TECHSTER

TECHSTER: Tech students, entrepreneurial routes

Research report IO2, IO3, IO5

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CONTEXT

Grant agreement	2020-1-PL01-KA203-082297
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Key action	Cooperation for innovation and the exchange of good practices
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Project title	Tech students, entrepreneurial routes
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Table of Contents

Introduction

TECHSTER aims to enhance the entrepreneurial and soft skills of Higher Education (HE) teachers and students who have a technical background. This will be developed by creating an entrepreneurial dimension to technical education and by strengthening the local and European network of HE institutions. As a result, young people will be able to create their own employment and become successful entrepreneurs not only at a national level, but also internationally.

The project's main objective is to integrate innovative tools in the HE professors' existing curricula to improve their own and their students' entrepreneurial and soft skills, as well as to strengthen the technical education already established around Europe.

As a start of the project, a survey has been conducted to validate the conclusions from the preliminary, informal research that has taken place prior to the project. We want to make sure that the work of the project fits the needs of the target groups (students and teachers in technical HE) and to make sure the project also meets the demands of the companies in the technical sector to facilitate a smooth transition from university to company.

We have asked both teachers and students in technical HE, as well as companies in the technical sector that hire graduates from technical HE how they see the level of entrepreneurial and soft skills of students/graduates, how they think more focus on these skills can be created in technical HE and if an online community existed on this topic, what they value most in such a community.

So, three surveys have been spread where each survey was targeted at one specific target group (teachers, students, companies). Since the main purpose of this report is to formulate recommendations, we have presented most of the results specific to the topics, with the opinion of each target group next to each other.
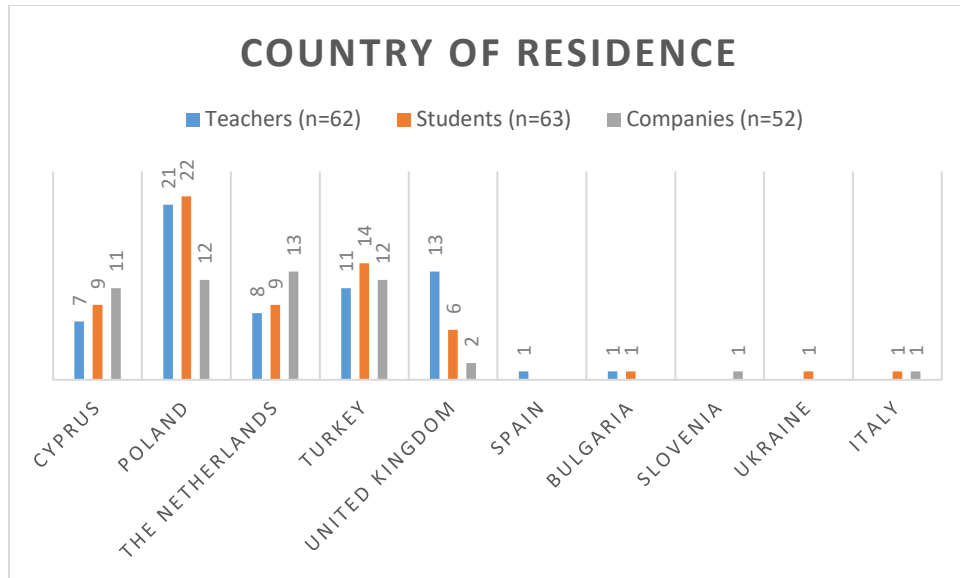
TECH-STER Survey results

General demographics and background of respondents
First, we have asked the respondent to provide some general information about their background.

Country of origin
The survey for teachers has been started by 62 persons, coming from 7 countries. The survey of students has been started by 63 respondents, coming from 8 countries and the survey of companies have been started by 52 respondents, coming from 7 countries.

In the graph below, you can see the distribution of respondents across countries.
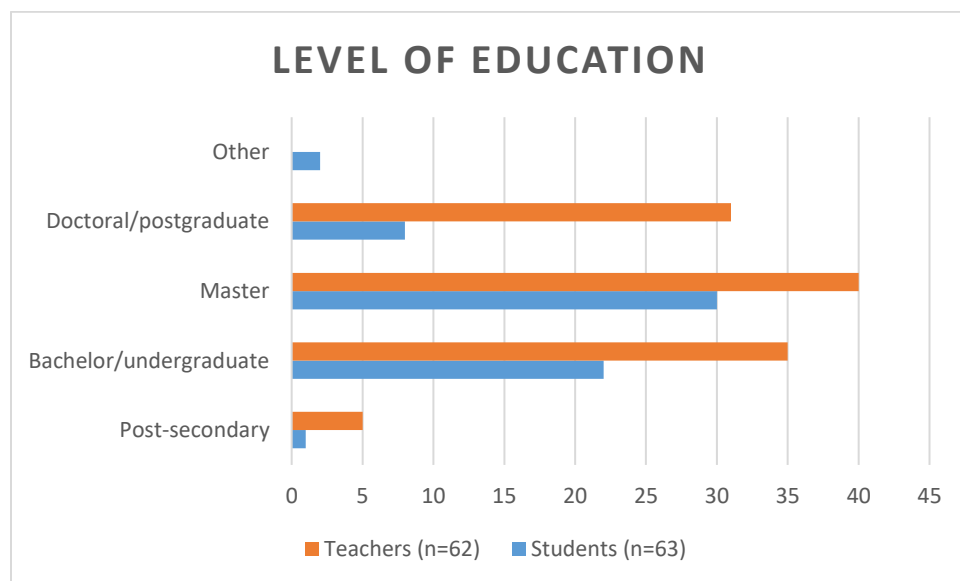
COUNTRY OF RESIDENCE

