Implementing Peer Tutoring for Stronger Research-Linked Education

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Abstract—**A strong research link is a crucial quality factor in higher education. This paper describes the process of implementing a peer-tutoring activity to strengthen this link. It also evaluates and discusses the effects of this activity on student learning from a student perspective and a teacher perspective. The results indicate that this implementation was a time-efficient way of studying and understanding scientific research articles and thus strengthening the link between research and education.**

Index Terms—**Peer Tutoring, Peer Learning, Higher Education, Courses, SoTL, Technology and Engineering**

I. INTRODUCTION

There is international consensus that a strong research link is a crucial quality factor in higher education. Lund University's Strategic Plan 2012-2016 [1] states that it intends "*to enhance the quality of education through in-depth research links*". There are many suggestions of how to establish a stronger connection between research and teaching. For example Lundmark et al. [2] provide a list of twelve education criteria. One of these is the students' ability to study and understand scientific texts and material. Surprisingly, few investigations and little literature can be found on how to implement this criterion effectively in curricula. As an initial attempt to do so, the purpose of this paper is to describe the process of implementing a peer-tutoring activity and discuss its effect on student learning.

II. WHAT IS PEER TUTORING?

According to Topping [3], the development and evaluation of the effects of peer learning have increased considerably in the last 25 years, although much research is still lacking. Topping [3] defines peer learning as "*the acquisition of knowledge and skill through active helping and supporting among status equals or matched companions*" and underlines that it involves "*people from similar social groupings who are not professional teachers helping each other to learn and learning themselves by so doing*". Peer learning is an umbrella term for various kinds of peer-learning activities such as collaborative learning, peer assessment, peer teaching, peer monitoring, peer counselling, and peer tutoring.

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Peer tutoring is widely used in a variety of different forms in further and higher education [4]. It is characterised by the students taking on a specific role. That is, someone fulfils the role of tutor while another or others take on the role of tutee. Falchikov [5], Forman and Cazden [6] emphasise that if peer tutoring is to occur, there needs to be a difference in knowledge between the two individuals, so that the more knowledgeable individual can act as tutor to the less knowledgeable one.

The benefits of peer tutoring found in research are: increased and deepened understanding (cognitive gains) of the subject both for tutor and tutee, and a decrease in the fear of asking for help among students. These effects are enhanced if the students have to act both as tutors and tutees. Many studies of peer-learning activities also report socio-emotional gains including changes in attitudes to school, the teacher, the subject and peers. Peer-learning activities are considered to be cost-effective forms of education. Nevertheless, the importance of the role of the teacher as guide and educator should not to be forgotten. Otherwise, there is a risk of "*the blind leading the blind, pooling ignorance, or one person doing all the work*" [3].

III. INTRODUCING PEER TUTORING IN PACKAGING LOGISTICS

The Packaging Logistics course constitutes 7.5 ECTS and is held in English on the advanced level. Most of the students taking the course are in their fourth or fifth year in the Mechanical Engineering, Industrial Engineering or Food Engineering and Nutrition Programmes. In addition, a number of exchange students take the course each year. The students are assessed by an individual written exam and a packaging logistics evaluation project carried out in groups. The literature consists of two text books and ten research articles. The research articles have two purposes: to improve the quality of the projects and to strengthen the link between education and research.

Motivation for peer tutoring

The project reports and the individual exams showed that all students did not understand the main message of the research articles. Even though the teachers emphasised the importance of and provided advice on how to read the articles, they seemed to be rarely read and hardly referred to in the project reports. After analysing the reason for this, the teachers came to the conclusion that they needed to help the students in obtaining knowledge from the research articles and, if

possible, reduce their workload. Higher education literature on how to help students read and understand new material and relate it to previous knowledge suggests peer tutoring [5,7]. These insights led us to the implementation of peer tutoring.

Implementing peer tutoring

Topping [3] stresses the importance of carefully planning the settings around any kind of peer learning. It is not just about pairing two or more students and giving one the responsibility to teach the other/s. Peer-learning education in any form has to be monitored by the teacher in charge; the planning of the activity has to be done by the teacher and help and instructions have to be given both to the tutor and the tutee.

The set-up for the peer-tutoring activity in the Packaging Logistics course is shown in Fig. 1. With 40 students and ten research articles they were divided into ten groups of four students each when the activity was introduced. Each group was assigned one research article and asked to collaboratively analyse and prepare a presentation. For the 7-minute presentation, each group was free to choose the approach, structure and technical aid. They were asked to include the purpose of the research article, the main message, main learning, a critical review, applicability to the course projects, and a potential exam question. The applicability to the course projects was meant to help the students utilize and think of opportunities with the current research. Posing an exam question also facilitates in-depth understanding because to do so, you need to know what you are asking. To motivate the students to develop relevant questions and be interested in the questions posed by other groups, they were told that at least one of the questions would be used in the final exam.

