

## Learning Workplace-Relevant Competence in Agricultural Sciences Courses: Students' Perceptions

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The aim of this Scholarship of Teaching and Learning (SoTL) study was to examine instructional methods that promote students' generic workplace-relevant competence in university education. We investigated courses that differed from each other in their ways to engage students in practicing collaborative knowledge work and career skills. Students from three agricultural sciences courses answered a questionnaire to self-assess their learning of collaborative knowledge-work practices and studying in the courses. The students assessed that the course based on real project work supported the learning of collaborative knowledge practices better than the courses that did so through simulated practices or group work for content learning. Students appreciated tasks where they did something for further use, like producing a CV or solutions for a customer. The results indicate that authenticity of course activities and outputs are important characteristics of assignments aiming at enhancing workplace-relevant competencies and learning of knowledge-work practices.

University students' opportunities to learn competences for their future careers depend on the characteristics of the module assignments of the course they attend. The importance of workplace-relevant competence for present day and future professionals is increasingly being acknowledged in research universities, which have traditionally emphasized disciplinary content as well as academic and research skills in the education they provide (Cremers et al., 2016; Kember, 2009). Politicians have also emphasized that university studies should include the teaching of generic workplace-relevant skills (OECD, 2012). Important competences required in current labour markets are related to self-initiative, communication, teamwork, networking, project management, problem solving, and the effective use of digital technologies (Barrie, 2012; Broussard et al., 2007). In literature, concepts including transferable skills (Ruuskanen et al., 2018); job readiness (Moore & Morton, 2014), workplace skills (Benbow & Hora, 2018), industry-relevant competences (Jackson, 2010), and career management skills (Bridgstock, 2009) have been used when referring to abilities that are central in the transfer from university to work.

According to Knorr Cetina (2001), the new competence requirements for the academic workforce are due to changes in society, emphasizing knowledge creation, innovation, and knowledge economy. Knowledge work is characterized by working with large amounts of information and abstract knowledge, non-routine problem-solving and the unpredictability of work processes, low levels of standardization, changing collaborators and technologies, and the creation of knowledge artefacts as the primary focus (Barnett, 2012; Pyöriä, 2005). Paavola and Hakkarainen (2005) regarded the ability to collaboratively create knowledge as central to workers in both present-day and future knowledge-intensive societies. They suggested adopting the knowledge creation approach to learning in settings whose aim is to advance students' competences in collaborative knowledge work. Design principles for knowledge creation pedagogy include collaboration in shared objects, the integration of individual and collective agency, foster-

ing long-term processes of knowledge advancement, development through transformation and reflection, cross-fertilization of practices across communities of expertise, and the application of flexible digital tools for co-creation (Paavola et al., 2011).

Based on these requirements, new courses were developed for an undergraduate degree offered by the Department of Agricultural Sciences at a research university to promote abilities among students that will be needed in their future careers in knowledge-intensive academic professions. According to Østergaard et al. (2010), modern agriculture has become multi-functional and multi-dimensional, which has led to new requirements to develop the teaching of agriculture in universities. In line with the key requirements of SoTL (Kern et al., 2015), we studied the impact of the courses on students' learning and experiences through systematic and sustained research efforts. We compared students' competence learning by their self-reflections, using a validated survey instrument in three courses that differed from each other in the key characteristics of course assignments related to collaborative knowledge work and career skills.

### INSTRUCTIONAL METHODS TO SUPPORT THE DEVELOPMENT OF WORKPLACE-RELEVANT COMPETENCE

It has been proposed that instructional methods such as group work, problem-solving, project work, and industry connections are beneficial for the development of students' generic and workplace-relevant skills (Crebert, 2004; Lakkala et al., 2015; Virtanen & Tynjälä, 2018). Previous studies have divided course designs promoting students' competences for knowledge work and capabilities for the higher education labour market into three main approaches.

One approach is to enrich conventional lecture courses with methods that bring some characteristics of knowledge work into course activities, such as open-ended problems, authentic examples, or group work (Burdett, 2003; Hortigüela Alcalá, 2019).

Group activities may be small-scale assignments part of lecture sessions, or more in-depth, long-term group work throughout the course both inside and outside lecture sessions. The benefits of group work and applied tasks include improved communication and social skills, an increased knowledge base, and the ability to formulate ideas and apply theoretical concepts (Hansen, 2006; Stover & Holland, 2018; Volkov & Volkov, 2015).

