

“Do I need research skills in working life?”: University students’ motivation and difficulties in quantitative methods courses

Mari Murtonen · Erkki Olkinuora · Päivi Tynjälä · Erno Lehtinen

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Abstract This study explored university students’ views of whether they will need research skills in their future work in relation to their approaches to learning, situational orientations on a learning situation of quantitative methods, and difficulties experienced in quantitative research courses. Education and psychology students in both Finland ($N = 46$) and the USA ($N = 122$), who thought that they would need research skills in their future work, differed significantly from the students who were not sure whether they would need these skills. The students, who considered research skills important for their future work, were more task-oriented, used a deeper approach to learning and experienced fewer difficulties in the learning of research skills than other students. This finding implies that experiences in learning, learning approaches and situational orientations are related to expectations about future work. For instruction, this means that if we were somehow able to change students’ experiences and orientations towards research into a more positive direction, students might be better prepared for their future work.

Keywords Learning of research · Research skills in working life · Motivation in research learning · Difficulties in research learning · Conceptions of research

Introduction

Academic education should prepare students with an understanding of the need for research skills in society and their future working life. Research skills are no longer needed only by those aiming at research work, but they are important to all university graduates, regardless of whether they aim to work in research, in the public or the private sector. The increasing complexity of society and working life requires better understanding of scientific results and research-based communication (Lehtinen 2007; Murtonen et al. 2007).

M. Murtonen (✉) · E. Olkinuora · E. Lehtinen
Faculty of Education, University of Turku, Assistentinkatu 5, 20014 Turku, Finland
e-mail: mari.murtonen@utu.fi

P. Tynjälä
Institute for Educational Research, University of Jyväskylä, PL 35, 40014 Jyväskylä, Finland

According to Tynjälä et al. (2006), new knowledge-intensive work organizations are not only using and applying knowledge produced in the university, but are also themselves producing, transforming and managing knowledge to create innovations. This means that the role of higher education institutions is not only to prepare graduates capable to perform in these new jobs, but also to educate workers who contribute to the development of working life (Välilä et al. 2006). Greer (2000) points out that the amount of information based on research and statistical analysis is growing in our society. Technical development and the increasing amount of information produced and made available by computers and electronic networks, require the skills to handle this information in many occupations, especially in professions demanding an academic education. Thus, skills to understand how knowledge is created and transformed in our society are central to university graduates.

University education is not, however, always able to equip students with realistic conceptions of their future work (e.g. Tynjälä et al. 2002). Universities' research methods courses are often experienced as difficult, dull and uninteresting by many university social and behavioural science students (e.g. Epstein 1987; Murtonen 2005). Universities are spending vast resources on research instruction, but the outcomes are not as good as expected (Lehtinen and Rui 1995, Rautopuro et al. 2007). Difficulties experienced by students are not decreasing, but rather increasing during courses (Murtonen 2005). Problems in the learning of research can result in slow progression rates (Meyer et al. 2005; Kiley and Mullins 2005), and in other types of procrastination during education. Difficulties in the learning of research may even have an effect on students' future career selections (e.g. Onwuegbuzie 1997).

The aim of this study was to explore whether the experienced difficulties and motivation to learn in research courses were connected to students' views of their need for research skills in working life. Our hypothesis was that some students were not convinced of that they would need these skills in their future working life, that the same students had problems with their motivation to learn research, and that the students in question were also the ones who experienced difficulties in the learning of research methods.

Theoretical framework

Difficulties in the learning of research methodology

The problems that students face in university research courses are diverse. The most problematic research courses for social science, psychology and education students tend to be quantitative methods and statistics courses (e.g. Gal et al. 1997). Murtonen and Lehtinen (2003) explored education and sociology students' views with open-ended questions concerning problems that they had experienced in quantitative methods courses. Students reported problems concerning superficial teaching, linking theory with practice, unfamiliarity and difficulties with concepts and content, constituting an integrated picture of the parts of scientific research, and they also reported negative attitudes toward quantitative methods studies. Similar problems have been reported in other studies and disciplines, such as in social work (Forte 1995; Rosenthal and Wilson 1992), in psychology (Hauff and Fogarty 1996; Pretorius and Norman 1992; Thompson 1994; Townsend et al. 1998), in sociology (Filinson and Niklas 1992), in education (Lehtinen and Rui 1995; Onwuegbuzie and Daley 1998), and in social science in general (Zeidner 1991).

