropy-TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution), was introduced to analyze the data.

2.1. Questionnaire Design and Data Collection

We designed the questionnaire depending on the objectives, selected contents, and modules. The three objectives were further divided into 25 items: 10 for traditional threshold knowledges, 9 for emerging market spotlights, and 5 for comprehensive faculties. In order to avoid confusion due to small changes in the wording (Robinson, Shaver, & Wrightsman, 1992) the Chinese and English versions were developed and translated mutually. The respondents answered the items using five-point Likert-type scale noted as 1=not at all important, 2=not important, 3=to some degree, 4=important, and 5=extremely important. Before conducting the survey, a pilot test was carried out among some undergraduate volunteers and teachers of our department, namely, the Department of Transport and Communications. This was done to enable us to refine the questions prior to the main survey.

The questionnaire was distributed to students and practitioners by asking them to scan the Quick Response (QR) Code that was automatically generated from a survey platform named WJX (www.wjx.cn). The students' survey was conducted on the pilot class, in which 117 students from different disciplines (out of 129, 9.3% absence rate) answered. The practitioners' survey was performed through a communication portal for alumni, and 49 practitioners (out of 180, 72.78% refusal rate) answered the questions (see details in Table 1).

Table-1. Distribution of the Respondents

	Fields	Number	Percentage
Student			
	Arts	18	15.38%
	Science	30	25.64%
	Engineering	28	23.93%
	Business	41	35.04%
Total		117	100%
Practitioner			
	Shipping Company	16	32.65%
	Agency	9	18.37%
	Shipper	6	12.24%
	Port Group	8	16.33%
	Others	10	20.41%
Total		49	100%

Note: The proportion of students chosen for the pilot class is random and basically complies with the proportion of the enrollments in the main subjects of the maritime university.

2.2. Measurement

Entropy-TOPSIS is an integrated method for optimal selection, where the concept of "entropy" is used to evaluate the weight of the individual elements (Jee & Kang, 2000). TOPSIS, meanwhile, can be used to determine the importance of weights (Olson, 2004). In the current study, the Entropy-TOPSIS model was introduced to rank the candidate contents of the course. The structure was then rearranged according to the grades and ranks of the contents.

First, the initial matrix was created using the data extracted from the questionnaires, excluding 13 invalid responses from surveys completed in a hurry or had the same answers. We set m and n as the numbers of respondents and indices (contents), respectively, in the questionnaire (see Table 1, n=25 in this case). Thus, the $m \times n$ matrix is given by

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mm} \end{bmatrix},$$

Where M is the set of objects (students or practitioners), D is the set of indices, X_{ij} is the grade of content j given by student/practitioner i ($i = 1, 2, \ldots, m$, $j = 1, 2, \ldots, n$).

In order to eliminate the effects of the different physical dimensions of each content, the normalization of the matrix was conducted with the equation (in the case of the positive index).

$$Y_{ij} = \frac{x_{ij} - \min(x_i)}{\max(x_i) - \min(x_i)},$$

Where Y_{ij} is in the range of 0 to 1.

The relative priority among the contents was evaluated through the weight factor, in which the entropy concept was introduced (Shannon, 2001). The entropy of the matrix was calculated by using the equation:

$$E_j = -\ln(n)^{-1} \sum_{i=1}^{n} p_{ij} \ln p_{ij},$$

where

$$p_{ij} = Y_{ij} \Big/ \sum_{i=1}^{n} Y_{ij}.$$

If $p_{ij} = 0$, then $\lim_{p_{ij} \to 0} p_{ij} \ln p_{ij} = 0$. The set of entropy is given by $E = [E_1, E_2, \ldots, E_k]$, and through the equation of the weight factor expressed as

$$w_j = (1 - e_j) \Big/ \sum_{j=1}^{n} (1 - e_j),$$

the weight factor matrix for contents was built as $W_n = [W_1, W_2, \ldots, W_n]$.