Another approach is to create specific study modules in which the practising of workplace-relevant skills or career skills is the main objective (Landrum, 2015). In such courses, practical skills are taught through organizing activities that simulate or model professional practices (Salminen-Tuomaala & Koskela, 2020). For example, Smarkusky et al. (2005) created study modules for teaching team knowledge skills to information technology students; after these modules, the students assessed their team knowledge skills as being better than those of students in a control group. Stankovic (2009) presented a scenario in which the central elements of professional project work were included in a course but tailored to suit the students' knowledge and skills levels.

A third approach is to offer students opportunities to engage in activities with real work contexts and professionals. Cremers et al. (2016) used the term 'hybrid learning configurations' to refer to learning designs that connect school-based learning with workplace experiences by integrating studying and working into the same learning setting. At best, such configurations consist of interdisciplinary co-creational activities with ill-defined and authentic tasks involving various stakeholders inside and outside educational institutions. Project courses are good examples of such methods: they engage students in producing tangible and meaningful results in cooperation with professionals, possibly for real use in the field (Muukkonen et al., 2010; Viswanathan et al., 2012). Project courses have been found to promote various workplace-relevant skills including self-efficacy, communication, teamwork, problem-solving and information management skills (Krsmanovic, 2021; Terrón-López et al., 2017).

In the present case, the motivation for course development was feedback received from students to have more courses that were oriented towards the real practices of the field (Kymäläinen et al., 2013). In addition, the university had a degree reform to take into account workplace relevance in all teaching and to include specific workplace-relevant study that amounted to at least ten credits (ECTS) in all bachelor's-level study programs. Therefore, we applied all three above-mentioned course design approaches to offer workplace-relevant courses for Agricultural sciences students at different stages of their undergraduate studies.

## AIMS AND RESEARCH QUESTIONS

To contribute to previous research, this study aimed to gain a better understanding of the instructional methods that promote students' generic workplace-relevant competence in university education. The study examined how university courses, differing from each other in the key characteristics of course assignments related to collaborative knowledge work and career skills, provide opportunities for students to learn workplace-relevant competences. As it is difficult to define workplace-relevant competence in general terms, we chose to concentrate on the competences required in collaborative knowledge work, and the students' own perceptions of the courses. We addressed the following research questions:

1. **How did the students in three agricultural sciences courses evaluate their learning of collaborative knowledge-work practices?**
2. **How did the students perceive that the instructional methods supported or hindered the learning of competences for collaborative knowledge work and future careers?**

## METHODOLOGY

A multiple case study design (Yin, 2013) was used to investigate the students' course experiences. We examined three courses, with three iterations from two courses and two iterations from one course. We investigated authentic courses in specific contexts and improved the subsequent iterations of the course designs based on students' perceptions as Blair (2013) proposed to be relevant to SoTL. However, we also compared the research results between the courses in order to gain new perspectives on the complex relationship between pedagogical practices and competence learning more generally. The statistical comparisons represent explorative rather than experimental approaches because of differences in the course settings.

## Context

The examined courses were part of an undergraduate degree offered in 2015–2018 by the Department of Agricultural Sciences at a research university. The courses represented prototypical cases in their pedagogical solutions to promote transferable skills relevant to the world of work: a lecture course enriched by applied tasks and group work for substance learning; a career skills course including a rich assembly of assignments for practising career-relevant skills, and a project course based on a project assignment for a customer. The course designs were as follows:

The *Substance course* ('Sustainable agricultural production: from field to table and back', 5 ECTS credits) was a lecture course redesigned as blended learning with a rich collection of activities, not typical in traditional lecture courses. The purpose was to promote workplace-relevant knowledge and skills through a holistic, systemic approach to the topic as well as through tasks such as group work and the application of theoretical knowledge. The course was obligatory for first-year agricultural sciences students. It lasted seven weeks, and entailed three meetings every week (about 30 hours in total). It consisted of expert lectures and small-scale group activities during the lectures, weekly group tasks as homework, individual home essays, but no final exam. All the tasks had a certain percentage weight in the formulation of the final course grade (1–5).