- Teachers (n=62) Students (n=63) Companies (n=52)

Country	Teachers	Students	Companies
CYPRUS	7	9	11
POLAND	21	22	12
THE NETHERLANDS	8	9	13
TURKEY	11	14	12
UNITED KINGDOM	13	6	2
SPAIN	1		
BULGARIA	1	1	
SLOVENIA			1
UKRAINE		1	
ITALY		1	1

Level of education

The second question raised to the HE teachers was about the level of education that they teach. Most of them teach at master's level (64.5%), but also a high number teach in bachelor/undergraduate (54.8%) and doctoral/postgraduate (46.8%). Please find below a full overview.

Students were asked about their own level of study. Almost half of them (47.6%, n=30) is studying at master's level and 34.9% (n=22) is studying at bachelor/undergraduate level. An overview can be found below.

Companies have not been asked this question.

LEVEL OF EDUCATION

Level	Teachers (n=62)	Students (n=63)
Other		2
Doctoral/postgraduate	31	8
Master	40	30
Bachelor/undergraduate	35	22
Post-secondary	5	1

Technical sector

Since we are only interested in the technical sector, both in education as well as in companies, we have also asked the participants if they consider their sector as technical. Participants who viewed their sector not as technical, were directed to the end of the survey.

From the 61 student answers, 7 participants indicated that they do not consider their field of study as technical. For the teacher survey this number was 8 out of 62 and for the companies this number was 3 out of 52.

Field of expertise

Next, teachers have been asked about the field of study of their students, which is comparable to the question to the students about their field of their studies. For companies we have not asked about their studies, but about the expertise of the company.

Additional question for teachers – length of experience

Teachers have been asked about the length of their experience in technical education. This was spread quite well, for example 38.9 percent (n=21) has been involved in technical education for already more than 15 years. The numbers can be found in the graph below.


YEARS OF EXPERIENCE IN TECHNICAL EDUCATION

- 16% 0-5 years
- 28% 6-10 years
- 17% 11-15 years
- 39% More than 15 years
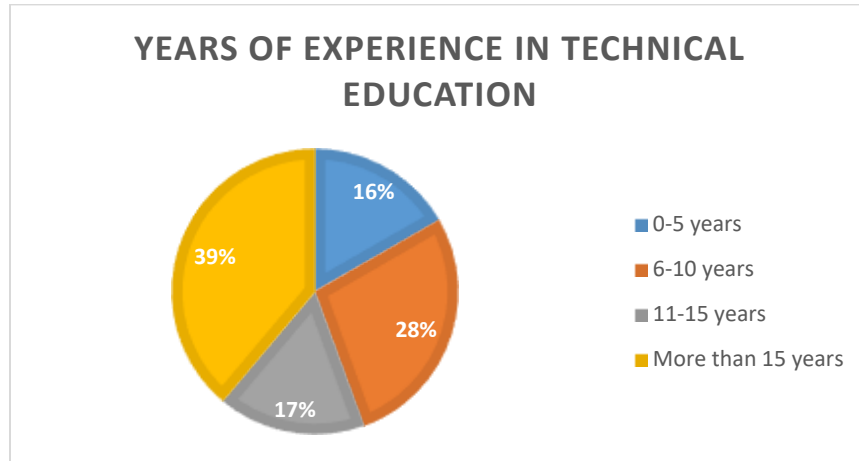
Additional question for companies – employment size

Companies have been asked about the employment size of their company. A majority (51%, n=25) of them were micro-entrepreneurs (between 0-9 employees). 22,4 Percent of the respondents were part of an organisation with more than 250 employees (n=11) and 20.4% (n=10) are part of an organisation with between 10-49 employees. A small number of the respondents (n=3, 6.1%) were part of an organisation with between 50-249 employees.

Entrepreneurial skills in technical HE

After the general information, the questions focused on entrepreneurial skills in technical HE. Entrepreneurial skills are the skills needed to act upon opportunities and ideas to create value for others. In the context of the Tech-STER project, entrepreneurial skills are not primarily meant to start a business, but for the students to use in their future workplaces. Think of e.g., creativity, motivation & perseverance.

This part started with a general question about how important entrepreneurial skills and behaviour are for tech students (and their later careers) in the field of expertise of the respondent where 1 is not important at all and 5 is very important. Almost all respondents agreed on the importance, the average score for teachers on this question is 4.28 (n=54), for students 4.26 (n=54) and for companies even 4.39 (n=49).

