

# MODERN MARINE AND MARITIME TEACHING AND RESEARCH TRAINING IN UK HIGHER EDUCATION ESTABLISHMENTS

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**Abstract** Teaching methods in UK higher education establishments are under constant change. The needs of student and their requirements dictate that flexible delivery is available to satisfy an increasingly diverse student population coming from differing backgrounds. Current methods increasingly take advantage of developments in IT particularly the Internet and Intranets. Simultaneously teaching in groups and a variety of project work both within HEs and using industry contacts allows the development of both the students and programmes. This latter contact allows industry to interact with the work of the HE and offer suggestions for update of syllabi and further skills that students should be developing.

Research is an important part of the suite of activities undertaken by any marine and maritime group and this underpins the teaching activities as well as providing valuable academic development for both lecturers and students.

This article outlines both modern teaching and research training activities in maritime and marine related fields at Liverpool John Moores University (LJMU). The taught programmes and current modes of teaching deliveries at both the undergraduate and postgraduate levels are analysed. Maritime research activities are described in detail using several on-going and completed research projects at LJMU.

**Keywords** teaching methods; Higher Education; flexible delivery; projects; syllabi

## 0 Introduction

Teaching in higher education (HE) establishments especially universities is constantly evolving. The wide development of computers and the Internet mean that students no longer have to obtain all their understanding from lectures or printed text but that much information is available electronically. Many firms, most institutions and HEs have their own Intranets and this enables complex electronic structures and menus to be developed to allow a variety of teaching and learning material to be available both for the lecturer and the student. LJMU has adopted the “Blackboard” electronic learning environment, which allows a vast array of opportunities for lecturers to place easily available electronic teaching material for use by students immediately or at some specified time in the future. Students are quick to grasp this provision and lecturers are under pressure to ensure that the majority of their modules can be studied at a distance in this way. A problem does lie in that students may feel they no longer have to attend classes however that should not undermine the benefit to be gained by having information available to students in this virtual environment.

Other developments include CDs and DVDs as well as the widespread use of e-mail. The latter is now so common that it is for many people the most convenient form of communication particularly to a mass audience. Information and instructions are easily sent via e-mail and recipients view the messages in their own time, in an environment of their choice and in a situation conducive to them. Thus assignments are easily sent via this route. The Internet is also now a great learning environment with vast amounts of material is at a student’s fingertips whether or not this information is appropriate, useful or correct. The Internet offers great challenges to educationalists as well as dangers and will be progressively more widely used over time.

Links with industry are very important. Maritime and seagoing departments have always had very strong industry links not least because the programmes of study have been so closely aligned with the legal requirements of seagoing whether on deck or in the engine room. Students studying maritime business subjects also need close links with their section of the industry and as these programmes become more widely available, whether at the undergraduate or postgraduate level, their place in the industry setting is vital. All LJMU programmes now have to explicitly show workplace learning thus where maritime business programmes have shied away from this aspect they now will need to become involved.

## 1 Literature review

Literature referring to teaching is widely available and this applies also to maritime disciplines.

The IAMU Journal and the AGAs in particular have made a major contribution to this debate by provision of their forums and encouragement of this important subject. Many aspects have been covered including the need for maritime education providers to develop their own teaching methods or have them imposed (Lewarn)<sup>[11]</sup>; a student centred approach (Tuna et al)<sup>[21]</sup>; measuring the quality of maritime education (Paine-Clemes)<sup>[31]</sup> and the reorganisation of courses (Nishikawa)<sup>[41]</sup>. Elsewhere CBT (Computer Based Training) is covered particularly with regard to simulation (Muirhead)<sup>[51]</sup>, low-cost PS based software (van Tassel)<sup>[61]</sup>, successful adoption (MacNeil)<sup>[71]</sup>, interactive programmes (Tomczak)<sup>[81]</sup>, development of a Virtual Maritime Academy (Mantel)<sup>[91]</sup> and new approaches to training provision (Addis)<sup>[101]</sup>.