The *Career Skills course* ('Project management and work life skills', 3 ECTS credits) aimed to provide an overview of practices in the labour market through individual assignments that supported job-seeking skills and group assignments for practising team and project work. The course was targeted at third-year undergraduate agricultural sciences students. It was voluntary for the participants in its first iteration, but in subsequent iterations, it was obligatory for most participants (depending on their study programme). The course duration was seven weeks, including two meetings every week (25–29 hours in total). Course assignments included writing a personal CV and a job application, giving a

personal ‘elevator pitch’, interviewing a professional in the field in pairs, practising arguing in groups, and producing a group project plan. In the first iteration, the project topic was defined by the lecturers and was arbitrary, but in the other iterations, the topic was given, and the solutions evaluated by experts from another university unit, based on the goal of an existing project. The course was graded on a pass or fail scale.

The *Customer Project* course (‘ProjectWork’, 5 ECTS credits) was built around project work assignments for customers in the field. We investigated the first implementations of the course also separately to gather students’ experiences of this type of project course (Mäkelä et al., 2017; Kymäläinen et al., 2018). It was a voluntary applied course for agricultural sciences bachelor’s and master’s students, targeted at third year students and above, and its aim was to practise real project work. The course consisted of three meetings, lasting three hours each, for all students and supervisors, and some team-based supervision and customer meetings. The first iteration of the course was 11 weeks but was later extended to 16 weeks on the basis of student feedback. Student teams prepared a project outcome for a customer in a business or a national government department. The potential customers suggested the project themes in advance. The students applied for entry to the course by letter, in which they also presented the project topics in which they were interested. Each lecturer supervised the project work of a team. For the final course grade (1–5), student groups, supervisors, and customers each made a summative evaluation using the relevant parts of a common evaluation matrix.

### Participants and Data Collection

Data were collected from multiple implementations of all three courses investigated. We asked the students to complete an online questionnaire during the last course session. We emailed the participants who had been absent from the last meeting, requesting them to answer the questionnaire. Table 1 provides information on the background and number of participants and the questionnaire response rates. In the Substance course, participation in the last contact session was not compulsory, and this had an effect on the response rate.

the questionnaire was to collect feedback on course-specific outcomes in a format comparable across courses, concentrating on the self-evaluated learning of knowledge work practices in a course, and not on the general level of competence mastery. It consisted of 27 statements asking students to evaluate, on a five-point Likert scale, how well they had learnt collaborative knowledge-work practices (e.g., During the course, I learnt ... to take responsibility for shared group work, or ... to develop further ideas together with others). The statements were grouped under seven scales (Muukkonen et al., 2020): Learning to collaborate on shared objects, Integrating individual and collaborative work, Iterative development through feedback, Persistent development of knowledge-objects, Understanding various disciplines and practices, Interdisciplinary collaboration and communication, and Learning to exploit technology. The theoretical basis of the questionnaire was the knowledge-creation approach to learning (Paavola et al., 2011)

In addition to direct statements, the questionnaire had three open-ended questions on what was positive or impressive, what was challenging or disruptive, and other comments about the course. The purpose of these questions was to collect students’ spontaneous perceptions of the instructional methods and studying in the courses.

### Data Analyses

To examine whether the course means on the Collaborative Knowledge Practices questionnaire scales differed among the courses, we first carried out Levene’s test of homogeneity of variance on the groups. However, we found that this violated the assumption of homogeneity ( $p < .04$  for four scales) and proceeded to use the nonparametric Kruskal-Wallis H test, which is robust in dealing with violations of this statistical assumption. A subsequent Mann-Whitney U test was used in a post hoc fashion to explain the significant main effect through pairwise comparisons. A Cohen’s d was calculated from the H as a measure of effect size (Lenhard & Lenhard, 2016).

The students’ responses to the open-ended questions were analysed using thematic content analysis (Braun & Clarke, 2006) with quantification of analysis results (Chi, 1997). First, text pieces

**Table 1. Information on investigated courses.**

Courses and participants	Iteration	Gender distribution M/F	Average age (SD)	No. of students who completed the course	Responses to questionnaire N / %
Substance: Mainly 1st year students, about half from agricultural sciences	1	5 / 12	26.4 (6.6)	60	17 / 28.3
	2	3 / 19	24.6 (8.7)	71	22 / 31.0
Career Skills: Mainly 3rd year agricultural sciences students	1	12 / 14	26.8 (7.1)	29	26 / 89.7
	2	3 / 13	23.3 (3.0)	26	16 / 61.5
	3	6 / 28	26.1 (7.0)	41	34 / 82.9
Customer Project: Bachelor’s and master’s level agricultural sciences students	1	1 / 7	30.0 (6.6)	8	8 / 100.0
	2	1 / 11	26.3 (5.5)	15	12 / 80.0
	3	4 / 5	31.6 (12.3)	10	9 / 90.0
Total				260	144 / 55.4