AVERAGE IMPORTANCE OF ENTREPRENEURIAL SKILLS AND BEHAVIOUR FOR TECH STUDENTS
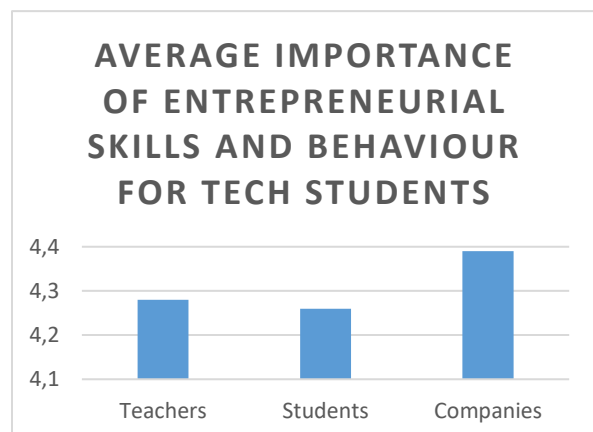
The next questions go deeper into the importance of several entrepreneurial skills and the current level of those entrepreneurial skills of tech students/graduates.
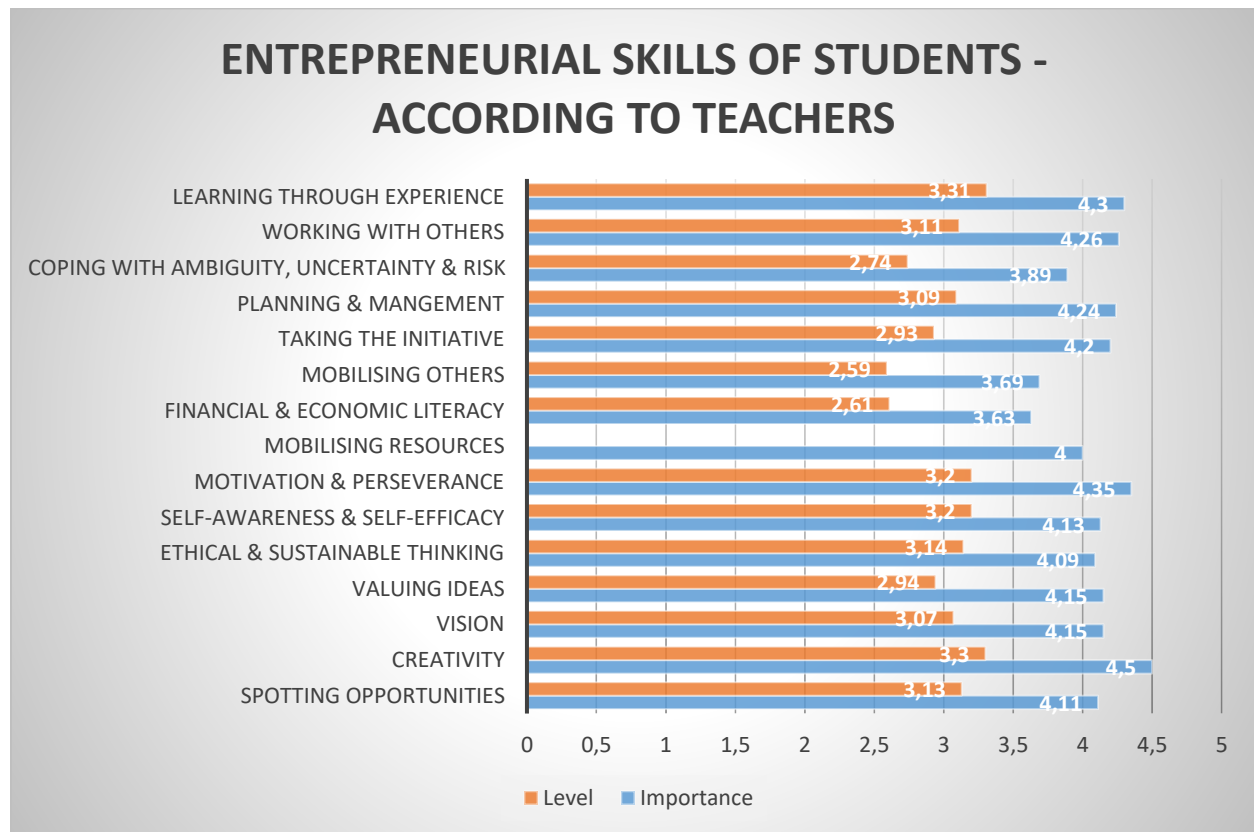
Teachers

Overall, the teachers rated the importance of entrepreneurial skills between 3.63 and 4.5 on average. The level of the skills is a little lower on average, between 2.59 and 3.31.

Importance of entrepreneurial skills

Almost all entrepreneurial skills scored on average above 4, so it is difficult to say which ones were the most importance, since the differences are very small. The three skills which received the highest average score were creativity (4.5), motivation & perseverance (4.35) and learning through experience (4.30). There are three skills which have scored below an average of 4, namely mobilising others, coping with ambiguity, uncertainty & risk, and financial & economic literacy (average scores respectively 3.69, 3.89 and 3.63).

Level of entrepreneurial skills

The scores of the level of entrepreneurial skills of tech students are also very close to each other. The highest average scores are for learning through experience (3.31), creativity (3.3) and on the third place are motivation & perseverance (3.2) and self-awareness & self-efficacy (3.2). According to the teacher respondents the following skills are the least developed by tech students: mobilising others (2.59), financial & economic literacy (2.61) and coping with ambiguity, uncertainty, and risk (2.74).

