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Marine student's information literacy skills- a case study of marine engineer's bachelor thesis at Chalmers University of Technology

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Abstract

What do the marine engineer students remember from their library instruction sessions in information literacy (IL) when it is time for them to write their bachelor thesis? The need for IL in the education is important due to the students coming work life. The skills to be an engineer are so much more than just technical knowledge. To state this, we have worked with integrated learning sequences and development due to the Conceive Design Implement Operate (CDIO) concept. Within in this specific subject we will highlight the need of writing and IL. CDIO main goals can be closely connected to IL especially about how to lead the operation of processes and understand research impact and development of the society (Crawley et al., 2014).
During the autumn semester in 2017 we asked the marine engineers to fill in a one-minute paper to reflect over the library lecture. In the spring of 2021, the students wrote their bachelor thesis and we wanted to look at how much they remember from their previous lecture. With a short survey after they finished their theses we wanted to find out if they had used their information literacy skills during these years as students.

Keywords information literacy, active learning, marine engineers, CDIO

Introduction

This paper describes and reviews the information literacy and writing process of the BSc Marine Engineering (ME) Program at Chalmers University of Technology. The goal of this has been until their last year with the thesis as sum-up of the education program. The program has several overviewed outcomes to fulfil as a Maritime Education. By this said the program shall comply with the requirements set out in the Higher Education Ordinance, the Swedish Transport Agency's regulations and the International Convention on Training, Certification and

Watchkeeping for Seafarers (STCW Convention) and the local degree regulations at Chalmers University of Technology.
During the years of 2017-2021 a developed information and writing process was implemented in the program, and it aimed to give the student better skills due to the report writing and the B.Sc. thesis and to prepare them for their coming career as engineers.

The department Communication and Learning in Science (CLS) functions as a pedagogical hub at Chalmers University of Technology (2020). *The Division for Language and Communication* teach among other things scientific writing and technical communication. At CLS you also find the Chalmers library and the division *Information Literacy for Learning and Research*, that is responsible for the IL-instructions. The two divisions are involved in the process of almost all academic theses within the university of Chalmers and offers a different range of course elements in IL.

Chalmers Marine Engineering program

Chalmers University of Technology in Sweden conducts education in and research in several different areas within the spectrum of natural sciences. Out of 11, 000 students approx. 800 students are enrolled to the Maritime Educations.

The Marine Engineering program at Chalmers is a four years education (270 ECTS) and it all ends with a B.Sc. degree in Marine Engineering. The title Marine Engineer was added during the 1950s and the main labor market for marine engineers has been as a engineer on board the merchant navy and as an engineer in the "shipping industry". Furthermore, marine engineers form an important part of Sweden's maritime cluster for both Swedish-flagged vessels and Swedish shipping companies in an international market. The change that has taken place in recent years is that several other industries outside the "shipping industry" have aroused interest in graduates from the program and see them as well prepared for other engineering jobs.

Conceive Design Implement Operate (CDIO)
The CDIO approach to engineering education was introduced in the early 2000’s. It started as a cooperation between Chalmers University of Technology, The Royal Institute of Technology (KTH), Linköping University in Sweden and Massachusetts Institute of Technology to reform

engineering educations. The cooperation has now grown to an international network with about 150 educational institutions from all parts of the world (Crawley et al., 2014).

The concept of CDIO consist of two main parts, a description of the professional role as engineer with generic goal descriptions and a systematic way of developing and work. The other main part of the concept is to create conditions for a clear progression in the program and general engineering skills that needs to be trained. Some example of skills are communication, teamwork and project management can be actively trained through integration into courses and projects. Also, the learning environment is important due to the CDIO and it will improve students to work in a more collaborative way. One, out of many, parts that can be achieved from the CDIO concept we have used the perspective of *"Integrating learning of professional skills such as teamwork and communication"*(Worldwide CDIO Initiative, n.d.). Due to the concept it is important for engineers to fulfill and understand the role out over the technical "problem solving".

