

Fostering Maritime Education Through Interdisciplinary Training

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Abstract

The nature and complexity of the challenges faced in today's world are forcing a greater number of specialised individuals to collaborate together, in order to produce a joint effort combining their expertise. Based on this observation that the professional world is interdisciplinary, the learning and teaching provided in Higher Education should adapt and consider interdisciplinary approaches to subjects in order to help develop key employability skills for working in interdisciplinary teams. Building on the perceived benefits of interdisciplinary education, an academic exchange between boatbuilding and yacht design students has been conducted to investigate an interdisciplinary pedagogical model aimed at the maritime industry. The finding reveals clear learning outcomes, revolving around the learning experience, the reflection generated, and the enhanced capabilities; respectively supporting their studies, contributing to bridging the skills gap and enhancing employability, thereby offering a contribution to meeting the contemporary demands from both students and the maritime industry.

Keywords

Interdisciplinary Maritime Education Yacht Design

1. INTRODUCTION

With the significant progresses made in every discipline, and the fast evolution of knowledge across areas of research, there is a vital need for specialisation, calling for a wider range of qualified professionals collaborating to solve increasingly complex problems. The medical field has long identified the importance for specialist health professionals to interact in order to provide patients with the best and most appropriate level of care (Hall & Weaver, 2001). As a consequence of the need for interdisciplinary teams, the approach to education in the health care disciplines has evolved to implement interdisciplinary teaching and learning, which after decades of on-going development has now become a well-established practice (Richards & Inglehart, 2006).

The maritime industry now faces similar challenges; maritime education and training (MET) must therefore adapt to stay in line with the latest developments on the industry. Indeed, with the contemporary technological advances, specialisation has become a new requirement. The design and production of vessels has now become a joint effort from a number of stakeholders, each with specialist skills. This is however not easily achieved, with communication often being highlighted as a problem area. For instance, the stylist, naval architect and builder will all have different views, each with specific concerns that the others may not have identified (Feeley, et al., 2016). Since the success of the design primarily relies on the ability of the multiple stakeholders to interact across specialisms in support of a common objective, an interdisciplinary approach to education may be benefits to the maritime industry. This is further supported by the International association of Maritime Universities, that recognises the need to broaden the skill set of seafarers' (Wei, 2002), extending to adjacent disciplines.

In order to evaluate the role of the interdisciplinary approach to maritime education and training, the background and benefits of interdisciplinary education will first be examined, with a strong emphasis on the maritime industry. The case study of an academic exchange between yacht design and boat building students will then be presented. Aiming to demonstrate the implementation of an interdisciplinary approach to education. Finally, building on a survey of the participants, a pedagogical reflection on interdisciplinary maritime education and training will be provided.

2. INTERDISCIPLINARY EDUCATION

2.1 Background

The roots of interdisciplinary education can be traced back to the concept of curriculum integration advocated as early as the 1930s (Oberholzer, 1937). Nevertheless, interdisciplinary education did not emerge until the 1970s (Mathison & Freeman, 1997), with the development of key definitions and concepts, documented in a rich literature. One of the first definitions of *interdisciplinary* is provided by Kockelmans (1979): “*to solve a set of problems whose solution can be achieved only by integrating parts of existing disciplines*”. Despite a number of additional definitions later provided, all revolved around the need for the synthesis of two or more disciplines (Klein, 1990), and the idea of a problem that cannot suitably be resolved with a single approach (Stefani, 2009), enabling the construction of new ways of creating knowledge.

The need for interdisciplinary learning arises from the ever-increasing complexity of the problems to solve (Klein, 2004), and modern challenges are very much interdisciplinary, or as stated by Dezure (1999): “*life is interdisciplinary*”. It is therefore of interest to education (Newell, 1998), and indeed maritime education, to consider the benefits of an interdisciplinary approach, and implement its practice.

Perhaps surprisingly, one of the main, and often neglected benefits of interdisciplinary education is allowing the students to reflect on their specialty and realise what their discipline really is. This is the argument brought forward by Eckert (2007), stating that: “*Students really aren’t that clear about what the various disciplines do. What students really need to know is what a discipline is*”. Interdisciplinary education can therefore spark a self-reflection which will enable the learner to better conceptualise what their discipline truly is, and identify limitations of knowledge and expertise, and areas for development.