We adapted the Collaborative Knowledge Practices questionnaire from previous studies to examine the university students’ self-assessment of their learning of knowledge-work practices and their course experiences (Laakkonen & Muukkonen, 2019; Karlgren et al., 2020; Muukkonen et al., 2020). The purpose of

containing single mentions of the evaluation of instructional methods or studying were selected for coding. In all, we selected 584 propositions from the answers. We further analysed separately the things that were experienced as positive or impressive ( $f=316$ ), or challenging or disruptive ( $f=268$ ) in the propositions. In a more

detailed analysis, we constructed the main categories by building on earlier studies (Kymäläinen et al., 2018; Lakkala et al., 2015) and created sub-categories in a data-driven manner in order to maintain contextual perspectives. The final categories were the following:

- Positive or impressive
  - *Entity and structure*: course quality, atmosphere, differences to other courses, appropriate workload, well organized and scheduled;
  - *Content*: interesting and useful content, variety of viewpoints;
  - *Tasks and activities*: requirements and assessment, meaningful tasks, project work, job-seeking practices, group work, activating lectures, variety of tasks;
  - *Teaching and guidance*: good lecturing and materials, streaming of lectures, feedback received;
  - *Collaboration*: group work practices, group members, collaboration with customers;
  - *Outcomes*: job-seeking knowledge and skills, workplace knowledge and skills, learning something new, project work knowledge and skills, group work result, group work skills, information and digital skills, networking.
- Challenging or disruptive
  - *Entity and structure*: heavy workload, resources, poor scheduling, overlapping tasks and deadlines, unclear course structure;
  - *Content*: irrelevant content, difficult content, unintegrated themes;
  - *Tasks and activities*: challenges in completing tasks, irrelevant tasks, requirements and assessment;
  - *Teaching and guidance*: unclear instructions, poor guidance, poor lecturing and materials;
  - *Collaboration*: group work practices, uneven collaboration, coordination of schedules.

The final categories were constructed iteratively, moving back and forth within the data set, the coded propositions, and the categories produced; combining categories or creating new ones based on the increased understanding of the data (Braun & Clarke, 2006). One author carried out the first coding, which was then examined together with the other researchers. Disagreements were discussed and changes made if needed. The coding was conducted using Atlas.ti version 7.5.18. The comparison of differences between the category frequencies of the courses was conducted using the  $\chi^2$  test.

**Table 2. The comparison of students' self-evaluations on the CKP scales by course and mean rank (Kruskal-Wallis H test).**

Scale	Course	N	Mean Rank	H	df	p	Cohen's d
Collaborate on objects		144		19.8	2	< .001	.76
	Substance	39	60.22				
	Career Skills	76	67.38				
	Customer Project	29	102.45				
Integrate efforts		144		27.2	2	< .001	.93
	Substance	39	58.24				
	Career Skills	76	66.40				
	Customer Project	29	107.66				
Feedback		144		41.8	2	< .001	1.26
	Substance	39	45.48				
	Career Skills	76	71.68				
	Customer Project	29	111.12				
Persistent development		144		48.1	2	< .001	1.39
	Substance	39	53.74				
	Career Skills	76	64.26				
	Customer Project	29	119.31				
Various disciplines		144		25.8	2	< .001	.90
	Substance	39	53.55				
	Career Skills	76	70.01				
	Customer Project	29	104.52				
Inter-disciplinary collaboration		144		27.3	2	< .001	.94
	Substance	39	44.18				
	Career Skills	76	79.14				
	Customer Project	29	93.17				
Exploit technology		128		8.5	2	.014	.47
	Substance	39	50.12				
	Career Skills	60	70.94				
	Customer Project	29	70.52				

## RESULTS

### Survey Results of Students' Learning of Knowledge Work Practices

The analysis of the students' responses to questionnaire statements using the Kruskal-Wallis H test indicated that the students in the three courses assessed their learning of the various knowledge work practices as being statistically significantly different (Table 2). Cohen's *d* was indicative of a small to large ( $d > .46$ ) effect for the course.