Based on the weight factor matrix W_n and the initial normalized matrix Y_{ij}, the content matrix is reconstructed as the weighted decision-making matrix $R = (r_{ij})_{m \times n}$ expressed as

$$r_{ij} = w_j \times y_{ij}$$

The most and least preferred valued are defined as ideal S_j^+ and S_j^-, respectively, and are accordingly expressed below.

$$S_j^+ = \max_{1 \le i \le m} \{r_{ij}\},\ j = 1, 2, \ldots, n$$

$$S_j^- = \min_{1 \le i \le m} \{r_{ij}\},\ j = 1, 2, \ldots, n$$

The Euclidean distance formula, given below, was used to calculate the distance of the ideal and others.

$$Sd_i^+ = \sqrt{\sum_{j=1}^{n} (S_j^+ - r_{ij})^2},\ i = 1, 2, \ldots, m$$

$$Sd_i^- = \sqrt{\sum_{j=1}^{n} (S_j^- - r_{ij})^2},\ i = 1, 2, \ldots, m$$

To determine the preferred content, the relative closeness was calculated by using the equation

$$\eta_i = \frac{Sd_i^-}{Sd_i^+ + Sd_i^-},\ i = 1, 2, \ldots, m.$$

In this formulation, the bigger the value of η_i, the more ideal the content.

3. RESULT AND DISCUSSION

Table 2 presents the outcomes of the Entropy-TOPSIS model. Some findings were summarized, and the common and divergent perspectives were identified and presented below.

The evaluation of the traditional elements in Module 1 ("Classification and Functions of Vessels," "Cargo Classification and Characteristics," and "International Shipping Routes and Ports") indicated that these were the three fundamental elements in the shipping industry. In fact, ranking them in the top 10 contents, students and practitioners both considered them as entry-level concepts. For novices who want to specialize in the international shipping market, they must have knowledge of vehicles and freights carried on board. Complying with the threshold concept in education, Module 1 can be restructured with priority.

The contents of Modules 2, 3, and 4 encountered obvious divergence between students and practitioners. Students focused on understanding the opportunities and challenges from a more macro perspective of operation and management. Meanwhile, practitioners were more pragmatic and preferred discussions from a market operation mode perspective; in their view, opportunities and challenges were less important. For Module 2, students placed more emphasis on "Opportunities and Challenges of Cargo Standardization and Non-standardization," giving it a ranking of 6th, whereas "Standardized and Non-standardized Freight Operation and Management" was 11th. The difference between them (−12 and 6, respectively) illustrated the difference in attitudes between practitioners and students. In Module 3, practitioners placed greater value on the "Organisation Structure of Liner Shipping and Chartering," as the 3rd most important content. Furthermore, the differential turned into 8 for "Organisation Mode of Liner Shipping and Chartering," as it is one of the least five contents from the students' perspectives.

The gap of content evaluation reached the most significant difference in the "Concept of Intermodalism." Students believed that the concept of intermodalism in Module 4 was the top priority, ranking it 1st in all contents, whereas the practitioners listed it in the 2nd half. This phenomenon demonstrates the significant difference between theory and practice. The word "intermodalism" has attracted public interest due to its high appearance rate in the media since the Chinese government launched the "Intermodal Demonstration Project" in 2015 (State Council, 2015). However, practitioners (as professionals) were no strangers to this concept, thus they tended to rank it lower than the other items. The reconstruction of Modules 2, 3, and 4 took the average value of the controversial contents. This was done in consideration of the students' interests and the goal of helping them get a head start in their careers.

Although differences appeared, the attitudes and understanding of shipping finance were generally consistent. The "Concept of Shipping Finance" and "Typical Cases of Shipping Finance" ranked at the middle level of the whole, but there was a large gap in the characteristics, whose differential reached 8. Overall, the students were not interested in the "Characteristics of Shipping Finance." They refused in-depth discussions because the concepts and cases were sufficient from their point of view; thus, they viewed these characteristics as undesirable. In comparison, the practitioners paid more attention to this aspect because these characteristics helped them understand the difference between shipping finance and other financial products, thus allowing them to adopt strategies accordingly. The combination of shipping features and financial theories had a positive impact on practice. Therefore, "Characteristics of Shipping Finance" was not deleted directly and it was transformed into the brief introduction for this course.