Furthermore, the most encountered benefit is the opportunity for the students to link ideas and concepts across varied disciplines, prompting a constructive paradigm that makes for a deeper level understanding and the development of problem solving skills relevant to employment. A non-exhaustive list of the benefits of interdisciplinary learning and teaching as reported by Nissani (1997) and completed by Appleby (2015) includes:

- More meaningful learning experience.
- New opportunities resulting from the cross-overs between two disciplines.
- Demonstrating real life applications.
- Varied perspective.
- Flexibility in problem solving.
- Bridge the communication gap between professionals.
- Critical thinking.
- Building confidence.
- Greater creativity.
- Transferable skills.

Moreover, the necessity for a strong and diversified professional network in the maritime industry (Martin & Thomas, 2001) and the inherent interpersonal and communication skills required (Haugstetter & Grewal, 2005) make interdisciplinary education a pedagogy more in line with the present expectation of graduates and employers. This is the primary motivation to promote this particular approach to learning and teaching at an international scale.

2.2 Interdisciplinary Education in the UK

To remedy the issues arising from the increasingly complex problems encountered by industry, and in order to tackle those with expertise and creativity, UK's Quality Assurance Agency for Higher Education (UKQAAHE, 2001) recommended the development of professional programmes overlapping multiple industries, yet not explicitly labelling those as interdisciplinary.

The UK Professional Standard Framework (UKPSF) (The Higher Education Academy, 2015) now specifies that fellows of the Higher Education Academic should engage in "*developing interdisciplinary or professional/work-based resources*". This is also suggested in the Teaching Excellence Framework (TEF) published by the Department of Business, Innovation & Skills (2016), stating that: "*The challenges facing the world are complex, and increasingly require multi- or inter-disciplinary approaches*".

Finally, at a more local level, it is part of Southampton Solent University's strategic plan for 2015-2020 (Southampton Solent University, 2015) to "*develop cross-institutional research groups based on interdisciplinary areas and addressing real-world issues*".

The interdisciplinary approach is therefore recognised and encouraged at a national level in the United Kingdom, and its benefits are further promoted by the UKPSF, the TEF and Southampton Solent University. This is however a worldwide trend, also encouraged in China.

2.3 Interdisciplinary Education in China

A common trend in the literature regarding seaport management in China is the crucial role of *guanxi*, namely the relationship and social network that promote professional and business development. This is of paramount importance for the Chinese maritime industry, and noted by Ng (2002), and further emphasised by Wang et al (Wang, et al., 2004).

The skill set promoted by an interdisciplinary maritime education, as well as the new opportunities it offers to both students, academics and industrial, is therefore a viable mean to strengthen the professional networks in the maritime industry. In addition, enhanced employment is achieved (Shah, et al., 2007), thanks to the learner adopting a professional and generalised understanding of the industry, as opposed to a narrowed and heavily specialised education, which does not allow for flexibility in the workplace

2.4 Interdisciplinary Education in the Maritime Field

At the heart of the maritime industry are transferable skills; a major benefit of the interdisciplinary approach. Indeed, most technologies in the relatively small maritime industry directly come from larger industries, such as the automotive or aerospace industry, and there is a large number of highly specialised fields within the maritime industry. This is one of the elements of the skills gap (Desty, 2012), defined as the difference between the employer's expectations and the graduate's capabilities. Answering the call for those specific skills in the maritime sector will result in enhanced employability (Boon, 2012), and will also benefit the industry by bridging the communication and interaction gaps between disciplines that appears to be a current issue faced by the superyacht industry (Feeley, et al., 2016).

Furthermore, the interdisciplinary approach is extending to shipping and port operation, with the addition of new disciplines, such as maritime law, human resources, coastal management and business development (Nawazawa, 2004). The links with problem based learning (PBL) are clear, and maritime training courses have been developed based on interdisciplinary learning and teaching in order to address the real-life implication of PBL (Taussik, 1998).

A strong case can therefore be made in favour of an interdisciplinary approach to education in the maritime industry, which is the primary motivation behind the academic exchange conducted between Southampton Solent University (SSU) and the International Boatbuilding Training College (IBTC) Portsmouth.