Education plan

The courses at Chalmers are formed into educational programs and the ME program and consist of 27 mandatory courses and six electable courses. The electable courses are the internship courses and the practical workshop courses, in total they are of 90 ECTS. If the students fulfil the degree of BS.C and the electable courses they will be able to apply for a certificate as second engineer. During the program we have strived to foster the student in several skills out over the traditional engineering skills. Through the education, the student is given good conditions for the development of personal qualities and attitudes. See appendix 1 for detailed information of an overview of each year in the program.

Program learning outcomes

The outcome of the program's degree BS.C is described in Swedish Degree Ordinance (Högskoleförordning [Higher Education Ordinance], 1993) as well as in the *Local Qualifications Framework for Chalmers University of Technology* (2020a) The IMO regulations are controlled by the Swedish Transport Agency but are not stated in the Swedish Degree Ordinance. Therefore, all the specified objectives at Chalmers are develop by the program management to explain how we do this at Chalmers and to make it more clear to stakeholders of the educations. In this article we will just highlight the program outcomes that relate to the communication outcomes.

The program description (Chalmers University of Technology, 2020b) has in total eleven learning outcomes and the seventh of that includes the following:

> **(7) demonstrate the ability to present and discuss information, problems and solutions in dialogue with different groups orally and in writing in different national and international contexts by:**
> (7.1) present information in writing and orally in Swedish and English
> (7.2) be able to reflect and discuss problems and solutions with sea captains, shipping staff and authorities

Out over the formal program outcomes the program has developed an agreement with the department CLS of what should be done in the courses.

Academic and information literacy

Students in higher education need to be prepared both for their upcoming student years but also for their future work life. Academic literacy, to understand academic texts, writing and reading skills is needed for them to success in both. Reading and writing abilities can be seen as core strategies for students to be able to learn new subjects and develop their knowledge (Wollscheid et al., 2020). In the Norwegian study *Prepared for higher education? Staff and student perceptions of academic literacy dimensions across disciplines* (Wollscheid et al., 2020) explores beginner students' perspectives of study preparedness across higher education. And students are *"apparently not used to working hard... struggling to read large text amounts, showing a lack of academic writing and reading skills"* (p. 20). They look at both hard and soft disciplines, for example natural science and engineering or humanities and social sciences. They argue for the importance of discipline-specific writing skills to prepare them for academic achievement. They write that engineering students as a hard discipline need to learn to write and understand structured reports in a technical language. Maritime students have the same needs. At Chalmers the maritime engineers' students writes a lot of lab reports, internships reports etc. But in some courses, they write more academic texts where they must back their claims with facts. They must find peer reviewed scholarly articles and cite them correctly. And then, besides academic literacy, they need information literacy (IL). One engineer student in Wollscheid et al's study responds that *"I know what I'm searching…I just screen the text, and*

when I find something which is relevant, I use it…" (p. 33). This cherry-picking approach to finding information is for the novice learner but a more experienced learner understands that you need to seek deeper and not take the first best hit in your search list. According to the American Library Association (ACRL, 2016) Information literacy is:

> "Information literacy is the set of integrated abilities encompassing the reflective discovery of information, the understanding of how information is produced and valued, and the use of information in creating new knowledge and participating ethically in communities of learning."

When we teach IL at Chalmers, we follow the *Framework for Information Literacy for Higher Education* (ACRL, 2016). The framework is organized into six frames, each consisting of a concept central to information literacy, a set of knowledge practices and set of dispositions. For example, how to seek information, valuating and use the information ethically according to academic honesty. The six frames are research as inquiry, scholarship as conversation, authority is constructed and contextual, information creation as a process, information has value, searching as strategic exploration.

There is not that much research about maritime students and their ability to find information and need of information, but a Turkish study look at how maritime students search for information on the web and their commitment strategies (Topal & Süner, 2020, p.1). They write *"For students preparing for a life at sea, it is important to establish and determine the appropriate strategies for accessing and interpreting information on the web, as their ability to perform such tasks quickly and effectively is vital for their success in this particular sector."* The shipping industry needs sea farers that are up to date and know about the latest technical equipment. For example, about energy efficiency so that they can reduce greenhouse gas emission or find information about global economy for smother operations (p.2).