ENTREPRENEURIAL SKILLS OF STUDENTS - ACCORDING TO TEACHERS

Skill	Level	Importance
LEARNING THROUGH EXPERIENCE	3,31	4,3
WORKING WITH OTHERS	3,11	4,26
COPING WITH AMBIGUITY, UNCERTAINTY & RISK	2,74	3,89
PLANNING & MANGEMENT	3,09	4,24
TAKING THE INITIATIVE	2,93	4,2
MOBILISING OTHERS	2,59	3,69
FINANCIAL & ECONOMIC LITERACY	2,61	3,63
MOBILISING RESOURCES		4
MOTIVATION & PERSEVERANCE	3,2	4,35
SELF-AWARENESS & SELF-EFFICACY	3,2	4,13
ETHICAL & SUSTAINABLE THINKING	3,14	4,09
VALUING IDEAS	2,94	4,15
VISION	3,07	4,15
CREATIVITY	3,3	4,5
SPOTTING OPPORTUNITIES	3,13	4,11

Support students to develop their entrepreneurial skills

We have also asked the teachers whether they have ever tried to help students to develop their entrepreneurial skills. Thirteen respondents indicated that they have not (24.07%), but the majority has tried to do that (75.93%).
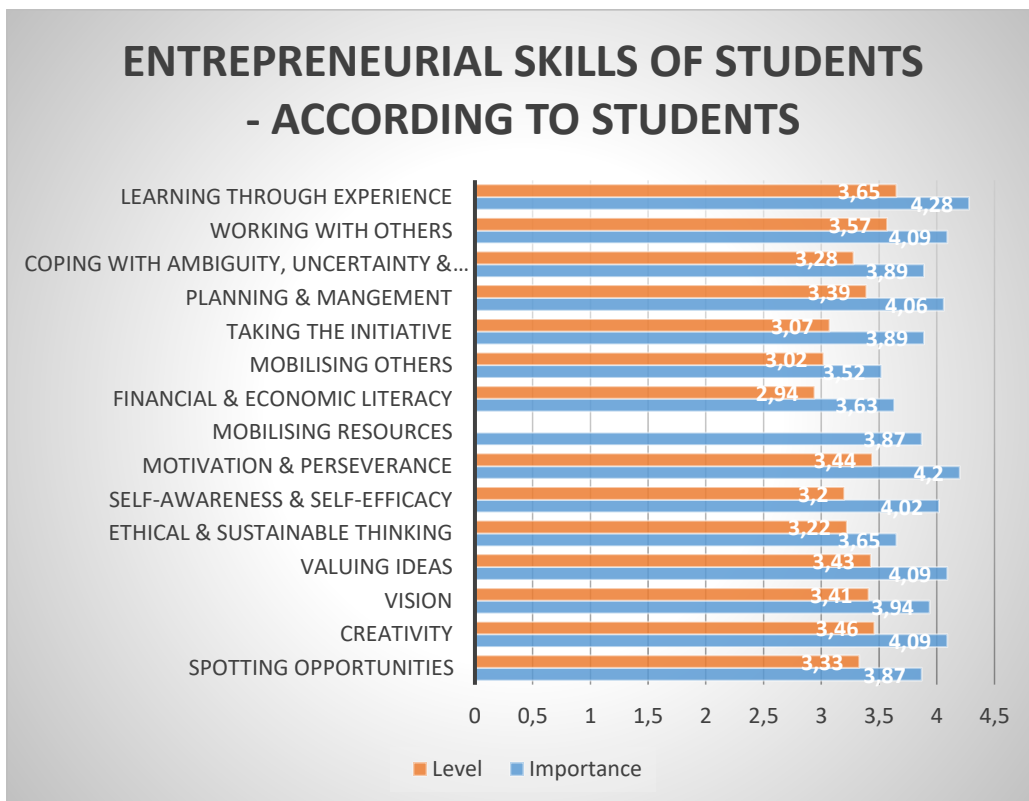
Students

Students also believe that entrepreneurial skills are quite important for students and their future careers in the technical sector. The students rated the importance on average between 3.52 and 4.28, and the level of the mastery of these skills by students on average between 2.94 and 3.65.

Importance of entrepreneurial skills

The three skills which received the highest average score by students were learning through experience (4.28), motivation & perseverance (4.2), working with others (4.09), valuing ideas (4.09) and creativity (4.09). The three lowest scores were for mobilising others (3.52), financial & economic literacy (3.63) and ethical & sustainable thinking (3.65).

Level of entrepreneurial skills

According to the participating students, the scores of the level of entrepreneurial skills of tech students are also very close to each other. The highest average scores are for learning through experience (3.31), creativity (3.3) and on the third place are motivation & perseverance (3.2) and self-awareness & self-efficacy (3.2). According to the student respondents the following skills are the least developed by tech students: mobilising others (2.59), financial & economic literacy (2.61) and coping with ambiguity, uncertainty, and risk (2.74).