A pairwise comparison using the Mann-Whitney U test on each scale showed that the students in the Customer Project course scored higher than those in the Career Skills course, who in turn scored higher than the students in the Substance course ( $p < .026$ ). However, there were some exceptions. On the Collaborate on objects scale, the Substance course (Mean rank = 53.5, Mdn = 3.5) and the Career Skills course (Mean rank = 60.3, Mdn = 3.5) did not differ significantly ( $U = 1306.0, p = .29$ ) from each other. Similarly, on the Integrate efforts scale the Substance course (Mean rank = 53.1, Mdn = 3.25) and the Career Skills course (Mean rank = 60.5, Mdn = 3.5) did not differ significantly ( $U = 1292.5, p = .26$ ) from each other, and the Persistent development scale also showed not statistical differences the Substance course (Mean rank = 51.2, Mdn = 3.0) and the Career Skills course (Mean rank = 61.5, Mdn = 3.25) did not differ significantly ( $U = 1215.0, p = .1$ ) from each other. These finding suggest that the learning outcomes on feedback practices, understanding various disciplines, interdisciplinary collaboration and experience with technology were particularly valued by the Career Skills course participants in this comparison.

On the Interdisciplinary Collaboration scale, the Career Skills course (Mean rank = 49.8, Mdn = 2.7) and the Customer Project course (Mean rank = 61.3, Mdn = 3.3) did not differ significantly ( $U = 861.0, p = .082$ ) from each other. Finally, on the Exploit Technology scale, the Career Skills course (Mean rank = 45.1, Mdn = 3.5) and the Customer Project course (Mean rank = 44.8, Mdn = 3.5) did not differ ( $U = 865.5, p = .97$ ) from each other. This suggests that the learning outcomes on collaborative knowledge creation were particularly highlighted by the Customer Project course participants.

### Open-Ended Answers on Students' Perceptions of Course Experience

The positive and negative evaluations in the students' open-ended answers were compared separately. The frequency ratio of positive and negative issues mentioned was as follows: Substance 62/54, Career Skills 127/136, and Customer Project 71/43. Table 3 shows

**Table 3. Comparison of positive or impressive issues in courses reported by students.**

Category	Substance		Career Skills		Customer Project	
	(f)	(%)	(f)	(%)	(f)	(%)
Entity and structure	2	3.2	9	7.1	16	22.5
Content	22	35.5	1	0.8	4	5.7
Tasks and activities	16	25.8	35	27.6	9	12.9
Teaching and guidance	14	22.6	1	0.8	3	4.3
Collaboration	2	3.2	31	25.2	17	24.3
Outcomes	6	9.7	50	38.6	22	31.4
Total	62	100.0	127	100.0	71	100.0

the frequencies and relative proportions of positive or impressive issues in the three courses that the students reported.

According to the  $\chi^2$  test, there was a statistically significant difference between the distribution of the frequencies of the reported positive and impressive issues of the courses,  $\chi^2 (10, N = 260) = 122.27, p < 0.001$ .

The *Entity and structure* category contained positive comments about the course overall and its organization. It was often compared with typical university courses: 'Surprising turns and challenges were good, as usually the course assignments are pretty straightforward.' (Customer Project 2). The course *content* (interesting and useful content, variety of viewpoints) as well as the quality of *teaching and guidance* (good lecturers, streaming of lectures) were mainly addressed by the participants in the Substance course. Apparently, these features were not so central in the other types of courses.

Different features of *tasks and activities* were perceived as positive, depending on the course type. The following features were commended on by multiple students in the courses:

- *Requirements and assessment*: multiple home exams instead of a conventional final exam in Substance courses ('Home exams instead of a traditional exam', Substance 2);
- *Project work*: project planning in Career Skills courses, and the real project work assignment in Customer Project courses ('The option to practise project work for the future', Customer Project 2);
- *Job-seeking practices*: writing a CV and a job application in Career Skills courses.

In addition, some tasks in both the Substance (essay writing, group work, activating lectures) and Career Skills course (expert interview, own presentations, argumentation task, making a portfolio) received single positive mentions.

*Collaboration* was frequently described as positive in both the Career Skills and Customer Project courses, but was hardly mentioned in the Substance course, even though the course had weekly group tasks. The positive comments mainly addressed effective group work practices, for example:

We got the work ready in time and nothing was left unfinished. It was nice to be part of well-functioning teamwork for once. (Career Skills 3)

Similarly, the beneficial *outcomes* listed by the students varied depending on the course. The Substance course students addressed content learning ('New information on sustainable development and climate change', Substance 2) and information or digital skills. The Career Skills course students most often mentioned outcomes related to job-seeking tips and practices ('Issues related to real work from university career services such as CV and job applications were positive', Career Skills 3) as well as project work knowledge and skills. The Customer Project course participants mostly mentioned project work knowledge and skills, produced project results ('Others have also considered the results interesting based on the presentations', Customer Project 3) as well as new contacts.