3. INTERDISCIPLINARY TRAINING

3.1 Academic Exchange

In order to enhance the learner's experience and achieve a deeper level of understanding and conceptualisation, an academic exchange is organised every year between the yacht design students from the BEng (Hons) Yacht and Powercraft Design and BEng (Hons) Yacht Design and Production courses at Southampton Solent University, and traditional boatbuilding students from the Practical Boatbuilding course delivered at the IBTC Portsmouth. The aim is to provide each cohort of students with insights into an alternative area of the maritime industry in which they will soon be employed professionals. During the week of the exchanges, the students will engage with knowledge from their disciplinary area, but presented from a new perspective.

3.2 Boatbuilding Students' Perspective

Building on the syllabus of the Practical Boatbuilding course, as defined by Soupez (2015), the scope of the academic exchange delivered to the IBTC Portsmouth aims at providing the theory underpinning their normal practice, as well as extend into new areas of boatbuilding. Furthermore, the series of lectures, practical activities and demonstrations revolves around the specialist facilities available at Southampton Solent University.

The lectures reinforce key elements of the IBTC practical boatbuilding course such as timber technology, but also introduces new knowledge in basic Naval Architecture and yacht design, thus allowing a wider understanding and helping future collaboration and inter-professional communication with designers. The practical activities build on their experience, with new skills outside of their normal comfort zone, moving from traditional timber construction skills and techniques to modern composite production skills, techniques and knowledge. Figure 1 depicts the manufacturing of a model yacht hull, emulating a representative scaled-down version of the composite boatbuilding industry, but utilising the key techniques and methods required at full scale. Moreover, the lamination of a test panel involving a range of composite materials is undertaken, enabling the manufactured properties to be compared to the theoretical ones, and supports a further exercise in composite repairs. Furthermore, demonstration of more advanced manufacturing techniques, namely vacuum bagging and infusion, were performed.

To provide an insight into other specific aspects of the development of yachts and small craft, an introduction to towing tank testing was included, as shown in Figure 2.



Fig. 1: Composite manufacturing.



Fig. 2: Towing tank demonstration.

Finally, students were able to apply their existing skills and knowledge of hull shapes with the use of specialist Computer Aided Design (CAD) software to generate simple yacht hull shapes, as depicted in Figure 3. This is a key area where boat builders in industry are directly responsible for working with the outputs of design processes, but due to the specialist nature of the software have few opportunities to understand the inputs and methodologies.

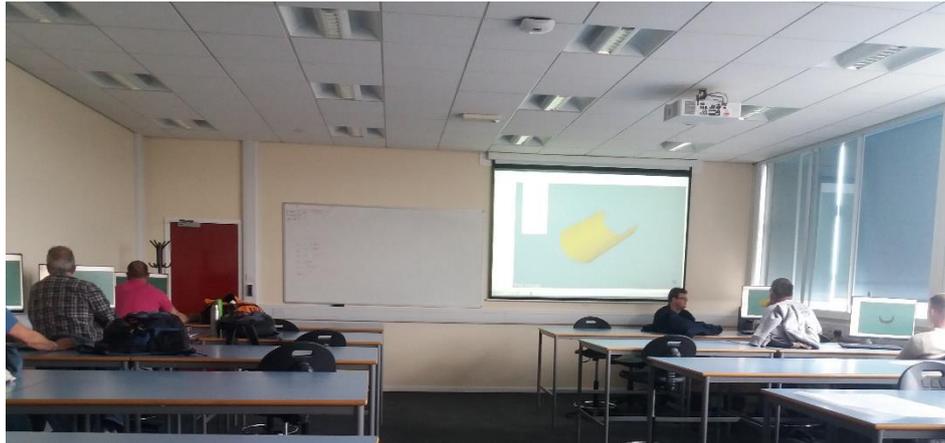


Fig. 3: Use of CAD for yacht design.

From the IBTC Portsmouth students' perspective, data gathered during the interdisciplinary exchange highlighted that they perceived the exchange to be successful in supporting their studies, helping them acquire new skills and knowledge, and in their opinion enhancing their future employability.