ENTREPRENEURIAL SKILLS OF STUDENTS - ACCORDING TO STUDENTS

Skill	Level	Importance
LEARNING THROUGH EXPERIENCE	3,65	4,28
WORKING WITH OTHERS	3,57	4,09
COPING WITH AMBIGUITY, UNCERTAINTY &…	3,28	3,89
PLANNING & MANGEMENT	3,39	4,06
TAKING THE INITIATIVE	3,07	3,89
MOBILISING OTHERS	3,02	3,52
FINANCIAL & ECONOMIC LITERACY	2,94	3,63
MOBILISING RESOURCES		3,87
MOTIVATION & PERSEVERANCE	3,44	4,2
SELF-AWARENESS & SELF-EFFICACY	3,2	4,02
ETHICAL & SUSTAINABLE THINKING	3,22	3,65
VALUING IDEAS	3,43	4,09
VISION	3,41	3,94
CREATIVITY	3,46	4,09
SPOTTING OPPORTUNITIES	3,33	3,87

■ Level ■ Importance

Develop student's own entrepreneurial skills

We have also asked the students whether they have ever tried to develop their own entrepreneurial skills. Eighteen respondents indicated that they have not (33.33%), but the majority has tried to do that (66.67%).
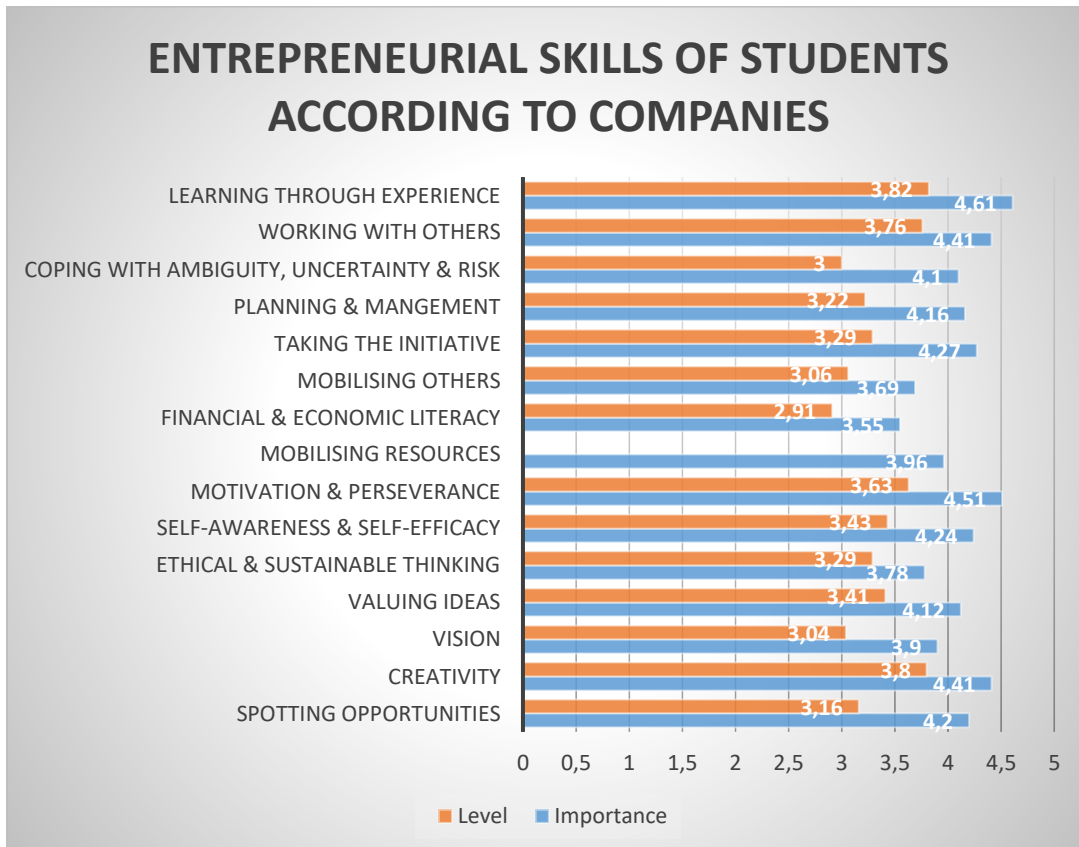
Companies

Companies also rate the importance of entrepreneurial skills for tech students and their future careers quite high. They rated the individual skills on average between 3.55 and 4.61. The mastery of these entrepreneurial skills scores on average a little lower again, between 2.91 and 3.82.

Importance of entrepreneurial skills

The three skills which received the highest average score were learning through experience (4.61), motivation & perseverance (4.51), working with others (4.41) and creativity (4.41). The three lowest scores were for financial & economic literacy (3.55), mobilising others (3.69) and ethical & sustainable thinking (3.74).

Level of entrepreneurial skills

The companies rated the level of entrepreneurial skills in general lower than teachers and students. The highest average scores are for learning through experience (3.82), creativity (3.8) and working with others (3.78). According to the companies the following skills are the least developed by tech graduates entering their companies: financial & economic literacy (2.91), coping with ambiguity, certainty, & risk (3.00) and vision (3.04).

ENTREPRENEURIAL SKILLS OF STUDENTS ACCORDING TO COMPANIES

Skill	Level	Importance
LEARNING THROUGH EXPERIENCE	3,82	4,61
WORKING WITH OTHERS	3,76	4,41
COPING WITH AMBIGUITY, UNCERTAINTY & RISK	3	4,1
PLANNING & MANGEMENT	3,22	4,16
TAKING THE INITIATIVE	3,29	4,27
MOBILISING OTHERS	3,06	3,69
FINANCIAL & ECONOMIC LITERACY	2,91	3,55
MOBILISING RESOURCES		3,96
MOTIVATION & PERSEVERANCE	3,63	4,51
SELF-AWARENESS & SELF-EFFICACY	3,43	4,24
ETHICAL & SUSTAINABLE THINKING	3,29	3,78
VALUING IDEAS	3,41	4,12
VISION	3,04	3,9
CREATIVITY	3,8	4,41
SPOTTING OPPORTUNITIES	3,16	4,2

Need for development of entrepreneurial skills

The next question was about whether the respondents believe whether the entrepreneurial skills of students need to be strengthened. None of the respondents (in all target groups) have disagreed with this statement.