The learning of quantitative methods, as well as the learning of research in general, have not been extensively studied. Difficulties in the learning of quantitative methods

have traditionally been considered to arise from previous bad experiences with mathematics, leading to anxiety towards mathematical subjects, and thus towards statistics, and maybe further towards the domain of research as a whole (e.g. Onwuegbuzie 2000). Such problems may also be due to other factors, such as beliefs and conceptions about research that may be fostered by peers and society. Hannover and Kessels (2004) have studied high school students' dislike of mathematics and science from a social psychology perspective. They suggest a prototype theory, i.e., that students' self-views are closer to their view of a prototypical peer, who likes humanities, than to the view of a peer who favours mathematics and science studies. Similarly, for example, a psychology university student may have a favourite-work-prototype of a psychologist whose work consists of solving people's problems by talking to them, and a least-liked-work prototype of a psychologist who runs data with a computer creating statistics. The former psychologist is closer to the student's own self-view than the latter. These kinds of prototypes can direct students' views on their future work, and thus affect their motivation and choices of courses. Thus, university students who experience problems with the learning of quantitative methods do not necessarily have problems primarily with the learning of mathematical subjects, but it is their views and beliefs that do not support the learning of them.

In instruction, there may also be some factors that do not foster learning. For example, Hannover and Kessels (2004) refer to a study conducted by Klieme et al. (1998), who videotaped classroom situations and found that mathematics teaching in the poor-achieving countries, Germany and the USA, consists mostly of narrow-focused class work, whereas lessons in top-performing Japan included group work, students' presentations and discussions about different ways of solving a problem. Hannover and Kessels (2004) conclude that for students, the former style of instruction may create a prototype of a typical student who favours these subjects; one who is socially incompetent, isolated, and not creative. This is not an ideal prototype for students, and thus they are not interested in the subject.

Students may also have other kinds of views that are problematic for learning. Students' conceptions of research have been studied by Meyer et al. (2005). They found that students have various conceptions of research, and that a wide range of misconceptions does exist, such as "research becomes true after it is published". Problems may occur, for example, if students' conceptions are incongruent with teachers' conceptions (see also Kiley and Mullins 2005), causing the students to experience difficulties in their understanding of teaching, or if students' conceptions otherwise hinder their understanding of the topic.

Students' struggle with research courses is not evidently visible in their study success at the level of course grades (Birenbaum and Eylath 1994; Murtonen and Titterton 2004). According to Murtonen and Titterton (2004), this might be due to the fact that the highly selected students have well-developed strategies for gaining good results in their courses, which are independent of their motivation, beliefs and attitudes. Townsend et al. (1998) concluded that although the problems are not necessarily visible at the level of grades in terms of correlation, this does not mean that we should be unconcerned about them. Students' beliefs and attitudes may influence not only their enjoyment of the subject but also the likelihood that they will select it for further study. The consequences might also appear in career selections later on (e.g. Onwuegbuzie 1997). The aim of the current study is to explore whether there are any correlates to the difficulties experienced in research learning that we should be worried about, such as, motivation to learn research or views of the nature of working life.

Approaches to learning and situational orientations

Students' conceptions of the learning of research methods might be embedded in more general conceptions of learning and studying. According to Entwistle et al. (2001), conceptions of learning are derived from the cumulative effects of previous educational and other experiences, and thus tend to be relatively stable and to influence, to some extent, subsequent ways of thinking and acting. Therefore, in the learning of research methods, students' previous experiences influence their way of thinking about the learning tasks, which influences their ways of learning when attending research methodology courses.