Based on course evaluations and discussions with students in 2010, improvements were implemented in 2011. It was found that some presentations were poorly structured and that the documentation was insufficient. To improve the structure of the presentations, a template in *PowerPoint* was developed with the areas to be included. To improve the problem of insufficient documentation, the students were required to publish their presentations on the course website after the peer-tutoring activity.
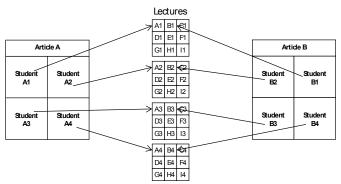
IV. RESULTS AND DISCUSSION

Fig. 1. Illustrative set-up for the peer-tutoring activity. Nine research articles [A-I] in this illustration.

In this section the effects of introducing the peer-tutoring activity are evaluated and discussed from a student perspective and a teacher perspective.

Student perspective

Two evaluations were conducted to gain insights into students' perceptions of the peer-tutoring activity. At the end of the course, the students' overall perception was surveyed using a questionnaire (Table I). On average, the students perceived the peer-tutoring activity to be important with good quality both in 2010 and in 2011.

The student perception was also evaluated with another

TABLE I
STUDENT OVERALL PERCEPTION ON THE PEER-TUTORING ACTIVITY

Peer tutoring	2010	2011
Important activity	3.7	3.9
Quality of the activity	3.9	3.9

Scale: 1-Not interesting/good at all; 2-Partially not interesting/good; 3-Ok; 4-Interesting/Good; 5-Very interesting/good

questionnaire (Table II). In order to ensure that the students gave an opinion, we used a slightly different Likert scale ranging from *strongly disagree (1)* to *strongly agree (4)*. The questionnaire also contained open-ended questions that enabled the students to write individual comments about the peer-tutoring activity. The scores were quite similar for both years. They reveal that the students strongly agree that the peer-tutoring activity facilitated their understanding of the research article that they presented. The score for the articles that were presented to a student are also acceptable, but could be improved. The changes made between 2010 and 2011 to improve the documentation and presentation structure are not reflected in the perceived understanding.

The evaluation supports the expected results that the peer-

TABLE II
STUDENT EVALUATION OF PEER TUTORING

Peer tutoring…	2010	2011
...facilitated my understanding of the article I presented	3.5	3.6
...facilitated my understanding of the articles that were presented to me	2.7	2.7
...is a time-efficient way of understanding all the articles	2.8	2.9
...facilitated an in-depth understanding of all the articles	2.5	2.3

Scale: 1-Strongly disagree; 2-Disagree; 3-Agree; 4-Strongly agree

tutoring activity is a more time-efficient approach to gaining an understanding of the articles. The majority of the students perceived that the added work for the additional learning activity was less time-consuming than reading all 10 articles individually. An explanation for the positive results could be that the students act both as tutor and tutee. Spurlin et al. [8] concluded that such an alternating condition conferred the greatest benefits to the students.

To gain an in-depth understanding of a research article in 7 minutes is quite challenging. Thus, the fact that the results of the perceived in-depth understanding of all the articles are lower than the other scores is not surprising. To gain in-depth understanding, the peer-tutoring activity would need to be complemented with individual study of the articles. This might be the case for the students who rated this criterion the highest.

Teacher perspective

By participating and observing as guide and educator the teacher found that the peer-tutoring activity improved the students' understanding of the articles. An indication that supports this is that in 2008, the average result on an exam question related to one of these articles was 2.8 (out of 5), while a similar question resulted in an average of 3.3 (out of 5) in 2010 and 3.6 (out of 5) in 2011. It should be noted that this is only an indication as the questions are not the same each year and the students are new each year.

Unexpectedly, it seems that the students did not improve in applying the content of the articles to their projects as expected. An indication that supports this is the measure of how extensive the students used the research articles as references in the final project report. No change was found when comparing the average number of references used in the 2008-2009 reports and after the peer-tutoring implementation 2010-2011.

Another challenge perceived by the teacher is to ensure a constructive discussion among the students (i.e. tutee and tutor) in the peer-tutoring activity. The learning situation is highly dependent on the student's ambition and motivation.

V.   CONCLUDING REMARKS

Higher education needs to have a scientific foundation in which research results are integrated into curricula. One criterion to establish this is getting students to study and understand scientific research material. This investigation indicates that introducing a peer-tutoring activity of scientific research articles can help students to understand the articles and decrease their workload. However, the students' ability to apply the content of the articles to other course tasks is an issue that needs to be further improved and investigated.

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