All these authors refer to the teaching of seafaring aspects and in particular to training rather than education. The Internet is becoming a widely used medium for educational purposes (Williams)<sup>[111]</sup> and universities have harnessed this mode in the form of the world wide web and locally as an Intranet. Efficiency in learning (Broad et al.)<sup>[121]</sup> is one of the benefits of the Internet as this can lead to an integrated virtual leaning environment. This, as claimed, can enhance a student's critical thinking (Rogers G)<sup>[131]</sup> and develop also the quality of cognitive thought. A virtual education environment has the advantages of cost and portability (van Tassel G)<sup>[61]</sup> and ease of access (MacDonald R)<sup>[141]</sup> and certainly present students use the web for research purposes in an ongoing fashion. One problem with the web is plagiarism (Evans R)<sup>[151]</sup> and the use of computer generated work has developed a cut and paste culture which without care on the part of the student can lead to plagiarism.

Project work forms part of undergraduate study (Haas & Wotrubo)<sup>[161]</sup> with this sometimes being in groups (Reardon et al.)<sup>[171]</sup>. The work is normally for assessment purposes only, which can mean that it does not go forward for publication and as such it is sometimes considered to be performed in isolation (Cronk)<sup>[181]</sup>. The projects can have a work-based learning element (Pascoe)<sup>[191]</sup> and this is useful as on an increasing basis in the UK, university programmes are required to have work-based learning embedded in the curriculum.

## 2 Electronic teaching

Teaching using IT in all its forms has been increasing for many years. Most lecturers are becoming familiar and adept at using electronics in the dissemination of their information usually using laptops and ceiling projectors. CDs and DVDs are developing however production of quality discs is both time-consuming and expensive. The ability to display a range of photographs and images is helpful in explanatory terms and in making comparisons.

The use of videos is good as often their production is professional. A problem does arise with dated material. Videos like books are dated to the time of their production however this is rarely apparent when the video is shown. It is tempting to show videos on a regular basis year on year however data and techniques change and these changes will not be accounted for in the video presentation.

### 2.1 CBT

Much on board training is carried out by CBT and in the University use is made of this mode in teaching cargo stowage and stability as well as navigation using electronic charts. Cargo stowage

is limited to bulk carriers both dry and liquid with students working through loading and discharging procedures to ensure that the shear force and bending moments are not exceeded. The graphical representation of this is helpful to students particularly those not experienced with ship profiles.

The development of electronic charts and ECDIS (Electronic Chart Display and Information System) has provided a valuable source of interactive teaching available to the navigation technologist.

## **2.2 The virtual learning environment**

The Internet and Intranet are two major components of any virtual learning environment. CDs and DVD may also be involved at a lesser level. Universities all have Intranets and many if not all will have embraced this technology to provide for students and lecturers the ability to interact through a virtual environment. At LJMU the “Blackboard” system has been provided. The architecture of this system is based on modules and student/lecturer academic profiles. Thus each student is able to access the modules on his/her programme and similarly with each lecturer for the modules that they teach. Within each module on Blackboard there are areas for module and staff information; module content and assignments; communication, external links and an area called “tools”. This tools area contains items such as a calendar, glossary and user manual for the system. The lecturer develops the first two whilst the latter is part of the system help. Students also have a “My Grades” section of the tools menu, which gives them on line information about their module grades provided that lecturers input the information to the system for modules under their control.

The module content section is where any online notes are developed. Clearly here presentations and diagrams can be lodged as well as text notes. All these can be time barred so that they are only available to students at a period suitable to the lecture profile. Assignments can be organised online or for students to print off and submit by hard copy. Again these can be time barred so as to be available only when the lecturer deems that it is necessary for the work to be completed. This may be particularly important if the common system of zero marks is in place for work submitted after the due submission date. The practice of a reducing penalty for late submission seems to be being replaced by the much harsher system as the requirement for students to conform to rules is adopted.

The announcement section is useful and can act as another information board to e-mail for notification of assignment availability and feedback sessions as well as seminar timings. Announcements can be permanent or temporary and again can be time dependent being available on a weekly or monthly basis.