According to Lindblom-Ylänne and Lonka (1999), students' conceptions of learning, approaches to learning, and the level of processing may be roughly divided into two categories: surface-level reproduction (or memorizing) versus deep-level transformation (or construction) of knowledge, the latter being associated with qualitatively better learning (see also Marton and Säljö 1976, Entwistle and Ramsden 1983). More general ways of orienting oneself towards learning have been called 'learning orientations'. According to Vermunt (1996), learning orientations refer to the whole domain of personal goals, intentions, attitudes, worries and doubts of students in relation to their studies, and they are supposed to influence learning, because students mainly use the activities they think are best suited for realizing their personal goals. Learning orientations may be studied as general or as context specific, relating to some specific topic or domain. In the case of the learning of research methods, it is important to study students' learning in the specific context of research.

In addition to context, students' behaviour on the very moment of learning may be important to understand the quality of learning. Lehtinen et al. (1995) have developed a theory of situational orientations, which is concerned with the target of an elementary school pupil's focus at a specific moment. When given a task, some pupils start to solve the given task, i.e., they are task-oriented. Some pupils are not task-oriented, but instead they have an ego-defensive or a socially motivated orientation that draws their cognitive activities away from the task. Ego-defensive orientation means that the pupil is most concerned about the coping of 'the self' when given a task, and her or his self-efficacy is low. The socially-oriented pupil uses her/his energy to please the teacher and does not really try to solve the task (Olkinuora and Salonen 1992). Situational orientations seem to be established gradually through children's and adolescents' learning histories in family and school contexts (Vauras et al. 2001).

In the case of university students' research learning, this type of situational orientation theory might explain why some students do not seem to behave in a task-oriented manner. Students' previous experiences are probably important for their situational orientation. For example, students' conceptions about mathematics might be laden with negative emotions, which subsequently result in ego-defensive orientation in domains such as research methodology, because of the superficial similarity with mathematics. One defensive strategy students might use in this kind of situation is to deny the practical meaning of research skills for their future life.

Students' views of their need for research skills

Research has shown that the conceptions people hold have implications for or relations to their other beliefs, orientations or behaviour, as was discussed above. In the educational context, students' conceptions of learning have been found to have an impact on study

outcomes, study orientations, and approaches to learning (e.g. Lonka and Lindblom-Ylänne 1996; Marton and Säljö 1976; Entwistle and Ramsden 1983; Vermunt 1996). Furthermore, when studying other populations, these conceptions have been found to be connected to other factors. When studying teachers, Trigwell and Prosser (1996) found that the strategy adopted by university science teachers matches the intentions they have in their teaching. Boulton-Lewis et al. (2001) found that secondary teachers' conceptions of students' learning are generally consistent with their conceptions of teaching. Similarly, it could be assumed, on the one hand, that students' conceptions, views and beliefs on research learning have an impact on their learning and also on their view of the importance of research skills in their future work; while on the other hand, these views might have an impact on their preparedness for their future work.

In the case of research methods and statistics, some students may consider these skills as unnecessary in real working-life situations, and thus they do not bother to study them. In a study by Onwuegbuzie (1997), students who displayed the highest levels of statistics anxiety, tended to view statistics as irrelevant for their future academic or career development. If students consider these skills as unnecessary, the question is whether this is due to the instruction or to other factors.

Traditional formal education with minimal work practice may not be able to prepare students with realistic conceptions of the nature of their future work and the skills needed in it. For example, in a study concerning professionals' and students' beliefs about skills needed in the domain of education and computer science, it was found that professionals rated the need for decision-making skills, problem-solving skills and higher-order thinking skills higher than students in general (Tynjälä et al. 2002). Many aspects of instruction may have an effect on students' views on the subject. As was discussed above, in the context of prototype theories, if the subject to be learnt is experienced as dull and uninteresting, it may arouse prototypical images of people working in the field as dull and uninteresting, which is not what students want to become like themselves (Hannover and Kessels 2004). The general views and stories that students and even teachers may tell at university may be harmful (e.g. Orr 1990). For example, teachers may guide students to prefer some methods by preferring them themselves, or by telling stories that make certain methods sound acceptable, or, on the other hand, old-fashioned or even bad.