From the respondents from the teachers, 88.9% (n=48) agreed that there is a need for improvement of entrepreneurial skills while the other 11.1% (n=6) responded that maybe these skills need to be strengthened. From the student respondents, 90.7% (n=49) agreed with this statement, while 9.3%(n=5) answered 'maybe'. Lastly, the companies were less sure about this statement: 77.6% (n=38) agreed that the entrepreneurial skills of tech graduates need to be improved, while the other 22.4% (n=11) answered maybe.

Soft skills in technical HE

The second part of the survey was about soft skills in technical HE. Soft skills are complementary to hard skills, and enable people to navigate their environment, work well with others, perform well, and achieve their goals.

This part started with a general question about how important soft skills are for tech students (and their later careers) in the field of expertise of the respondent where 1 is not important at all and 5 is very important. Almost all respondents agreed on the importance, the average score for students on this question is 4.09 (n=54 and for companies 4.22 (n=49).

The next questions go deeper into the importance of several soft skills and the current level of those soft skills of tech students/graduates.
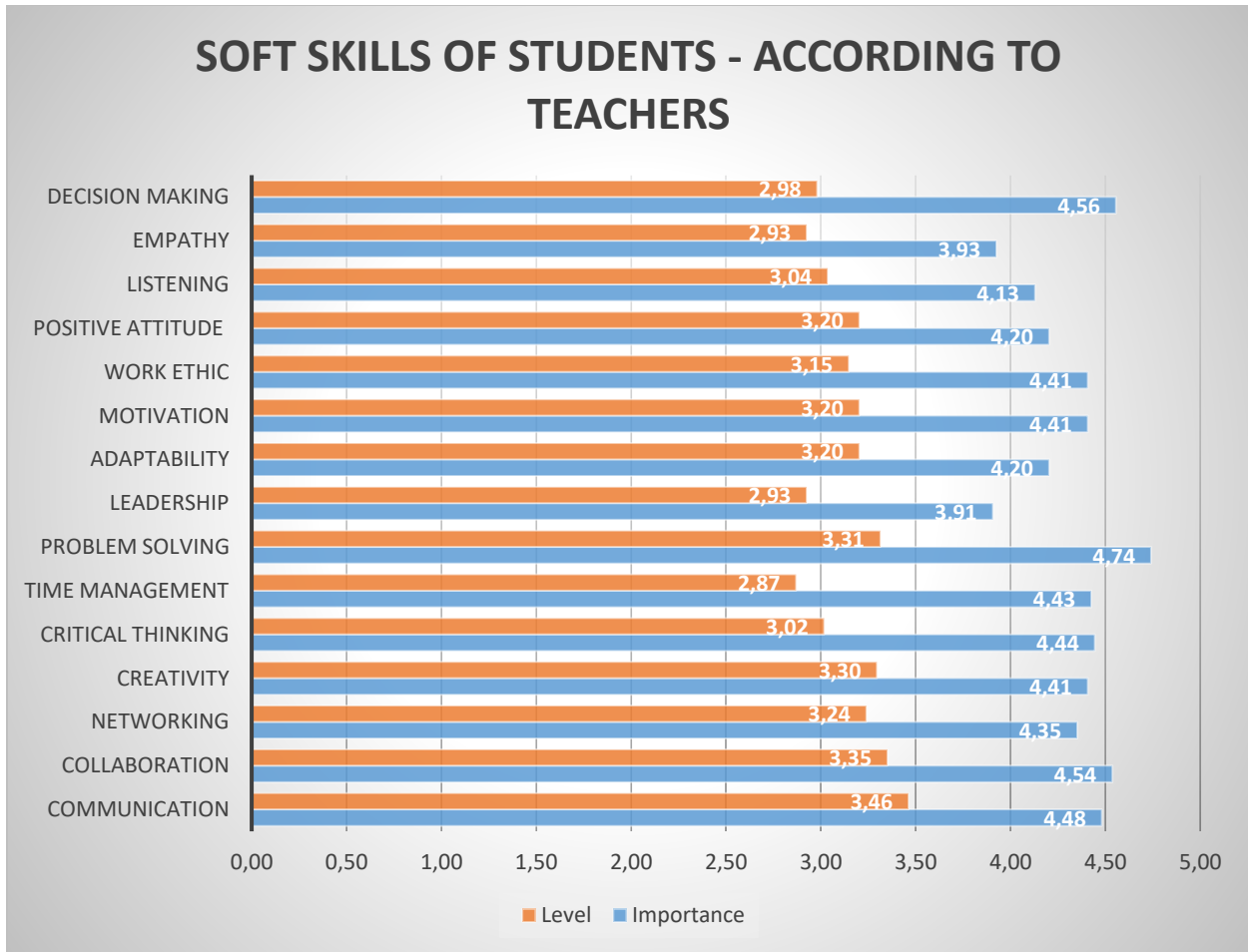
Teachers

Overall, the teachers rated the importance of soft skills between 3.91 and 4.74 on average. The level of the skills is a little lower on average, between 2.87 and 3.46.