Table-2. Evaluation Outcomes of the Module Contents via the Entropy-TOPSIS model.

Module	Items	Student Engagement			Practitioner Engagement			Differential
		Entropy Weight (%)	TOPSIS Value	Rank	Entropy Weight (%)	TOPSIS Value	Rank	
Module 1	Classification and Functions of Vessels	3.35	0.5239	7	1.9	0.5476	8	−1
	Cargo Classification and Characteristics	2.72	0.5434	3	2.06	0.5574	6	−3
	International Shipping Routes and Ports	4.36	0.5318	5	2.01	0.6065	2	3
Module 2	Opportunities and Challenges of Cargo Standardization and Non-standardization	3.79	0.5292	6	4.5	0.4283	18	−12
	Standardized and Non-standardized Freight Operation and Management	3.01	0.4980	11	3.26	0.5802	5	6
Module 3	Interest Parties of the International Shipping Market	5.18	0.4888	14	2.78	0.5319	10	4
	Coordination among the Related Shipping Companies	2.97	0.4630	17	2.92	0.4921	13	4
	Organisation Mode of Liner Shipping and Chartering	9.87	0.4427	20	3.46	0.5061	12	8
	Organisation Structure of Liner Shipping and Chartering	2.81	0.4935	13	2.08	0.6061	3	10
Module 4	Concept of Intermodalism	1.51	0.5338	1	2.46	0.5933	17	−16
	Typical Cases of Container Intermodalism	3.71	0.5669	15	3.92	0.4432	15	0
	Barriers and Solutions of Intermodalism	4.31	0.4681	12	4.37	0.4648	19	-7
Module 5	Concept of Shipping Finance	1.87	0.4964	9	4.97	0.4176	9	0
	Characteristics of Shipping Finance	4.79	0.5023	19	2.53	0.5383	11	8
	Typical Cases of Shipping Finance	4.86	0.4460	10	2.93	0.5202	7	3
Module 6	Concept of Cruises and Yachts	2.23	0.5008	24	3.21	0.5511	21	3
	Organisations and Operation of the Cruise Market	3.6	0.3955	25	7.54	0.3198	24	1
	Bottlenecks of the Cruise Market	3.23	0.3534	23	7.51	0.2995	25	−2
Module 7	Concept and History of the Shipping Cluster	3.18	0.4001	18	7.53	0.2888	20	−2
	The Essence of an International Shipping Cluster	4.85	0.4613	16	5.92	0.3673	22	−6
	Practices and Logics of Famous Shipping Clusters	4.68	0.4637	21	4.66	0.3174	23	−2
	Future Trends of the Shipping Industry	4.34	0.4384	4	5.63	0.3084	4	0
Module 8	Structure of the International Shipping Laws	4.52	0.5177	8	2.53	0.6314	1	7
	Evolution of the Mainstream Shipping Polices and Laws	6.25	0.4028	22	4.66	0.4454	16	6
	National Strategy to The Changes of International Shipping Policies and Laws	4	0.5514	2	4.66	0.4816	14	−12

Another content with great alignment was "Future Trends of the Shipping Industry," ranking 4th whether in the overall ranking of the contents or in the interior of the module with 0 differential. Thus, we can say that both the students' and practitioners' concern for the future was relatively high. Meanwhile, the cruise module was ranked last in both the student's and practitioners' evaluations—a surprising result given the current boom in the cruise market in China. The cruise market in China, according to the China Cruise and Yacht Industry Association (CCYIA), has been developing rapidly since 2006, with 40% to 50% growth rate annually. In fact, a total of 11 cruise ports, including Tianjin, Dalian, Qingdao, Yantai, Shanghai, Zhoushan, Wenzhou, Xiamen, Guangzhou, Shenzhen, Haikou, and Sanya, from north to south, welcomed 1181 cruise ships and nearly 5 million tourists in 2017 alone. One of the main reasons for this phenomenon is the fact that it is a relatively new industry for the Chinese people. In the eyes of the general public, the cruise market is related to tourism management. It is difficult to realize their connection with merchant shipping, except for material supply and route planning of the cruise ships. It may also be related to the university's emphasis on merchant marine as the focus of its education programs. Therefore, the cruise module was adjusted such that the proportion of allocation was reduced. We did not, however, completely delete this from the course. Last but not the least, both surveyed parties believed that Module 8 was crucial, but they were not attracted by "Evolution of Mainstream Shipping Polices and Laws." The "Structure of International Shipping Laws" ranked the 1st among practitioners and 8th among the students, but "National Strategy to the Changes of International Shipping Policies and Laws" revealed a -12 differential. Students were more interested in whether or not China was part of these regulations. Yet, the practitioners were already aware of the answer. As a result, this content was still reserved and constantly updated due to the students' requirement to learn about it. On the other side, the "Evolution of Mainstream Shipping Polices and Laws" was not ideal in the course design, ranking 22nd and 16th, respectively. Therefore, these were omitted. As an explanation, both the students and practitioners were more concerned about the applications of policies and laws, the existing and latest policies and laws, and whether or not China was part of these regulations.