Students' views may, of course, also be influenced by other factors than academic instruction. For example, cultural conceptions, such as "mathematical subjects are hard to understand", or stories and attitudes of peers, parents, the media etc. may create the basis for one's own conceptions. Students may also have formed negative or unrealistic views of future working life, even before they start their education at university. On entering university, some students may not know that their major subject includes research courses, or that research courses include statistics. In addition, these students probably do not know, before they start their education, that such skills are needed in jobs they will apply for in the future. If they were aware of these, they might have considered choosing another major subject. Students may cope in this situation by starting to believe that there really is no need for these skills in real working life.

Mistaken views of future work requirements may be harmful for students in many ways. First, these views may direct their motivation towards learning and the selection of courses. This is very probable on the basis of studies on conceptions and behaviour, as noted above. Second, students may enter working life with insufficient knowledge and inadequate or false views concerning their tasks. Thus, they may not be able to perform their job, whether in research, in the public or the private sector, to the best of their abilities.

Method

The goal of this study was to investigate whether learning approaches, situational orientations and difficulties experienced in research learning are related to students' views about the need of research skills in their future work. The aim was also to find out whether the result was bound only to a specific population, e.g. to Finnish students, or whether it was more general. A space triangulation method was used for the study. According to Cohen et al. (2000), the space triangulation method attempts to overcome the limitations of studies conducted within one culture or subculture. To study whether the results are similar in different populations, we used samples from two countries, Finland and the USA.

The participants of the study were 46 education students in Finland and 122 psychology students in the USA. The questionnaires were handed out and collected by the teacher or by the researcher at the beginning and at the end of a quantitative research course.

Recent studies on motivation have emphasised the impact of context and situation. In the learning of research, these are important factors. To study the context, i.e. a specific domain to be learnt, in a specific learning situation, we gathered the data methods classes, asking students to imagine a statistical task-solving situation when answering how they believe they would behave. This, of course, does not give us the kind of information about real behaviour in the situation that socio-constructivist theories aim at with interviews and video-stimulated recall interviews (e.g. Op't Eynde et al. 2001), but it does give us information about how students believe they would feel and behave.

The questionnaire consisted of four parts. First, 21 questions measured the experience of difficulty in quantitative methods course. The items were based on a study by Murtonen and Lehtinen (2003), where students answered open-ended questions about difficulties in the learning of quantitative methods. Items were, for example: "I'm not interested in quantitative methods", "I'm not good at mathematics and that's why I'm not good at methodology", "Statistical tests are difficult to understand (i.e. what they do and why)", "The teaching is too superficial", "Methodological skills are easy to forget, because you don't need them daily", "It's hard to see links between different parts of research methodology", "Too many new concepts are introduced too fast during courses", "Teachers don't see and understand students' problems" and "Methodological books are difficult to understand". The scale was from 1 = strongly disagree, to 5 = strongly agree.

The second part of the questionnaire was aimed at measuring the learning approaches. It consisted of eight questions that were based on the work of Entwistle and Ramsden (1983), and Marton and Säljö (1976). The items about surface orientation stated, for example, "I try to learn as much as possible by heart for the examination" and "I expect the teacher to say exactly which tasks will be in the examination", and questions about deep orientation, for example, "I am thinking how I could apply the knowledge in everyday life" and "If I can't understand something during a lecture or when I read the text book, I try to find more information about the subject by myself".