## **2.3 Powerpoint**

This has been a common teaching aid (Essex-Lopresti)<sup>[20]</sup> for more than a decade and its use is now commonplace or even expected within the classroom at University level. Powerpoint presentations might have additional items such as audio (Maloney & Paolisso)<sup>[21]</sup> however complicated presentations are not necessarily liked by students (Blokzijl & Naeff)<sup>[22]</sup>. PowerPoint does allow lectures to interact with online notes through virtual learning environments such as Blackboard as the presentation is available in the VLE as well as given during the lecture. Providing students with notes and presentations beforehand does allow them to prepare questions

and to develop the lecture process in the age-old method of university tutorials. It does however put the lecturers on their mettle, as they need to be constantly ahead of the game. Presentations once made can of course be passed over to future years however currency of information needs to be assured. PowerPoint notes are also rarely sufficient in their own right and students need to take further notes from the information provided by the lecturer. There is a tendency for students to consider that any hardcopy notes whether they be copies of PowerPoint sides or not are an end in themselves. This proves dangerous and can lead to students learning in a “bullet point” fashion indicative of Powerpoint slides and is perhaps a reason for “exam answers that are feeble and not properly thought through.

The addition of diagrams and tables is one of the joys of PowerPoint from the lecturers’ viewpoint. It does allow clear analysis of reasonably complicated diagrams and involved tables to large numbers of students. Connections between data and trends are reasonably easily presented and explained.

### 3 Casestudy material

Case studies are a valuable way of presenting concepts in a practical sense. Theories are often more easily explained and shown if a case study can be developed. This is particularly appropriate if students are familiar with some aspects of the case study. These can be true or devised and based on true events. Either way is valuable with no particular way being more effective.

#### 3.1 Seagoing

There is not necessarily a difference between case studies for seagoing and non-seagoing students, however there is perhaps more opportunity to utilise technology with seagoing case studies than non-seagoing. The use of bridge watch keeping simulators for instance has more effect for seagoing students than non-seagoing. The non-seagoers may see the simulator as a gigantic walk in video game because they are never going to have to use the situation professionally. Deck Officers on the other hand are familiar with the layout and bridge scene and are aware of the dangers and consequences of the situations presented and thus are able to treat the experience in a much more professional way.

Case studies for seafarers outside of the bridge simulator will of course consist of electronic and paper based exercises devised around the vast variety of activities that take place in the seagoing arena. Over the years lecturers build up banks of case studies even if these are only known as exercise sheets. These in their own way are case studies although perhaps they are not discussed in the formal way of presenting an actual problem; then a solution followed by an analysis of the actions taken and finally the outcomes achieved. Teaching of the seagoing subjects is very much concentrated around the demands of a syllabus dictated by a national authority thus lecturers are constrained in the scope of their teaching by conforming to the rigorous learning outcomes required by Certificates of Competency. With regard to non-seagoing case studies lecturers generally have more control over the syllabus and therefore have a much wider scope and flexibility in the form and outcomes of their material.

### 3.2 Non-seagoing

The non-seagoing maritime disciplines tend to be maritime business, logistics and technology. The latter is often taught to students who aspire to a more technical and mathematical degree than those taking the business and logistics routes. Case studies in these areas are individual or worked on in groups. Except for “Bridge Watch keeping” seagoing case studies are usually individual as they are designed to develop individual competencies rather than the ability of the student to work as part of a group.

Table 1 Examples of case studies

	Case Study Name	Associated Module	Level
1	Ship Scheduling	Integrated Activities	UG 1
2	Containership Loading	Integrated Activities	UG 1
3	RoRo Terminal Break Even Analysis	Integrated Activities	UG 1
4	Shipping Company Development	Business of Shipping	UG 2
5	Bulk Terminal Operation	Port Operations	UG 3
6	Container Terminal Operations	Maritime Transport Systems	M

Non-seagoing case studies (Some used at LJMU are itemised in Table 1) are designed to illustrate both general and specific concepts in a practical setting. This can be actual or generic and adapted to bring to life concepts that may be clear to the seagoing student but are opaque to the non-seagoer. These case studies are often timed to last for one teaching session of one or two hours and may be preceded by a taught session. Where the learning outcome is not necessarily clear to students then the taught session is essential however as the case study develops and the meaning is clear then the taught session can be reduced to outlining the scope of the case study before it begins.

## 4 Work based learning

In UK Universities this aspect of degree programmes is fast becoming required. At LJMU work based learning has been a part of non-seagoing programmes for many years. It takes different forms from visits to industrial sites and offices to short 20-hour group projects, whole semester group projects, sandwich years and work associated with final year dissertations.

