# Multi-Background Project Teams in a Masters Degree Curriculum

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Abstract
Participants in the Interfaculty Offshore Engineering curriculum have entered with backgrounds in any of the following disciplines:

- Civil Engineering
- Mechanical Engineering
- Naval Architecture
- Petroleum Engineering

from the Delft University of Technology as well as from a number of foreign institutions. Each year these new participants are grouped into project teams to carry out the conceptual design of an offshore oil and gas field development. The material presented here is derived from six years of experience with two or three field development teams each year.

The paper goes into topics such as:

- Team member selection procedure.
- Stimulating early project team productivity - getting them working.
- Adapting project requirements to accommodate team members' backgrounds.
- Overcoming (cultural and intellectual) differences.

## Introduction

An offshore field development project has been included at the beginning of the Offshore Engineering (OE) curriculum at the Delft University of Technology since the 1996-97 academic year. This corresponded with the re-introduction of the 5-year engineering curriculum in that year. Originally, the course was quite isolated (relative to other offshore engineering courses) in the second semester of the third of the five curriculum years.

The Delft University of Technology recently adopted a 3 + 2 BSc - MSc curriculum structure with English-language MSc curricula. Along with this, OE has become purely a MSc curriculum since the Fall of 2002. An early form of this curriculum was described by Massie and Vugts (2001)[1]. The curriculum has continued to evolve since that paper was written; some details of the discussion below will be effectuated only in the coming academic year as this evolution continues. In spite of this on-going and gradual process, the basic objectives of the curriculum and of its survey of offshore engineering course have remained the same. Massie (2003)[2] describes this evolution process over a period of a quarter century.

The overall objective of the curriculum is to prepare its participants to work in larger teams involved with offshore developments by being able to design various man-made structures for use in the open sea. This supports the offshore oil and gas industry, but also includes offshore wind energy development, for example.

The Survey of Offshore Engineering course including its offshore field development project now extends through most of the first MSc year in parallel with many other offshore engineering courses.

BSc graduates from at least:

- Civil Engineering (CE)
- Mechanical Engineering (ME)
- Naval Architecture (NA)
- Petroleum Engineering (PE)
- Ocean Engineering (OcE)

can enter the OE curriculum. Only the first four of these are taught (in Dutch) in Delft, by the way.

Survey of Offshore Engineering Course Setting

Participants successfully completing the Survey of Offshore Engineering course can expect to have achieved the following objectives:

1. Be aware of the diversity of facets involved in the design of many types of offshore structures.
2. Know how and where to find more information on any of the topics involved and be able to discuss problems with experts.
3. Have experienced how conflicting requirements must be accommodated in a responsible offshore design.
4. Be aware of the economic constraints imposed on industrial projects.
5. Integrate and use knowledge gained from this as well as companion curriculum courses.
6. Be able to utilize simple project management techniques.
7. Be a more effective worker in teams and individually.
8. Be more actively involved in one's own learning process.
9. Be able to make more motivated choices for additional relevant (elective) courses.

The team project work being discussed in this paper is only one (but the largest) sector of this course. Additional sectors include:

- A series of lectures introducing many of the supporting disciplines involved. This is provided by a team of about 20 persons from the university as well as industry. This series is scheduled in the early Fall. Objectives 1 and 2 depend upon this sector. Many topics such as bottom founded structures are amplified later via separate dedicated courses. Other topics such as petroleum geology may be developed via electives if desired.
- A series of talks by a retired oil company engineer highlighting facets of the approach to field development in industry. This helps participants "learn to swim" - see below. He gives an overview from a manager's point of view by showing the importance of good conceptual design and the significance of economics in offshore field development.

- A series of joint team discussions are held to improve functionality. Specific topics such as team organization, proposal writing, library utilization, effective meetings and time planning illustrate the scope of these. This sector supports objectives 6 through 8 primarily.

Table 1 summarizes the backgrounds of the more than 100 participants who have joined the course since January 1997. It reveals that the group has become increasingly diverse, thus improving team balance. Also, the decline in participants from a civil engineering background has been compensated by a welcome increased interest from others. The first experience with participation from outside Delft was in 1998. The current trend toward increased foreign participation is expected to continue as the OE MSc curriculum becomes more well-known internationally.

Table 1 Survey of Offshore Engineering Participant Registrations

| Year | Total | CE | PE | ME | NA | Other | Specify | Remarks | Men | Women |
|---|---|---|---|---|---|---|---|---|---|---|
| 1997 | 14 | 14 | | | | | | 1 resigned | 12 | 2 |
| 1998 | 18 | 15 | 1 | | 1 | 1 | Appl. Phys. | | 12 | 6 |
| 1999 | 21 | 18 | | 3 | | | | | 20 | 1 |
| 2000 | 11 | 7 | 1 | 1 | 1 | 1 | ME Erasmus | From Italy | 9 | 2 |
| 2001 | 21 | 17 | | 3 | | 1 | external BSc | CE | 21 | 0 |
| 2002 | 19 | 11 | | 2 | 3 | 3 | external BSc | 2 NA, 1 CE | 17 | 2 |
| **Totals:** | 104 | 82 | 2 | 9 | 5 | 6 | | | 91 | 13 |

Team Member Selection Procedure

The course leader chose from the beginning to make each participant team as heterogeneous as possible. His primary motivation for this was that this best represented the industry which the curriculum serves.

Making the teams heterogeneous implied:

- Distributing the various BSc backgrounds over the participant teams.
  This included both the BSc field of study as well as - more recently - the schools from which foreign participants had come.
- Distributing the sexes over the teams.
- Balancing intellectual capabilities and interests within each team.
  The few participants including this course simply as an elective in another curriculum were spread over the groups. OE participants with weaker preparation were mixed in with other intellectually stronger and better prepared colleagues.