3.3 Yacht Design Students' Perspective

The recent improvements and revalidation of the two yacht design degrees at Southampton Solent University saw the addition of a stronger emphasis on practical skills, as directly required by the industry (Barkley, 2012). This is however restricted to composite manufacturing, due to the available facilities (and rather ironically the requirement for a range of different skills associated with other materials), and the overwhelming dominance of composite manufacturing in the yacht and small craft industry. Nevertheless, wooden boatbuilding is tackled theoretically as part of the course; the syllabus of the exchange for the Southampton Solent University students is therefore aimed at a practical application of the traditional boatbuilding skills and inherent activities in support of the theoretical delivery during the degree programmes.

Firstly, the students are introduced to the use of hand tools, as well as working with wood. To do so, small projects such as the construction of a mallet or a simple paddle are undertaken; as illustrated in Figure 4. As opposed to their normal studies where they would draw a plan aimed at the builder, they are now given the plan and need to build from it. This allows them to better reflect on what to provide a builder on construction drawings and should enhance their drafting skills in the future.



Fig. 4: Wood working with traditional tools to make a mallet (left) and a paddle (right).

Students then discovered skills specific to traditional boatbuilding, namely steam bending ribs, spinning oakum (Figure 5) to create caulking to create seals between planks, and installing steam bent ribs (Figure 6). While those techniques are taught theoretically, it is an invaluable experience to realise how flexible steamed timber is, and how much labour goes into the process; knowledge that will feed back into future design projects of the students.



Fig. 5: Spinning oakum for caulking.



Fig. 6: Installing a steam-bent rib.

During the exchange, the students are fully involved in the work currently taking place in the boatyard, which leads to a wide variety of project. An interesting example is a World War II lifeboat, for which they were tasked with taking the scantlings (dimensions of structural components) and draw plans that would enable a replica to be built. On completion, the existing boat, beyond repair, was entirely deconstructed by the students, providing fantastic opportunities to better understand the assembly process and to see an actual cross-section through a vessel, as shown in Figure 7. From the offcuts, students were given the opportunity to build their own creative project, ranging from a stool to a skateboard.



Fig. 7: WWII lifeboat deconstructed.

Finally, students are made aware of the maintenance and use of traditional craft. This is done through a coastal rowing experience, depicted in Figure 8, that demonstrates the level of care involved when operating wooden vessels.



Fig. 8: Coastal rowing experience to better grasp the utilisation of traditional wooden crafts.

Through a series of practical tasks, all specific to traditional boatbuilding, but with numerous transferable applications, the students were able to apply theoretical knowledge of materials, construction techniques, structural arrangements and design learnt during their course. This is supplemented by practical experiences leading to new skills and deeper understanding, as highlighted in the feedback gathered among the participants.

3.4 Survey of the Participants

At the end of the week, a short survey of the participants is realised in order to gauge the value of the exchange for the students. The questionnaire is divided into two sections: a multiple-choice satisfaction survey aimed at assessing the learning benefits, and an opportunity for the participants to provide written feedback, targeted at improving the future editions. After two completed exchanges (in March 2016 and April 2017), a total response rate of 69% has been achieved (34 respondents out of 49 participants).

The primary aim of the survey is to evaluate the student’s perception of the learning benefits of the interdisciplinary exchange; this is done through fifteen questions. The feedback gathered from both the Southampton Solent University and IBTC students is detailed in Figure 9.