### 4.1 Short term

Under this heading the industrial visits, short 20-hour group projects and whole semester projects can be considered. The latter two project types differ from the former in the involvement of the students. In the former students are shown the work of a firm and perhaps are introduced by lecture to the details of the operation. The latter two involve activities in which the students become personally involved, as they have to work through the project in a given time frame. The project brief is developed with the firm who choose a topic area in which they have a development need or are interested in getting the input of thoughts of degree level students. The remit to the firm however is that this project is a learning curve for the students and whilst a commercial outcome is useful the main emphasis is on the learning outcomes of the students. Local Liverpool firms have been very good in taking this aspect into account.

All student academic activities at LJMU must be credit based, which means that the study and assessment must result in credits towards the students' final award. This puts pressure on the lecturer to develop work based learning activities that are embedded in core modules taken by all students, as they must now be exposed to learning in this form. The difficulty comes in the layout and assessment of the tasks. Two modules have been developed in the LJMU Maritime & Transport programmes to harness this aspect of learning. The layout and assessment of each of work-based elements of these modules is similar however one is studied for longer. On the Maritime programmes at level 2 all students undertake a group project for 20 hours in semester 2 between mid February and April. The group size is 3 or 4 students and all must make a contribution. Table 2 lists some of the projects undertaken with a success rating attached to each project.

Table 2 Short 20 hour work based projects

	Project Name	Year Completed	Success Rating 1~5 (1 is low)
1	Reviewing and Assessing the Induction Process of New Employees	2003,4&5	3/4
2	Design/ update of company Web Site	2003&4	2
3	Reviewing the Process of Shipping a Heavy Lift from the UK to South East Asia	2003&4	3/4
4	The Business Opportunities for Coastels	2005	4
5	The Business Opportunities for Local Ferries	2005	4
6	Scrutinising the Database of a Freight Forwarding Company	2005	4/5

An important aspect of project work is the assessment. These short projects, in line with the longer semester long projects, require the students to present their findings and Conclusion to industry managers. The 20-hour project presentations are made to all industry managers and academic staff in the form of a seminar. This then requires students to develop presentations of an industry standard and over the three years of the present module life has proved to be successful and worthwhile to both students and the firms. The success rating, listed in Table 2 is not based on any formal methodology but on the impressions of the academic staff supervising the projects. It serves to indicate that some project types have not been successful. Web-based design projects are not liked by students who feel that this is not developing their maritime skills but is something that should be carried out by students trained in this discipline. Lecturers or those in the firms who set the projects do not hold this view as they feel that students having a maritime background can add some valuable comment to a generic skill such as web-based design. Certainly a knowledge of the maritime scene is an advantage in organising the material on a maritime website so as to ensure that the right material is available in the correct order.

The other work-based learning module lasts for 2 semesters in level 3 of the BSc (Hons) Management, Transport and Logistics. These projects are studied at 3 hours per week over a semester: There being 2 projects studied each year. The projects can be much more involved and occupy much more of the students' time. Often two student groups will investigate different aspects of the same project. The main brief will be the same for each group with a separate individual brief to indicate the alternative perspective to be analysed. Assessment is similar to the shorter projects in that they will be delivered to industry managers in an industrial setting rather

than in the University.

Table 3 Semester long work-based projects

	Project Title	Year Completed	Success Rating 1-5 (1 is low)
1	Greater Manchester Transport (Light Rail Study)	2001	4
2	Business Link (Opportunities in Logistics)	2002	3
3	Liverpool Airport	2003	3
4	British Coal Logistics	2003/4	4
5	Lairside Maritime Centre. Future Possibilities	2004	3

Table 3 shows projects studied under the transport and logistics heading. The learning outcomes are listed in Table 4 and this shows that the longer project has more onerous outcomes. Both project types require production of a report but of varying lengths. The semester long project has a report of around 10 pages whereas the 20-hour project's report is 1000 words or about 3 pages. Both do serve to test the students' ability to work as part of a team and to critically analyse information researched from an industrial base. As the shorter project is studied at level 2 it serves to underpin the induction to the level 3 Dissertation Project whereas the semester long project report is completed alongside the development of the level 3 Transport Project.