In the third part of the questionnaire, 12 questions were set to measure situational orientations, based on the theory by Olkinuora and Salonen (1992). Four items measured task-orientation, four items social orientation, and four items ego-defensive orientation. Task-orientation items were, for example, "I begin to solve the problem at once, because I want to solve it for myself" and "I am eager to try to solve it so that I can learn more". Examples of social orientation items were: "I try to solve it because the teacher might remember it when giving me my grade", and "I want to solve the problem so that other students can see how smart I am". Examples of ego-defensive orientation items were:

“I refuse to even try to solve it, because I would fail anyway” and “I feel uncomfortable in the situation”.

Finally, there was a question about the view of the need for research skills in working life: “Do you think you will need research methodology and statistics skills in working life?” Alternative answers were “Yes”, “No”, and “Maybe”.

The questionnaire was pre-tested and inoperative questions were removed. Group comparisons were conducted with parametric tests, and for post hoc tests the Tuckey HSD test was used.

Results

Students' views of their future work

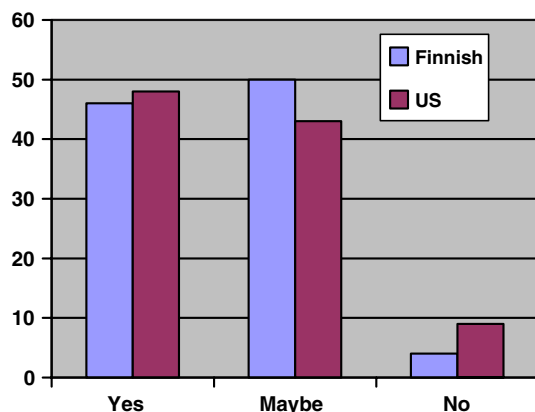
The question measuring the students' views of their future work “Do you think you will need research methodology and statistics skills in working life?” had three alternative answers: “Yes”, “Maybe”, and “No” (see Fig. 1). Only two of the 46 Finnish students checked the box “No” (4%), and thus we used the “Yes” and “Maybe” answers as a grouping variable and left the two students who answered “No” out of this analysis. The two groups were quite equal in number; 21 answered “Yes” and 23 answered “Maybe”. The US students used the “No” option slightly more often. Of 122 students, 11 answered “No” (9%), 53 “Maybe” and 58 “Yes”. All the US groups were used in the analysis.

Situational orientations

The 12 questions measuring orientations were divided on a theoretical basis into three groups: task-orientation (4 questions, Cronbach's alpha for Finnish .76 and for US .79), social orientation (4 questions, Cronbach's alpha for Finnish .85 and for US .79) and ego-defensive orientation (4 questions, Cronbach's alpha for Finnish .68 and for US .64).

The Finnish students' answers were on a moderate level in the task-orientation scale ($M = 2.96$, $SD = .75$), while the US students' task-orientation was slightly higher ($M = 3.29$, $SD = .92$; $t(164) = -2.12$, $p < .05$). Also in ego-defensive orientation, the

Fig. 1 Percentages of students' answers on whether they think they will need research and statistics skills in their future working career at the beginning of the course



Finnish students ($M = 2.44$, $SD = .79$) had rated the items lower than the US students ($M = 2.81$, $SD = .83$; $t(164) = -2.56$, $p < .05$). On the social-orientation scale, the differences between the countries were highest, because the Finnish students ($M = 1.99$, $SD = .74$) rated these questionnaire items very low compared to the US students' ratings that were quite moderate ($M = 2.99$, $SD = .94$; $t(165) = -6.40$, $p < .001$).

Next, the "work view" groups were compared in their situational orientations (see Table 1). Both the Finnish and the US work view groups differed significantly in task-orientation and in ego-defensive orientation. The Finnish group, which saw research skills as useful in their future work, i.e. the "Yes" group, was more task-oriented and less ego-defensively oriented than the other group. The US "Yes" group was more task-oriented than the "No" group but there was no difference to the "Maybe" group. The US "Yes" group was less ego-defensively oriented than both the "No" and "Maybe" groups. None of the groups, either in Finland or in the US, differed as regards social orientation. To conclude, seeing research skills as important was connected to high task-orientation and low ego-defensiveness.