Table 4 summarizes the frequencies and relative proportions of challenging or disruptive issues reported by the course students.

**Table 4. Comparison of challenging or disruptive issues reported by course students.**

Category	Substance		Career Skills		Customer Project	
	(f)	(%)	(f)	(%)	(f)	(%)
Entity and structure	14	25.9	74	54.4	10	23.8
Content	10	18.5	5	3.7	2	4.8
Tasks and activities	14	25.9	18	13.2	11	26.2
Teaching and guidance	6	11.1	25	18.4	4	9.5
Collaboration	10	18.5	14	10.3	15	35.7
Total	54	100.0	136	100.0	42	100.0

None of the students' comments criticized the course outcomes. According to the  $\chi^2$  test, there was a statistically significant difference in the distribution of the frequencies of the reported challenging and disruptive issues of the courses,  $\chi^2 (8, N = 232) = 43.475, p < 0.001$ .

The results in Table 4 show that depending on their course, the students considered different issues challenging or disruptive. Criticism of the course *entity and structure* focussed on some shortcomings in technical resources as well as on the heavy workload in the Substance course ('The number of essay tasks was huge and the subject area was wide'. Substance 1) and the third iteration of the Career Skills course (in which some tasks were added according to the reported time use by students in previous iterations). In addition, some courses were criticized as having poor scheduling (mostly the Career Skills course and the first iteration of the Customer Project course), too many overlapping tasks and deadlines (mainly in the Career Skills course), and unclear course structure (mostly the third iteration of the Career Skills course):

Time resources and the amount of work in proportion to each other -> too busy (Customer Project 1)

A lot of different submissions and deadlines, some of them alone, some in pairs and some in groups. (Career Skills 3)

Critical comments on course *content*, such as irrelevant and uninteresting or difficult content, mainly came from the Substance course students. Concerning *tasks and activities*, the students found different aspects challenging or disruptive in the three course types:

- *Challenges in completing the tasks*: calculation tasks and home exams in the Substance course, or time management and the project task of the Customer Project course ('The most challenging thing was collecting and analysing the results of the project'. Customer Project 2);
- *Irrelevant tasks*: the weekly group tasks in the Substance course ('In my opinion, the group tasks were totally useless and time-consuming from the point of view of learning'. Substance 2), or project planning in the Career Skills course ('We did group work, but didn't understand its meaning, and didn't feel it was useful to us'. Career Skills 3);
- *Requirements and assessment*: compulsory attendance of lessons in the Career Skills course, or assessment based on weekly tasks of the Substance course.

Dissatisfaction with the quality of *teaching and guidance* mostly related to unclear task instructions, both in the Substance

course ('Unclear, ambiguous (home exam) assignment instructions'. Substance 2) and the Career Skills course ('At the beginning there was a bit of confusion as to what we were supposed to do and at the same time, we had to brainstorm the project'. Career Skills 3). Some students were also somewhat dissatisfied with the lecturing in the Substance course and the guidance in the Career Skills and Customer Project courses.

The challenges and disturbances to *collaboration* were addressed in regard to all the courses, but relatively more so to the Customer Project course, probably because the whole course was based on a demanding group project task. The problems related to ineffective group practices, the uneven contribution of group members, and the coordination of schedules, for example:

Group work was sometimes difficult to get going because not everyone was equally committed to the task and didn't act according to the plans agreed on by the group. (Substance 1)

There were communication challenges within the group, which may have slowed down the progress of the project. (Customer Project 3)

## DISCUSSION

### Students' Learning of Collaborative Knowledge Work Practices

The students' self-evaluated learning of knowledge-work practices, investigated through the Collaborative Knowledge Practices questionnaire, was at a higher level in the courses in which the assignments and activities provided the students with opportunities to engage in long-term projects and teamwork. There was a statistically significant difference between the courses, highlighting several differences between the Subject course and Career Skills course as well as between the Career Skills and Customer Project courses, while all scales showed significant differences between the Subject course and Customer Project course. The effect size remained small for the Exploit technology scale but were intermediate to large for the other scales.