Importance of soft skills

Almost all soft skills scored on average above 4, so it is difficult to say which ones were the most important, since the differences are very small. The three skills which received the highest average score were problem solving (4.74), decision making (4.56) and collaboration (4.54). The lowest scores were for leadership (3.91), empathy (3.93) and listening (4.13).

Level of soft skills

The scores of the level of soft skills of tech students according to the teachers are also very close to each other. The highest average scores are for communication (3.46), collaboration (3.35) and problem solving (3.31). According to the teacher respondents the following skills are the least developed by tech students: time management (2.87), empathy (2.93) and leadership (2.93).

SOFT SKILLS OF STUDENTS - ACCORDING TO TEACHERS

Skill	Level	Importance
DECISION MAKING	2,98	4,56
EMPATHY	2,93	3,93
LISTENING	3,04	4,13
POSITIVE ATTITUDE	3,20	4,20
WORK ETHIC	3,15	4,41
MOTIVATION	3,20	4,41
ADAPTABILITY	3,20	4,20
LEADERSHIP	2,93	3,91
PROBLEM SOLVING	3,31	4,74
TIME MANAGEMENT	2,87	4,43
CRITICAL THINKING	3,02	4,44
CREATIVITY	3,30	4,41
NETWORKING	3,24	4,35
COLLABORATION	3,35	4,54
COMMUNICATION	3,46	4,48

■ Level ■ Importance

Support students to develop their soft skills
We have also asked the teachers whether they have ever tried to support students with the development of the students' soft skills. Ten respondents indicated that they have not (18.52%), but the majority has tried to do that (81.48%).

Students

Students also believe that soft skills are quite important for students and their future careers in the technical sector. The students rated the importance on average between 3.63 and 4.41, and the level of the mastery of these skills by students on average between 2.94 and 3.37.
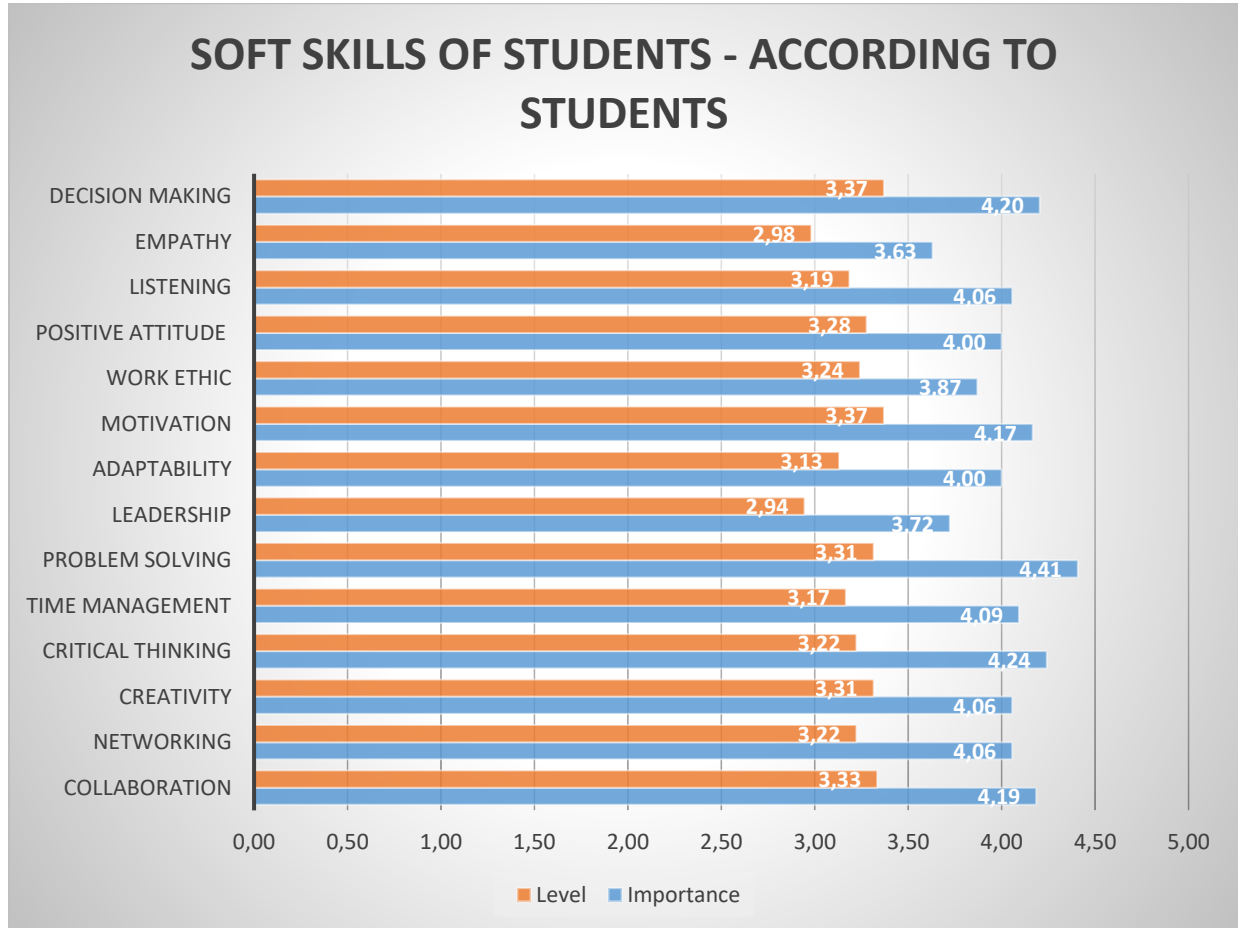
Importance of soft skills
 The three skills which received the highest average score were problem solving (4.41), critical thinking (4.24) and decision making (4.20). The three lowest scores were for empathy (3.63), leadership (3.72) and work ethic (3.87).