Learning approaches

For learning approaches, four questions were used to measure a deep approach (Cronbach's alpha for Finnish .74 and for US .57) and four questions to measure a surface approach (Cronbach's alpha for Finnish .58 and for US .52) in the learning of quantitative methods. The alphas were low, and thus the results concerning learning approaches should be considered preliminary.

In general, students in both countries reported high deep approach values (FIN: $M = 3.65$, $SD = .71$; US: $M = 3.74$, $SD = .70$), and there were no differences between the countries. In surface approach, the US students ($M = 3.69$, $SD = .72$) reported high values, while the Finnish students had only moderate values ($M = 3.10$, $SD = .66$; $t(166) = -4.88$, $p < .001$).

Both the Finnish and the US work view groups differed in their deep learning approach (see Table 2). The "Yes" groups reported deeper approaches than the Finnish "Maybe" group and the US "No" group. The US groups did not differ in surface approach, where all values were high. The Finnish "Yes" group had a lower mean on surface approach than the other group, but the difference did not reach statistical significance. In any case, the results

Table 1 Finnish and US students' situational orientations in different work view groups

Situational orientation	View on the need for research and statistics skills in working life						
	Finnish students			US students			
	"Yes" <i>M/SD</i>	"Maybe" <i>M/SD</i>	<i>t</i>	"Yes" <i>M/SD</i>	"Maybe" <i>M/SD</i>	"No" <i>M/SD</i>	<i>F</i>
Task-orientation	3.23/ .76	2.66/.63	$t(41) = 2.67^*$	3.44/ .96	3.27/.83	2.52/ .76	$F(2,118) = 4.98^{**}$
Social orientation	1.99/ .73	1.99/.71	$t(42) = -0.01$	2.90/ .96	3.13/.89	2.73/ 1.03	$F(2,119) = 1.31$
Ego-defensive orientation	2.18/ .89	2.66/.66	$t(42) = 2.66^*$	2.59/ .82	2.96/.83	3.25/ .49	$F(2,117) = 4.71^*$

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Table 2 Finnish and US students’ learning approaches in different work view groups

Learning approach	View on the need for research and statistics skills in working life						
	Finnish students			US students			
	“Yes” M/SD	“Maybe” M/SD	<i>t</i>	“Yes” M/SD	“Maybe” M/SD	“No” M/SD	<i>F</i>
Deep approach	3.95/ .71	3.36/.54	<i>t</i> (42) = 3.13**	3.84/ .70	3.78/.61	3.00/ .71	<i>F</i> (2,117) = 7.53***
Surface approach	2.89/ .71	3.23/.58	<i>t</i> (42) = -1.72, <i>p</i> = .09	3.60/ .77	3.76/.70	3.84/ .46	<i>F</i> (2,119) = 0.96

Note: * *p* < .05, ** *p* < .01, *** *p* < .001

on surface approach should be considered with caution, because the Cronbach’s alphas for sum variables in both samples were low. The main conclusion concerning the learning approaches is that the students with a deep approach were most sure of the need for research skills in working life.

Experience of difficulty

All 21 questions measured the experienced difficulty in the learning of quantitative methods. (Cronbach’s alpha for 21 questions was for Finnish .89 and for US .92). The Finnish students (*M* = 2.93, *SD* = .50) experienced more difficulties than the US students (*M* = 2.60, *SD* = .65; *t*(163) = 3.11, *p* < .01). The Finnish work view groups differed in their experience of difficulty (see Table 3). The group, who saw these methods as important in their working life, experienced fewer difficulties in methods courses. The US “Yes” and “Maybe” groups had fewer difficulties than the “No” group. The US groups’ variances differed significantly, and thus we conducted a Kruskal-Wallis median test to confirm the difference. The test resulted in a difference that was almost significant ($X^2(2) = 5.62, p = .06$).

Do views alter during a course?