The difference between the Substance course and the other courses in terms of the learning of collaborative knowledge-work practices is understandable, because the course focused on content learning and the role of group work was smaller than in the other two courses. Students in the Career Skills course felt that they had learned feedback practices, understanding of various disciplines, interdisciplinary collaboration and technology use more than students in the Lecture course. Most interesting was the difference between the Career Skills course and the Customer Project course. In both courses, the students completed project work in teams, but in the Career Skills course, the teams made a project plan without implementing the actual project, and the course included other assignments related to various career skills. In the Customer Project course, project assignment was mostly authentic, and the student groups collaborated with and were accountable for their outcomes to a real customer, which offered the students the opportunity to face the challenges of professional knowledge-creation practice. As regards the Interdisciplinary Collaboration and Exploiting Technology scales, there were no statistically significant differences between the Customer Project and the Career Skills courses, perhaps because both courses involved collaboration between

the students and the external experts, even if it was somewhat different in nature, and also because technology usage was similar in both courses.

### Students' perceptions of Instructional Methods and Studying in Courses

The purpose and nature of the course had a major impact on how the students perceived the course assignments and activities. For example, in the Substance course, individual home essays requiring knowledge seeking and synthesizing, as an alternative to conventional exams, were considered beneficial for learning professional knowledge and skills, but group tasks were criticized: group work for only reinforcing content learning was not experienced as effective or motivating. Group tasks were completed outside lecture sessions, relying on the group's self-regulation, which the students complained had created unnecessary practical problems. A solution could have been to organize more support for groups, for example, to explain the benefits of group work for individual learning, to provide class time for group work, or to foster individual accountability through explicit criteria (Hansen, 2006; Stover & Holland, 2018).

Students of the two other courses described group work in positive terms, although they also made many comments about the difficulties in carrying out group work, especially in the Customer Project course. The critical comments addressed challenges in collaboration rather than a negative attitude towards group work assignments as such. Helle et al. (2007) reported similar student perceptions in a project course: project and teamwork assignments were evaluated as challenging and laborious but also as rewarding and valuable. As Kapur (2008) witnessed in his study about 'productive failure', even if students do not succeed in a demanding group task, they might benefit from the experience and learn to cope with the challenges in the future. Feelings of uncertainty and challenge should not be seen as failures but as an integral part of authentic, open-ended, and complex tasks with which students should learn to cope (Barnett, 2012; Muukkonen et al., 2010).

The Career Skills course received contradictory feedback from the students in terms of its goal to promote the learning of various career- and workplace-relevant practices. This course received more critical than positive comments from the students; the critics addressed the large number of overlapping tasks and deadlines, an arbitrary project-planning task, workload experienced as heavy, and unclear instructions. The purpose of the course was to provide students with opportunities to practise multiple skills through a rich assembly of tasks, but this resulted in a somewhat confusing course structure and collection of unintegrated and partly artificial tasks. However, the course also provided the students with a unique opportunity to learn skills for the world of work through bachelor's studies, and the students in this course evaluated their learning of knowledge-work practices more highly than those in the substance-focused lecture course.

Many participants criticized the tight timetable of the Career Skills and Customer Project courses. One challenge in course design is making compromises between course schedules and creating tasks challenging enough to promote competence development.

Students appreciated the tasks in which they did something that could be used for real: producing individual job-seeking documents (CV, job application or LinkedIn profile) or creating a solu-

tion for a customer. Authentic knowledge creation assignments combine disciplinary epistemic practices (Jensen et al., 2012) and generic knowledge-work practices, providing students with opportunities to experience the real complexities of their future profession (Barnett, 2012; Stankovic, 2009). Some Career Skills course students criticized making a project plan just for practising as being unnecessary and unmotivating. The authenticity of the project planning task increased somewhat in the subsequent iterations by involving experts from another university unit who provided the project topic and evaluated the results, but still the difference between the nature of project assignment in the Career Skills course and the Customer Project course was evident from the students' viewpoints. Based on the results of her course redesign study, Krsmanovic (2021) concluded that students' self-efficacy increased particularly through participating in authentic project-based assignments where knowledge was constructed in collaboration and applied to realistic and real-life scenarios. Similarly, in a study by Crebert et al. (2004), graduates felt that various group work activities at university had been beneficial in developing generic abilities such as communication, problem-solving, analysis, and teamwork skills, but they felt that only industry involvement during the undergraduate curriculum exposed them to 'real-world' problems and experiences, such as meeting deadlines or time management.