Table 4 Learning outcomes of short work-based project

	Learning Outcome	Project Type
1	Understand the key issues affecting transport managers and policy makers in the present day transport environment.	1 semester
2	Analyse critically the actions of transport businesses and regulatory bodies.	1 semester
3	View transport policy and operations in the light of external social and economic implications.	1 semester
4	Work as part of a team to produce a commercial report	20 hour

## 4.2 Long term

Longer-term project work usually entails a year out of the main degree study and lengthens the course from 3 to 4 years. This form of project often known as a "Sandwich Year" has been a common option for degree students for many years and whilst it is still possible it has become harder recently to find these work placements. Maritime and Transport firms are reluctant to take on students owing to cost and training commitments. Some firms feel that a student will only be of use after the year's training, thus just at the time when they leave they become of most use. This is a short-sighted view as history has proved that students who study a sandwich degree perform better in their final year, possibly gain a higher degree and find it much easier to gain good employment after graduation. That is due to their confidence level and their ability to quickly become valued members of a firm. Some recent Maritime and Transport sandwich placements at LJMU are listed in Table 5.

Table 5 Sandwich placement projects

Sandwich Placement Project	Year
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1	International Container Logistics Management	2004/5
2	Bus management	2004/5
3	Local Container Logistics Management	2002/3
4	Freight Ferry Terminal Management	2001/2

### 4.3 Dissertation project work

All level 3 students studying an honours degree at LJMU Maritime have to complete a dissertation project. The preparatory work to this occurs at level 2 with the short 20-hour work-based project mentioned earlier. Other preparatory work takes place simultaneously with the work-based project in semester 2 allowing the student to study and collect data over the summer vacation period between levels 2 and 3. Students have a free hand in choosing the project subject as long as it is within the maritime or transport field depending on the speciality of the degree studied. Some students have problems deciding on a project area and it is important for them to choose a topic that has a research element rather than one that merely a long description. The research element often requires that they make contact with firms in order to obtain new and current data and then the analysis of this data allows them to provide their addition to knowledge. This is often difficult at the bachelor level, however if they can obtain their own data this is a good way of overcoming this problem.

Table 6 Undergraduate dissertation projects

	Project Titles	Year
1	An Analysis of the Factors Affecting the Cycle Time of Quayside Gantry Cranes in Container Terminals	2005/6
2	Bank Loans as a Source of Fund Raising for the Shipping Industry	2004/5
3	A study into the in-service training provided to UK Cadets at sea	2004/5
4	The Charterer's Role within the "Safety Chain"	2001/2
5	Recreational Boating in the UK. Education v Legislation	2000/1
6	New Applications for X-Band Radar	1999/2000

Table 6 shows the variety of areas studied by undergraduates in their final year projects. Those undertaking projects of a mathematical nature tend to find it easier to obtain data than those of a qualitative nature although many students will use questionnaires and interviews for comparison and synthesis.

## 5 Research education and activities

Research degrees include an element of research training although this is more apparent at the Masters degree level than at PhD. At Post Doctoral level it is assumed that research skills are already honed and thus further training is not required.

### 5.1 Postgraduate

The Maritime and Transport section of LJMU offers postgraduate courses taught in Liverpool and also in a distance learning form overseas from the UK in Greece and Iran. Both forms of delivery

offer the same course however in the UK the course has six modules running concurrently whilst overseas each module is taught on a block basis with the teaching being carried out over a two week period. Whilst this is intensive students are able to continue working and just attend classes in the evenings and at the weekend whilst the lecturer is available. It has been very successful with many students studying in this way over the last few years.

One third of the Masters degree is taken up by the individual project and it is this element that provides many students with the hardest aspect of their studies. The research element here is covered in a preparatory module called Research and Communications Methods. This module presents to the students methods of developing projects and laying out the written work. It also covers important elements such as the literature review and critical analysis. The development of aims and objectives to underpin the research forms a skeleton on to which the project is built. The uses of different methodologies are covered as these often provide students with problems.