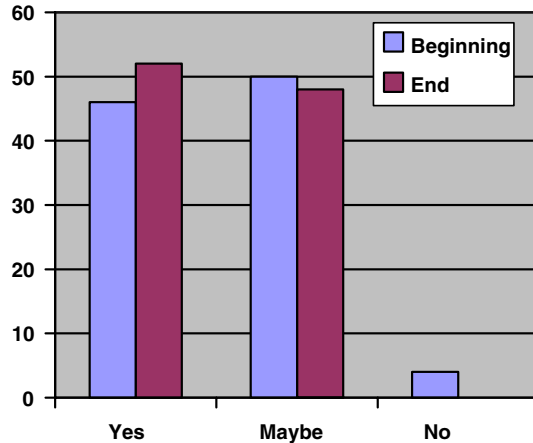
The students were asked to answer the question “Do you think you will need research methodology and statistics skills in working life?” both at the beginning and at the end of

Table 3 Finnish and US students’ experienced difficulty in university quantitative research courses in different work view groups

	View on the need for research and statistics skills in working life						
	Finnish students			US students			
	“Yes” M/SD	“Maybe” M/SD	<i>t</i>	“Yes” M/SD	“Maybe” M/SD	“No” M/SD	<i>F</i>
Experienced difficulty	2.72/ .46	3.04/.40	<i>t</i> (41) = - 2.47*	2.46/ .60	2.62/.61	3.21/ .73	<i>F</i> (2,117) = 6.88**

Note: * *p* < .05, ** *p* < .01, *** *p* < .001

Fig. 2 Percentages of Finnish students' answers at the beginning and at the end of the course, to whether they think they will need research and statistics skills in their future working life



the course. Of the 46 Finnish students who returned the questionnaire at the beginning of the course, 33, i.e. 72%, were present and returned the questionnaire at the end of the course. Of the students who answered “Yes” the first time, 71% were present at the second measurement at the end of the course, and 20% of them had changed their opinion to “Maybe”. Of the students who answered “Maybe” at the beginning, 78% were present in the end, and 28% of them answered “Yes” at the end of the course. The two students, who answered “No” at the beginning, were not present at the end. Altogether, at the end, 17 students answered “Yes” and 16 “Maybe”. In general, the Finnish students’ views did not seem to change much during the course, although a change might be seen towards a slightly more positive view (Fig. 2).

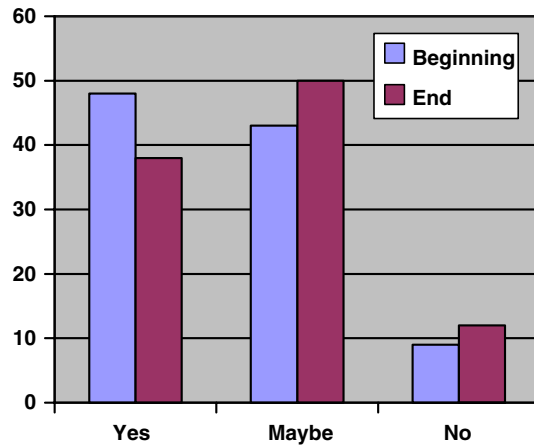
Only 58 of the 122 US students were present at the end of the course, resulting in a response rate as low as 48%. Of these 58 students, 14 could not be identified as students who gave an answer at the beginning, i.e., they were either not present in the first lecture or they did not give their name, and thus it was impossible to identify them. Of these 14 students, 13 answered this question.

Of the students who answered “Yes” in the first time, 38% were present at the second measurement, and 45% of them had changed their opinion to “Maybe”, while two (9%) had changed their opinion to “No”. Of the students who answered “Maybe” at the beginning, 36% were present in the second measurement, and of these 19 students, 58% kept their view, 32% changed it to “Yes”, and 10% changed it to “No”. Of the four students who answered “No” at the beginning and were present at the second measurement, three answered “No” and one answered “Maybe” at the end of the course. Due to the low response rate, we cannot really say whether the views did or did not remain the same at the beginning and at the end. Some kind of change might be said to have occurred towards a less positive view (Fig. 3).