Heterogeneous teams have had both positive and negative consequences:

+ New acquaintances and friendships result and clique formation is discouraged.
– The members of each team with their different backgrounds were often participating in a wide variety of other courses - each with its own schedule. This often made it more difficult for teams to schedule extra work sessions. One team even held evening sessions at a team member's home. He provided the coffee as well as the beer.

Each year, the course leader 'juggled' the available team members until reasonably balanced teams resulted. These were made known shortly before each team started work. Motivated

requests for team modifications have generally been honored. Some have had to switch teams in order to better accommodate their part-time jobs.

In 1998 the course leader had the opportunity to form one all-girl team and two male teams. He adhered to the guidelines above, instead. When he discussed this with one of the girls after the course she responded that she felt that his decision had been good; the mixture of sexes had had a moderating effect on each team's work process.

Getting Teams Working

It is said that one way to teach swimming is to throw the student overboard at sea. Each team experiences this (figuratively) about three weeks into its first MSc semester. An oil company representative presents offshore reservoir exploration information and requests a complete conceptual design for - and an economic evaluation of - the field's development by the end of the academic year. At this point the new participants feel very wet!

The swimming teacher above can improve the chances of success above by staying close to the swimmer and tossing out a rope when necessary! The 'rope' for the teams in this analogy is a pre-defined time schedule specifying when certain activities have to be completed. These pre-scheduled milestones include:

1. Submission and oral presentation of each team's project proposal midway through the first semester.
2. Report submission and oral presentation focusing on the well design and associated topside design segment at the end of that same semester.
3. Report submission and oral presentation focusing on support structures during the first half of the second semester.
4. Submission of a draft final report.
5. Oral presentation of each team's overall findings in a single session. All OE students (and many former participants) as well as all involved teachers are invited. Of course the oil company representative is there too.
6. Submission of the final report about 1 week later.

The latter three milestones come in the last weeks of the academic year. They are planned so that teams can use reactions to the written draft and from the oral presentations when editing the final report.

Adapting Projects to Teams

Specific details of each team's project have sometimes been differentiated in order to force a specific team along a certain path. For example, in 1998 the team which included the naval architect was told that oil export must be by tanker. They soon concluded that a floating production storage and offloading (FPSO) installation would be appropriate. That team was the only one to choose this option for the field, by the way.

Such project changes have the potential disadvantage that they limit direct competition between the teams. On the other hand, it makes comparison between more distinct solutions possible during the final presentations and the discussions which follow.

Overcoming Differences by Providing a Sociable Work Environment

An ice-breaker party at the home of the course leader helped to get the teams started. All of the teams were invited to the same party before the teams had ever met individually on a

formal basis. It was not only their first contact with new colleagues, for most it was his or her first invitation to the home of a faculty member.

As already mentioned above, some teams held intermediate work meetings at the home of one of its members. This was a more sociable setting than the more sterile academic environment can provide. Everyone attending the final oral presentations - item 5 above - joins for informal drinks and conversation at a convenient nearby location afterwards.

The final report is submitted to the oil company representative and the curriculum leader at the latter's home about one week after the final oral presentation. This report submission ceremony dissolves into an informal barbecue held in his back yard that evening.

No significant interpersonal or other social difficulties have been experienced even though the author has heard of such problems involving other MSc participants outside the OE curriculum. One reason for this good fortune within the OE curriculum may be that work in multi-background teams has been stressed in course information provided from the beginning; OE participants have been mentally prepared to accept others and to work with them from the beginning. Some have even mentioned these broad teams as a motivation for joining the curriculum in the first place.

## Reflections

The socio-academic activities has lowered the academic barrier between the faculty and the participants. One of the extra benefits has been more sincere and constructive annual evaluations of this course and the curriculum in which it is included. This openness has indeed surprised one of the newer faculty members. Participant reactions contribute significantly to the on-going evolution of the curriculum.

One common course evaluation comment has been that multi-background teams have added richness to the team's activities. As with many good wines, the value of this course - for its participants - seems to improve with age. Several who are further along their academic and even professional career paths have reported appreciating their Survey of Offshore Engineering experiences even more as time progresses. They remark that they have found that they are especially capable of presenting a problem to and discussing it with a consulted expert.

## Conclusions

Multi-background teams provide an added dimension to projects which are broad enough to allow each member to make a unique contribution. An offshore field development provides an excellent setting for this within the Offshore Engineering MSc curriculum at the Delft University of Technology.

The broad hands-on experience relatively early in the curriculum becomes more and more valued as team participants progress through the curriculum and on into their careers. It also helps to motivate the selection of later elective courses.

## References

[1] Massie, W.W. & Vugts, J.H. (2001) ***Engineering an Offshore Engineering Curriculum*** Paper presented at

the ***Eleventh ISOPE Conference*** held in Stavanger, Norway; pp 616 - 619, June.

[2] Massie, W.W. (2003) ***Curriculum Change: Revolution as well as Evolution*** Keynote paper for ***International Conference/Workshop on Engineering Education Honoring Professor James T.P. Yao***, Texas A&M University, College Station Texas, USA; 7 pp, February.

## Biographical information

Walter W. Massie

Walt has a primarily US background in Civil as well as Mechanical Engineering. He first went to The Netherlands as a Fulbright Scholar in 1968 and has been on the faculty of the Delft University of Technology since 1970. He has filled various functions within the Faculty of Civil Engineering as well as the university's Interfaculty Workgroup for Offshore Technology. He is currently Curriculum Leader for the Offshore Engineering MSc curriculum in Delft.