### LIMITATIONS OF THE STUDY

One limitation of this study was that the evaluation of students' acquisition of knowledge-work competence was based on self-evaluation data. In general, we need diverse methods to capture the learning of complex skills, which are easy to implement in educational practice and apply in SoTL research (Landrum, 2015; Muukkonen et al., 2020). In addition, the students may only later recognize the improvement in their competence and realize the value of course practices, after gaining real workplace experience, but no good methods exist to investigate such long-term effects.

The response rates of the different courses varied due to practical reasons but also the absolute number of participants was different due to the course type and setting. The courses had students from different grade levels and, partly related to that, there is variation in the average age of students between the courses. In addition, only some courses were compulsory for the participants and one course had many non-major students. Different backgrounds may have influenced some of the students' attitudes towards the courses, but it is not possible to assess how the differences affect the results. In the BSc programme of agricultural sciences in question, students in all courses usually have diverse backgrounds in terms of age, work experience, or the specialization within the discipline. This heterogeneity relates to the premises of our research to investigate real courses where the context and students' backgrounds cannot be controlled. We aimed to further investigate the relationship between pedagogical practices and the learning of certain domain-generic competencies that are important for all higher education students regardless of their background (Muukkonen et al., 2022). In addition, our survey instrument does not measure general level of competence mastery, but students' perceptions of their competence learning contextually during a course.

The assignments were changed somewhat between successive implementations of the courses, because we wanted to take

into account the course feedback reported by the students. Valuing students' opinions in course design is in line with the key principles of SoTL (Felten, 2013), but changes can be seen methodologically problematic as regards to statistical comparisons. However, the changes were minor regarding the learning of collaborative knowledge practices and career skills and the lecturers responsible for organizing the courses were the same in all implementations, which ensured that different implementations of the courses were fairly similar.

## CONCLUSIONS

According to the findings, students experience higher levels of learning in collaborative knowledge work competence in courses that have activities that resemble professional knowledge practices. Authenticity is an important characteristic of course assignments, from the viewpoint of both competence development and engagement. Students are ready to put effort into laborious and demanding tasks if they represent relevant disciplinary and professional interests and practices. They especially appreciate tasks that involve doing something that has further use, such as drawing up a CV or a project report for a customer.

Group tasks that are primarily meant for content learning and are based on students' self-directed coordination are not experienced as meaningful or effective for learning professional collaboration practices. The purpose of group work should be made clear to students, and professional ways of collaborating should be explicitly promoted if learning these is an objective of the course.

Students may see the benefits of course assignments differently at different points of their careers. A major challenge is how to design motivating assignments and engage students in career- and workplace-relevant practices in courses for which real-world assignments are not possible, or when the benefits of the assignments can only be fully understood later in life.

Our study about students' perceptions of their competence learning and course practices advanced the scholarship of teaching and learning in the faculty in question by applying research-based methods to examine how the developed undergraduate courses promoted relevant competencies for the world of work (Kern et al., 2015). The study showed that it is important to use multiple research methods by combining quantitative survey data with qualitative open-ended answers to provide a more comprehensive view of students' experiences. We also need new, innovative research and assessment methods to complement self-reporting data and to examine long-term effects by investigating the development of complex transversal skills during university studies.

The context of the investigated courses was agricultural sciences and, specifically, the learning of workplace-relevant competencies of that field. Taking into account the context is essential in SoTL, as was expressed by Blair (2013) in the following way: "Developing individualised context-orientated data on teaching and learning will allow scholars to make recommendations in response to their specific situation and that are attuned to the needs of those in that environment" (p. 128). However, the critical features of the course designs discovered in the study – allocating enough time for group and project work processes, making the assignments as authentic as possible, or building clear support structures for group work – are not context-bound or domain-specific issues; on the contrary, they are relevant in any field of education. Instructional methods for supporting work-

place-relevant competence in higher education have previously been investigated in case studies that examine individual courses and focus on different competence areas in each case. Our study offers new research-based viewpoints through comparing multiple course designs and addresses the same competences, examined through the same instruments. In future research, it would be valuable to publish results from courses in various contexts, using the same methods in order to obtain cumulative research evidence on effective instructional practices that could increase the workplace-relevant competence of higher education students.

In university pedagogy, it is typically up to lecturers themselves to decide whether and how to promote students' workplace-relevant competence, and many lecturers do not necessarily know appropriate methods. In addition to case examples and instructional recommendation, our study presents an approach to comparing students' experiences through research-based evaluation methods that can be used in a scalable way across domains and contexts, providing academic teaching staff a model to engage in the scholarship of teaching and learning in their educational practice when developing the workplace-relevance of university studies.

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