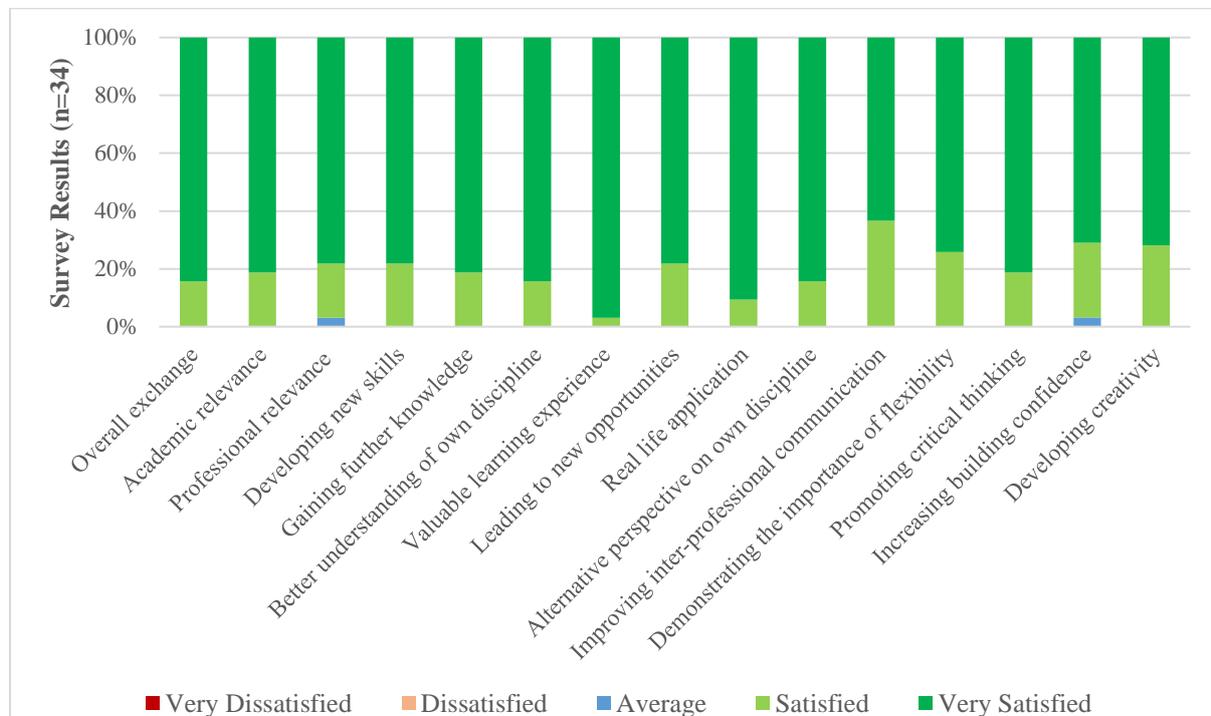


Fig. 9: Survey results.

The overwhelmingly positive feedback obtained highlights the positive perception of the interdisciplinary approach to education implemented. The students very clearly identified the value of the exchange to support their current studies and future careers, allowing them to develop a range of inter-professional and transferable skills. Written comments from the students also proved to be very positive, revolving around three core values: learning, reflection and capabilities, each respectively contributing to support their studies, bridge the skills gap and enhance employability.

Whilst it is enormously encouraging for the organisers of the exchange to have such positive feedback, it must be taken in context. Due to the nature of the exchange, it was run on the basis of students volunteering to participate, so there may be a bias in the results as those attending may be more likely have a positive interest in doing so. There is also the “novelty” factor in undertaking new learning for a short period of time, with anecdotal comments from students that they enjoyed the change of routine and the chance to do something different.

4. INTERDISCIPLINARY PEDAGOGY

The interdisciplinary pedagogy is specifically target at enhancing some of the key areas in higher education, together with answering the growing needs to the maritime industry. This approach is indeed best suited at strengthening the academic studies of the students, generating a skill-set thought after by the industry, eventually promoting graduate employment (Soupez, 2017).

Evidence of the academic learning benefits, notably a better understanding of their own discipline, creating a valued learning experience and offering new opportunities, was strongly indicated in the comments. The ability to now understand the other aspects and the various points of views was highlighted, together with the entertaining and interesting nature of the learning experience. Each group of students also mentioned the new possibilities offered and the new skills gained; or as summarised by one student: *“Surprisingly fun week and I think the educational outcomes will be shown in the exams at the end of the year. I really enjoyed the exchange to IBTC, it helps me develop skills and gain new ones”*.

The reflection aspect, looking at real life application of concepts discussed in lectures and offering a varied perspective is also present the students’ comments, despite a lack of direct recognition for the benefits inherent to inter-professional communication. The feedback demonstrated the interest of students for the practical application of concepts they previously considered mostly theoretical. Those aspects are encapsulated in the following comment: *“The course was overall beneficial to my academic studies as it first was very relevant to one of the six subjects that I currently study of marine materials and so provided a practical platform to what we had studied for example the steam bending of wood was covered in lectures so it was good to see this done outside of the class”*. A particular student also noted the future benefits of better understanding the boat builder’s job, and thus making design decision that promote the construction of yachts: *“I had the opportunity to see how classic boats are made and maintained. This will help me incorporate design features to allow for easy construction and maintenance”*.