## **5.2 Research activities**

The Marine, Offshore and Transport Research Group (MORG) at LJMU was set up in 1998 and has since been actively engaged in research. It currently consists of 7 academic members and 14 doctoral and postdoctoral members (for details, visit: <http://www.ljmu.ac.uk/eng/researchgroups/morg/>). The research members in MORG come from many countries including Britain, China, Greece, Iran, Korean, Malaysia, Nigeria and Sri Lanka. MORG has attracted external funding of more than £1m from the UK EPSRC (Engineering and Physical Sciences Research Council), EU, HSE, industry, etc., and completed a number of doctoral and postdoctoral research projects supported by both internal and external funding. MORG is equipped with a wide range of risk modelling and decision making software tools including *ITEM* and *IDS* (intelligent decision system). Several research projects have been conducted closely with the Lairdside Maritime Centre (LMC), which is an autonomous centre within the Faculty of Technology and Environment at LJMU. LMC has the UK's only 360° ship simulator for research and advanced ship-handling/bridge teamwork training (LMC 2006).

MORG has the following research interests at both the doctoral and postdoctoral levels:

- Electronic charts.
- Formal ship safety assessment.
- Human error studies.
- Marine and offshore system design.
- Navigation studies.
- Offshore safety analysis.
- Offshore structural assessment.
- Port safety assessment.
- Port studies.
- Safety based design/operation decision-making.
- Safety-critical software assessment.
- Simulator-based research.

➤ Transport studies.

Any industrial organisations and government agencies have collaborated with MORG in research. These include AMEC Process and Energy Ltd, Vectra Technologies Ltd, NNC Ltd, Shell Global Solutions, UK Offshore Operators Association (UKOOA), American Bureau of Shipping, Maritime and Coastguard Agency (MCA), Lloyds Register and HSE Offshore Safety Division. MORG has also collaborated in research with many universities world-wide including India Institute of Technology, Loughborough University of Technology, Salford University, Staffordshire University, Shanghai Maritime University, Technical University of Lisbon, Technical University of Gdansk, The University of Manchester and Wuhan University of Technology. MORG has hosted international visiting scholars for research collaboration of 6 to 12 months from Chosun University in Korea, Dalian Maritime University, Shanghai Maritime University and Wuhan University of Technology in China.

Some typical doctoral and postdoctoral research projects within MORG are briefly described as follows:

### **5.2.1 A Selected List of Some Current Projects**

#### **.1 An advanced tool for safety-based offshore operations (2004-2007)**

Safety is of paramount importance in offshore operations. Human and organisational factors (HOFs) play a critical role in offshore operations and are often at the root of many major failures with disastrous consequences. Research in this area poses a significant challenge and is so far very limited. This may be due to the unique characteristics of offshore operations in harsh environments and with many innovative features, the high level of uncertainty in failure data, and the difficulties of integrating HOFs into overall risk assessment together with other failure events as well as factors in finance, the environment, etc. This postdoctoral research project is funded by the UK EPSRC and deals with such problems in a rational and integral manner. It is aimed to develop a novel decision support tool for offshore operations. The project includes an initial investigation into the generation of best operation strategies, development of an advanced risk-based framework for modelling HOFs, formulation of Bayesian networks and a linguistic approach, and development of a novel group decision analysis methodology for supporting overall multiple criteria assessment of offshore operational strategies. The collaborators of the project are Shell and HSE.

#### **.2 Logistics performance of liner shipping (2003-2006)**

An appropriate liner shipping performance measurement can only be achieved by closely integrating the internal functions within carriers' companies with the external operations of shippers' and consignees' companies. In this regard liner shipping performance measurements will encompass not only internal operation efficiency parameters, but also measures of customer-facing services effectiveness. This doctoral study will develop a conceptual assessment framework of the logistics performances of liner shipping and provide suggestions for using validated measures in substantive research and practice in the context of the marine industry with particular reference to safety assessment. The collaborators of this project include Shanghai Maritime University and Mersey Docks and Harbour Company.