Faculty librarian collaboration

Just as reading and writing are seen as a core strategy even IL is recognized as a core competence (Junisbai et al., 2016; Kastner & Cheng, 2019). Junisbai et al, (2016) writes that faculty often thinks that their students have poor skills in locating and evaluating scholarly information but there is an ambivalence on how to teach it. In their study they look at collaboration between faculty and librarians and how to best integrate IL in the curriculum. With conversations about clear goals and learning outcomes that the teaching librarian can put her input on and how she can complement the faculty. Findings from the study shows that

greatest gains come from when librarians provide moderate input into the syllabus and assignments, followed by a few strategically placed hands on library sessions.

In Brierton Granruth & Pashkova-Balkenhol's (2018) study that also looks at the benefits of collaboration between faculty and librarians. They have developed a new model to integrate information literacy to strengthens social students writing skills. The students were positive with the combined expertise from the faculty teacher, the librarian and also the writing tutor. The authors got the insight that students need interactive, hands-on and just in time teaching (Brierton Granruth & Pashkova-Balkenhol, 2018, p. 459) And Kastner and Cheng (2019) highly recommends a collaboration between faculty and librarians is the best way to help first years engineering students to develop critical information literacy skills and it should be in the beginning of their academic journey (p. 4).

Active learning at Chalmers library

The library, that serve the marine students and faculty at Chalmers, reopened as a Learning Commons in 2017 (Chalmers University of Technology, 2017). In conjunction with the new premises the librarians changed the library instruction sessions in information literacy from mainly passive lectures in computer labs to more active workshops in ALC (active learning classroom) inspired classrooms. Active learning shifts focus from the teacher to the student and this learner-centered approach place more responsibility on the students (Felder & Brent, 2016). And for some students this can be hard, but the advantages of active learning have been confirmed by many scholars, among others, by Freeman (Freeman et al., 2014).

Over the years we have meet the student in different courses and at different times during their study years, depending on what would best for the students, see fig 1 and 2. But usually we offer a so-called one-shot lecture where we introduce the students to our library resources, focusing mainly on the discovery service, databases and our so called libguides. We have a libguide for the maritime students were we have gathered important resources in the subject of shipping and maritime studies https://guides.lib.chalmers.se/Shipping.

Figure 1. Class start 2017

Year	Library activity	Information literacy	Writing assignment
1	Library introduction, one- shot lecture	Library resources, information seeking, references	No academic writing, only a lab report
2	One- shot lecture	Source criticism, avoid plagiarism, peer review, citations	Argumentative text
4	One- shot lecture, online module, dropin sessions and tutoring	Academic honesty, source criticism, avoid plagiarism, peer review, citations	Bachelor thesis

Figure 2. Class start 2020

Year	Library activity	Information literacy	Writing assignment
1	Short introduction to the library (and the librarian), quiz in canvas (sea-web)	Library resources	No academic writing
2	Library introduction one- shot lecture	Information seeking, references	Argumentative text
4	One- shot lecture, online module, dropin sessions and tutoring	Academic honesty, source criticism, avoid plagiarism, peer review, citations	Bachelor thesis

We go through the process of seeking information and evaluating what they find. And we introduce them to the reference style commonly used in their program, APA7th ed (American Psychological Association). The librarian holds a shorter introduction, gives the students an assignment that they work on in smaller groups and that they must reflect on in whole class. When students periodically get something to do that requires using recently presented information, their working memories have a chance to rehearse that information and being stored in the long-term memory (Felder & Brent, 2016, p.117). They also write about the win-win situation that *"academically weak students get the benefit of being tutored by stronger classmates, and stronger students get the deep understanding that comes from teaching someone else"* (p.119).

We meet them in class again when they start working on their bachelor theses. And now with progression in mind. In consultation with teachers we have set up a suitable package with focus on academic integrity. We have a mandatory one-shot lecture and the students also have to do our online module Chalmers Library Education Online (CLEO) in academic integrity that focus

on plagiarism, scholarly communication and copyright (Nordfeldt & Wernbro, 2017). We also offer drop in and tutoring sessions.

Method

That first semester in 2017 with active learning we asked all the students from different programs we meet in class to fill in a one-minute paper to reflect over the lecture. One-minute papers is a good way to receive formative assessments. We asked; What have you learned today that can be helpful for your further studies? What did you think about todays lecture? And an open-ended question for other comments.