Finally, the capabilities, whether it is critical thinking, confidence, creativity or transferable skills, all supporting future employability, are highlighted in the students’ responses. For instance, one student noted: *“very useful skills to learn with excellent tutoring. It is better to know more and increase skill set to improve employability”*, thus recognising the transferability of the skills and knowledge gained over a short and very specific course to a much wider range of applications in the maritime industry. Furthermore, the concept of building a socio-professional network, characterise as *guanxi* in the Chinese literature, also transpires through the student’s feedback: *“The course was really fun and interesting, and besides being useful for the course it was also very good team building”*.

It is worth noting that students were explicitly asked for qualitative comments on any negative aspect or possible future improvement. The primary answer given by the participants is that exchange should be run over a longer period of time. However, it is not intended to be extend beyond the current week it has been conducted over. Indeed, as noted by Kanikia (2007) and further supported by Jones (2010), a major focus on interdisciplinary learning can lead to an isolation from the original core of the field of study. Furthermore, issues can arise if interdisciplinary itself is considered a primary field of study (Szostak, 2007). This precise exchange programme is therefore to remain relatively short. However, providing students with similar opportunities, with an alternative discipline in another year of their degree would appear a more suitable approach.

5. CONCLUSIONS

An interdisciplinary approach to education has long been praised due to its multiple benefits. In the United Kingdom, its practice is supported at a nationwide level by the UK Professional Standard Framework and the Teaching Excellence Framework. It is also a way to promote relationships and networking, a value particularly desirable in several regions of world, including China. Moreover, the

presented exchange appears a necessity in the maritime industry to reinforce interdisciplinary learning and teaching to promote employment and better solve issues currently faced by the industry.

To ascertain the benefits of this educational approach, a one week exchange has been conducted between the yacht design students of Southampton Solent University and the traditional boatbuilding students of the International Boatbuilding Training College Portsmouth in March 2016 and April 2017; and is now set to be organised annually. The exchange revealed a very high satisfaction from all students and allowed to support the interdisciplinary learning model, with the benefits of interdisciplinary learning classified into three main categories:

- Learning, which enables the students to better understand their own discipline in contrast with an alternative discipline within the same industry, promotes new and motivating learning experiences as well as new opportunities.
- Reflection, demonstrating the real-life applications of a studied theory, promoting varied perspectives on a given topic, which then improves inter-professional communication and gives a higher flexibility in problem solving.
- Capabilities, to develop critical thinking, gain more confidence and promote creativity; the end result being to acquire the much-needed transferable skills for professional purposes.

Those three core values then turn into concrete outcomes, respectively supporting the student's studies, bridging the skills gap, identified as a primary issue in the maritime industry, and finally enhancing the employability.

6. REFERENCES

- Appleby, M., 2015. What are the Benefits of Interdisciplinary Study? The Open University.
- Barkley, G., 2012. Attracting & Equipping Yacht Design and Production Graduates for Employment in Today's Yacht Design & Manufacturing Industry. Proceedings of the Royal Institution of Naval Architects Seminar on Education & Professional Development, pp. 115-122.
- Boon, B., 2012. Four Decades of Learning and Teaching and Doing, but can it be Transferred? Proceedings of the Royal Institution of Naval Architects Seminar on Education and Professional Development, pp. 65-68.
- Brodie, P. & Irving, K., 2007. Assessment in Work-Based Learning: Investigating a Pedagogical Approach to Enhance Student Learning. *Assessment and Evaluation in Higher Education*, 32(1), pp. 11-19.
- Department of Business, Innovation & Skills, 2016. Success as a Knowledge Economy: teaching Excellent, Social Mobility and Student Choice, London: Department of Business, Innovation & Skills.
- Desty, N., 2012. The Marine Skill Gap and its Impact on Industry. Proceedings of the Royal Institution of Naval Architects Seminar on Education and Professional Development, pp. 37-46.
- Dezure, D., 1999. Interdisciplinary Teaching and Learning. *Teaching Excellent*, 10(3).
- Eckert, P., 2007. Speaking of Teaching: The Centre for Teaching and Learning. *Stanford University Newsletter*, 16(2).
- Feeley, J., Hadjidimos, D. & Spence, E., 2016. Contemporary Trends vs Client Needs. London, Superyacht Design Week.
- Hall, P. & Weaver, L., 2001. Interdisciplinary Education and Teamwork: a Long and Winding Road. *Medical Education*, 35(9), pp. 867-875.