### .3 Risk-based inspection of large oil tankers (2003-2007)

Recent isolated and highly publicized incidents have undoubtedly cast a shadow on international maritime safety affairs. The benefits of a comprehensive regulatory system applied uniformly and controlled by an international body (IMO) need to be recognized. However, following the loss of oil tankers “Erika” in December 1999 and “Prestige” in 2002, the operations, engineering and management sectors involved in tanker safety have been subjected to intense criticisms from the media and the public. Leading Figures in the classification industry have recently called for a “re-invention” of the industry’s primary self-regulation system in response to these developments. Another observer encapsulates the fundamental problems with the present system of international rule-making. The system is to a large extent reactive, responding to accidents rather than proactively preventing them. There is a lack of transparency and the process of developing the rules is insufficiently systematic. This doctoral research looks at this important topic area.

#### **5.2.2 A Selected List of Some Recently Completed Research Projects**

##### .1 Application of approximating reasoning approaches in offshore engineering design (2002-2004)

To improve competitiveness companies must reduce cost and environmental impact whilst improving safety, quality and maintainability in design and manufacture of their products. Such multiple criteria have to be considered in design assessment at various design stages. The difficulty in conducting design assessment comes from the fact that limited reliable data is available to measure criteria at the early design stages where vague information or subjective judgement is often used. Advanced approaches that can address the above issues need to be developed. In this postdoctoral research project funded by the UK EPSRC, several pragmatic modelling techniques, a rigorous assessment methodology and software were developed. They can be used to facilitate assessment of offshore and other made-to-order products even in situations where conventional approaches cannot be applied with confidence due to the lack of data and the high level of vagueness and subjectivity. The outcomes of this project can be used to significantly improve the design assessment processes in conceptual design, design validations and requirements definition. The collaborators included AMEC Process and Energy Ltd, Vectra Technologies Ltd, NNC Ltd, HSE Offshore Safety Division and UKOOA.

##### .2 Cyprus and Mediterranean Cruise Market: A financial and economic appraisal (2000-2004)

This doctoral research proposed a “financial and economic” methodology for a cruise product. The developed methodology consists of seven distinct sections including consolidation and globalisation; market segmentation; evaluation of consumer attitudes and competition; marketing analysis; formal safety assessment; cost and risk assessment and investment risk analysis. It was used as the basis for the development of more scientific and objective financial and economic methods and safety modelling techniques applicable to the operation of cruise ships in the Cyprus and Mediterranean regions. A generic cruise ship and anonymous cruise companies operating in the Cyprus and Mediterranean regions were used to demonstrate the methodology developed. Finally the results of the project were summarised and the areas where further research could be focused were identified. This research was conducted via a distance-learning mode. The collaborators of this research included several leading cruise operators in Cyprus such as Louis Cruise Lines and New Paradise Cruises.

### .3 Formal safety assessment of fishing vessels (1998-2001)

This PhD project was concerned with the application of formal safety assessment to fishing vessels. Fishing vessels are generally smaller than most merchant vessels and the amount of data available to carry out an extensive safety assessment for this type of vessel is lacking. The failure and accident data available for fishing vessels are associated with a high degree of uncertainty and are considered unreliable. As such the work carried out in this research was directed to look at the development of novel safety analysis methods to address this problem. This research developed several subjective safety analysis methods for fishing vessels within the formal safety assessment framework. A fishing vessel was used to demonstrate the methods developed. The industrial collaborators of this project were Boyd Line Ltd and MCA.

## 6 Conclusion and future development

It is inevitable that the future lies in the greater use of IT in teaching, with much of this involving the Internet. The ability for students to learn at their own pace in their own time enabling them to mix learning with work is going to be the education of the future. It is already clear that distance learning is available in many subjects, however this method of learning is not very widely available. In the UK and elsewhere for many years there has been an “Open University” that offers all programmes in a distance-learning mode. They are able to harness the mass media of television as well as video and this will be beyond the resources of most universities. Nevertheless many universities will find ways of offering potential students this learning method.

Short courses in universities will also develop allowing students the opportunity of studying elsewhere whilst obtaining their main qualification from the home establishment. Greater emphasis on learning in the workplace will allow closer cooperation between academia and industry consequently a variety of ways of achieving this will develop.

This paper has set out the ways that LJMU has developed to harness modern teaching methods to provide a more attractive learning experience and one that is attuned to student requirements. The scope of research at LJMU has also been covered in the resume of some of the projects previously studied and some of those at present being studied in Liverpool.

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