We received 46 answers from the marine engineers student in year one and two. The students that 2017 were the first-year students were now writing the bachelor thesis in the spring 2021 and we sent out an survey. We wanted to know what they remembered from the library instruction. Has it been of any help? The survey was sent out to the class by mail, and it was performed in Google forms. The survey was in Swedish and the questions where both closed and open form. The questions will be found in appendix 2. The participation was voluntary and the survey where sent out to 23 students and 12 of them responded. A reminder was sent out after a week. The response rate was 52% which we considered good even if it is a small group of respondents. According to (Denscombe, 2014, p.54) there's no benchmark figure for what is considered an acceptable response rate.

Results

A lot of the comments from the one-minute paper in 2017 mentions that they learned about information seeking, how to write correct references but also were to search and they seemed to understand the importance of information literacy. Some students wrote that learned (translated from Swedish):

> *Future essay writing, the use of the library/school's "research database".*
>
> *Where I can search for information. Who can I turn to in case of problems.*
>
> *I have gained a deeper understanding of how references work and what resources I have available.*

The students liked the active learning and were positive to the lecture, the majority thought it was “good” (54,3%) or “very good” (37%). They also mentioned that it was good that they had the library instruction early in the course, that they learned a lot and that they liked the “live” teaching. But they also said that it was short on time, our one-shot lectures are 1 hour 45 minutes and a lot need to be covered in that time.

The first year they didn’t have a written assignment but in their second year the librarian meet them again as mentioned earlier in fig 1 and now they had to write an argumentative text based on scholarly articles. Since this was the first time, they actually needed to find information and cite it correctly, the library session was more needed and the perception from the librarian was that the students didn’t really remembered that much from year one.

Results from the survey from the fourth year when the students wrote their bachelor thesis show that they were still positive to the library sessions and that information literacy is important, even if that is a term used by librarians and some students said that they haven’t heard it before. But they defined it as “the ability to find, understand and sort out relevant information on a topic, and to be able to be source critical to assertations/statements” and *“a skill to mediate information”* which is an important skill in the maritime sector. We asked how information literacy and academic writing has been beneficial for them during their education and also if they see how it will be of importance in their coming work life. The majority said that it was beneficial for the bachelor thesis but only a few could see the importance of information literacy in the workplace. One student summed up *“only for the bachelor thesis, my program is not that academic so for my future career is it completely unnecessary. However, for my personal development and general education is it very useful…”*. And then on the other side some students responded that it is useful for the career, *“I’ll certainly write reports and manuals at work so gaining this knowledge is priceless”.* We also asked if the student thought that information literacy and writing skills should be integrated earlier in the program and it was a 50/50 response on yes; it should be integrated earlier and keep it as today. None wanted it to come later in the course. *“It would have been good to be more prepared for information seeking and referencing earlier in the program so that you don’t need to develop that knowledge during the writing process. However, if you asked me three years ago, I would have said that it was totally unnecessary and that it would have been better to focus on current studies”.* Interesting is that the library sessions in year one was as previously stated appreciated and that they learned how to seek information and cite correctly. But now in the survey when

we asked what they remembered they responded; *"not much, a little about how to search…"* and one even wrote that they didn't had any library education instruction in year one.

Conclusion

This is just a small case study and it's hard to draw any final conclusions. The students appreciate the active learning, but the library instruction need to be right on time with clear learning outcomes. As Junisbai et al, (2016) writes that the library sessions should be strategically placed in the right courses were information literacy is a goal. And that it is better to have shorter elements were the library just introduces our services than have unnecessary one-shot lectures without a cause. Already back in 2017 we realized that the one-shot library lecture we had for that class in year one when they didn't have an academic writing assignment wasn't suitable. The year after with discussion between faculty and librarian it was decided to just have a short introduction in the course *Introduction to marine engineering* so that the students got to know the library as a place and also "their" librarian. In the course we also integrated a quiz in canvas, were the students would find information about ships and engines in Sea-Web that was connected to the course, se fig 2. Based on the feedback from the students and from the literature the librarian will be present during the whole education and IL should be embedded in the curriculum from the start and it's important with progression.

The results also give us that this is a very fruitful way of working with the skills of communication and we will strengthen and develop the learning sequence of this for the coming educational year.

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