- Haugstetter, H. & Grewal, D., 2005. Innovative techniques and port management: implications for port organisations. *IAMU Journal*, 4(1), pp. 35-42.
- Jones, C., 2010. Interdisciplinary Approach - Advantages, Disadvantages, and the Future Benefits of Interdisciplinary Studies. *Essai*, Volume 7, p. Article 26.
- Kanikia, R., 2007. Talks about Benefits of Interdisciplinary Approach, s.l.: Stanford Report.
- Klein, J. T., 1990. *Interdisciplinary: History, Theory and Practice*. 1st ed. Detroit: Wayne State University Press.
- Klein, J. T., 2004. Interdisciplinary and Complexity: An Evolving Relationship. *E:CO Special Double Issue*, 6(1-2), pp. 2-10.
- Kockelmans, J. J., 1979. Why Interdisciplinary? *Interdisciplinary and Higher Education*, pp. 123-160.
- Martin, J. & Thomas, B., 2001. The container terminal community. *Maritime Policy and Management*, 28(3), pp. 279-292.
- Mathison, S. & Freeman, M., 1997. The Logic of Interdisciplinary Studies. Presented at the Annual Meeting of the American Educational Research Association.
- Nawazawa, T., 2004. Maritime English - the only way to communicate? *IAMU Journal*, 3(1).
- Newell, W., 1998. The Place of Interdisciplinary Studies in Higher Education Today, s.l.: Association of American Colleges and University and the Association for Integrated Studies.
- Ng, K., 2002. Port operation, reform and governance in China: a case study, Hong Kong: The University of Hong Kong.
- Nissani, M., 1997. Ten Cheers for Interdisciplinary: The Case for Interdisciplinary Knowledge and Research. *The Social Science Journal*, 34(2), pp. 201-216.
- Oberholzer, E. E., 1937. *An Integrated Curriculum in Practice*. New York: AMS Press.
- Richards, P. S. & Inglehart, M. R., 2006. An Interdisciplinary Approach to Case Based Teaching: Does It Create Patient-Centred and Culturally Sensitive Providers? *Journal of Dental Education*, 70(3).
- Shah, A., Treby, E., May, V. & Walsh, P., 2007. Bridging the divide between academia and practitioners: training coastal zone managers. *Ocean and Coastal Management*, 50(11-12), pp. 58-871.
- Soupepe, J.-B. R. G., 2017. Interdisciplinary Pedagogy: a Maritime Case Study. *Dialogue: The Journal of the Solent Learning Community*, pp. 37-44.
- Soupepe, J.-B. R. G., 2015. A Student's Take on Education in the Maritime Industry. *Proceedings of the Royal Institution of Naval Architects Seminar on Education & Professional Development*.
- Southampton Solent University, 2015. *Building and Excellent University*, Southampton: Southampton Solent University.
- Stefani, L., 2009. Assessment in Interdisciplinary and Interprofessional Programs. In: *Interdisciplinary Learning and Teaching in Higher Education*. New York: Routledge, pp. 44-57.
- Szostak, R., 2007. How and Why to Teaching Interdisciplinary Research Practice. *Journal of Research Practice*, 3(2).
- Taussik, J., 1998. Interdisciplinary education: The master programme in coastal and marine resources management at the University of Portsmouth, UK. *Ocean & Coastal Management*, Volume 41.
- The Higher Education Academy, 2015. *UKPSF Dimensions of the Framework*, s.l.: The Higher Education Academy.

UKQAAHE, 2001. The framework for higher education qualification in England, Wales and Northern Ireland., London: Quality Assurance Agency for Higher Education.

Wang, J., Ng, K. & Oliver, D., 2004. Port governance in China: a review of policies in an era of internationalizing port management practices. *Transport Policy*, 11(3), pp. 237-350.

Wei, R., 2002. Meeting the requirement and development of Maritime Education and Training. *IAMU Journal*, 2(1), pp. 73-78.