4. CONCLUSION

Maritime University is an important platform for students to learn shipping management and related professional knowledge, which the setting of shipping courses generally lags behind the development of the ever-changing shipping industry. As stated in the structure rearrangement (Section 2), based on a general education course, the structure is rearranged by increasing the student and practitioner engagement, where the Entropy-TOPSIS model is introduced to evaluate the contents of each module. It is shown that students and practitioners who express their attitudes and values to the content of the course from their perspectives are very sensitive to the different modules. In addition, common and divergent perspectives were identified. The contents of Modules 2, 3, and 4 encountered obvious divergence between students and practitioners. Among them, the gap of content evaluation reached the most significant difference in the "Concept of Intermodalism". Although differences appeared, the attitudes and understanding of shipping finance were generally consistent. Finally, the proportion of each content was adjusted accordingly based on the results of the measurement.While this paper provides a reference for in structure rearrangement of an introductory course on general shipping education, future researches can be extended to other specific fields with similar characteristics. And the contents of such an introductory course are not restricted in the modules of this paper.

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Appendix-A. Main Contents of the Curriculum

Modules	Main Contents
Module 1: Function and Technology of Vessels	Shipping vehicles: type and function Shipping goods: types (dangerous cargoes), import and export countries Maritime geography (Shipping route structure): main nodes and links …
Module 2: Ship Operation and Management	History of containerization Terminology: shipper, charterer, shipowner, carrier, consignee, consignor, etc. Trade terms: international commercial terms (Incoterms 2010) Documents during transportation: letter of credit, bills of lading, manifest, dock receipt, etc. …
Module 3: Operation Mode of the Shipping Market	Liner shipping companies: Contract parties (top players, freight forwarder, ship agency, etc.) Bulk/Break Bulk carriers: Contract parties (charterer, shipowner, disponent, broker, etc.) Operation procedures of transportation (liner and chartering) …
Module 4: Container Intermodalism	Terminology: Intermodalism Mode: Rail-road, Sea-rail, Air-Road, Sea-rail-road, Sea-river-road, etc. Contract parties: rail operators, truck companies, shipping companies Some typical cases of container intermodalism; (land bridge transportation) Problems (choke points) and solutions …
Module 5: The Market of Shipping Finance and Operation	Terminology: Shipping finance Common financial services Typical cases: forward freight agreement, shipping loan, container lease, etc …
Module 6: Cruise Ships and Yachts	Terminology: cruise ship, yacht Top cruise companies Cruise routes and ports Cruise management: ship supply and arrangement Safety management: Case of the Henna accident …
Module 7: Development of the International Shipping Cluster	Terminology: Shipping cluster Components of the shipping cluster: organisations, companies, institutions, etc. Case of London/Singapore/Hongkong Future trends of the shipping industry …
Module 8: Policies and Laws	Legal system of international shipping: SOLAS, STCW, MARPOL, MLC, Hague Rules, Rotterdam Rules, etc. Evolution and trends of the main international shipping laws National policies and laws: Shipping law, Maritime law, Port law, Regulations of the PRC on international ocean shipping National strategies and perspectives …

Source: Wang et al. (2021).