Discussion

About half of the students in both countries were not convinced that they would need research and statistics skills in their future work. This is quite worrying when considering the central role of understanding, using and applying research knowledge in the

Fig. 3 Percentages of US students' answers at the beginning and at the end of the course, to whether they think they will need research and statistics skills in their future working life



information society. It is not only researchers who need these skills, but the skills are needed in all kinds of jobs where it is important to constantly follow new knowledge, understand phenomena with the aid of scientific thinking skills, and to be able to act as an active knowledge builder in society. Naturally, this includes the skills to understand how research is conducted. If students do not see the value of these skills for their future life and work, they may have problems in their motivation to learn research skills. If the only goal is, for example, to pass compulsory courses or get a thesis done, we should be asking why waste a great deal of time and resources in teaching these students research skills. If we agree that the contents of the education are meant for real life, not just for course work, we should help students understand why these skills are important for their future working life.

The Finnish and the US students did give different answers to the question on views of future work. This may be due to cultural differences in answering these types of questions. There is also a possibility that the country groups or discipline groups may differ from each other. Regardless of the fact that the Finnish students did not use the “No” option, the results were very similar in both groups. The groups in both countries expressed quite high task-orientation in an imaginary statistical task-solving situation, and reported quite low ego-defensive orientation.

The results of this study showed that views of future work, motivational factors and difficulties were connected to each other. In both countries, the students who were not sure whether they will need research skills in their future work, were less task-oriented and less deep-oriented, more ego-defensive, and experienced more difficulties in quantitative research courses than the groups who thought they would need these skills. Thus, on the basis of the situational orientation theory (Lehtinen et al. 1995), it is probable that, in a learning situation, these students cannot concentrate on learning as well as the students who reported better task-orientation. This may further have an impact on the quality of their learning. According to the situational orientation theory (Olkinuora and Salonen 1992), the ego-defensively oriented students may see possible future work tasks that require skills in research as a threat to the ego, and thus they deny the value of these skills. Neither do they approach these studies with a deep learning approach. The high difficulties experienced by these students, compared to other groups, also reflect problems with understanding the subject to be learnt.

On the basis of the Finnish students' answers at the second measurement, views did not change much during the one semester course. Only 37% of the US students were present at

the end of the course, and thus we cannot be sure how the whole group's views changed or did not change. The US students, who were present, had changed their views in a more negative direction.

These results show that learning approaches, situational orientations, difficulties experienced in learning and views of future work form a connected web. Difficulties and harmful views seem to accumulate for some students, and although we do not know how they will behave in their future work, we know from the results of this study that the students, who had difficulties, did also think they might not need research skills in their future work. We also know from prior studies (Murtonen 2005) that difficulties experienced in research learning are connected to accepting the relevance of the method to be learnt. The experienced difficulties may thus have some impact on students' behaviour in their later studies, i.e. what courses they select, or on their future work, i.e. how able and willing they are to deal with problems that require understanding of research. Thus students' difficulties experienced in research learning should be taken seriously.

If the results of this study are interpreted in the manner that the high task orientation and deep learning approach result in seeing research skills important in working life, teachers should foster these learning factors in their teaching. If, on the contrary, we think that the working life views influence students' learning behaviour, these views should be tackled in teaching.

Whatever the explaining factor is, or whether the problems accumulate each other, it is important to consider all of these problems in research teaching. Teachers should discuss with students' their working life views and the possible difficulties that they have experienced in their learning of research methods. Discussions concerning students' conceptions of research and learning of research are also important in helping students to become aware of the factors that may affect their learning. In order to enhance students' understanding of the need of research skills in working life, connections from research learning to real working life situations should be made. These changes are not to be implemented only on the level of individual courses, but also on the level of curricula (Leech et al. 2007). Students' awareness of their thoughts and views gives them better possibilities to regulate their learning. Linking teaching to real working life tasks helps students' to build up realistic view about their future work.

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