Level of soft skills
The scores of the level of soft skills of tech students are also very close to each other. The highest average

scores are for motivation (3.37), decision making (3.37) and collaboration (3.33). According to the student respondents the following skills are the least developed by tech students: leadership (2.94), empathy (2.98) and adaptability (3.13).

SOFT SKILLS OF STUDENTS - ACCORDING TO STUDENTS

Skill	Level	Importance
DECISION MAKING	3,37	4,20
EMPATHY	2,98	3,63
LISTENING	3,19	4,06
POSITIVE ATTITUDE	3,28	4,00
WORK ETHIC	3,24	3,87
MOTIVATION	3,37	4,17
ADAPTABILITY	3,13	4,00
LEADERSHIP	2,94	3,72
PROBLEM SOLVING	3,31	4,41
TIME MANAGEMENT	3,17	4,09
CRITICAL THINKING	3,22	4,24
CREATIVITY	3,31	4,06
NETWORKING	3,22	4,06
COLLABORATION	3,33	4,19

■ Level ■ Importance

Develop student own's soft skills
We have also asked the students whether they have ever tried to develop their own soft skills. Sixteen respondents indicated that they have not (29.63%), but the majority has tried to do that (70.37%).

Companies
Companies also rated the importance of soft skills for tech students and their future careers quite high. They rated the importance of the soft skills on average between 3.63 and 4.69. The mastery of these soft skills scores on average a little lower again, between 2.90 and 3.94.

Importance of soft skills
The three skills which received the highest average score were problem solving (4.69), motivation (4.49) and critical thinking (4.47). The three lowest scores were for leadership (3.63), empathy (3.76) and networking (3.86).

Level of soft skills

The companies rated the level of soft skills on average above 3 points. The highest average scores are for motivation (3.94), positive attitude (3.88) and work ethic (3.69). According to the companies the following skills are the least developed by tech graduates entering their companies: leadership (2.90), decision making (3.12), networking (3.35) and problem solving (3.35).

SOFT SKILLS OF STUDENTS - ACCORDING TO COMPANIES

Skill	Level	Importance
DECISION MAKING	3,12	4,24
EMPATHY	3,45	3,76
LISTENING	3,61	4,41
POSITIVE ATTITUDE	3,88	4,37
WORK ETHIC	3,69	4,06
MOTIVATION	3,94	4,49
ADAPTABILITY	3,51	4,12
LEADERSHIP	2,90	3,63
PROBLEM SOLVING	3,35	4,69
TIME MANAGEMENT	3,37	4,41
CRITICAL THINKING	3,39	4,47
CREATIVITY	3,61	4,22
NETWORKING	3,35	3,86
COLLABORATION	3,63	4,33
COMMUNICATION	3,67	4,37

This section was concluded with a general question about whether the respondents believe that the soft skills of students need to be strengthened. Overall, the respondents are more sceptical about this statement, although only one respondent indicated that there is no need for improvement of soft skills for tech students (in students).

From the respondents from the teachers 5.56% indicated that 'maybe' these skills need to be strengthened and the other 94.44% agreed that there is a need for improvement of soft skills amongst tech students.

Students are a bit more sceptical, from the 54 respondents 9 indicated that there may be a need for development of soft skills (16.67%), 1 person said that there is no need for improvement (1.85%) and the majority agreed with the statement that there is a need for improvement: 81.48% (44 respondents).

Finally, companies are even less sure about the need for improvement of soft skills. Of the 49 respondents nobody responded that there is no need and 69.39% (34 respondents) indicated that there is a need for further development of soft skills amongst tech students, but on the other hand, also 15 respondents indicated that there 'may be' a need for the improvement of these skills (30.61%).

Teaching entrepreneurial/soft skills in technical HE

The next part of the survey discussed the possibilities to teach entrepreneurial and soft skills in technical higher education. We have asked both teachers and students their opinion.

Possibility of introducing a short exercise on entrepreneurial competences/soft skills in class

Teachers

From the 54 respondents, 49 respondents (almost 90%) indicated that they would be able to include any short exercise on entrepreneurial competences/soft skills in their classes, although that needs to be under formal permission (24.1%), or they first need to improve their teaching competences (25.9%).

Reasons for not being able to introduce short exercises on entrepreneurial competences/soft skills are:

- Already included in some of my classes
- Because of remote education/not possible because of the pandemic situation
- I would rather think of dedicated classes instead of such kind of exercises
- I would rather avoid it

15. Do you allow the possibility of introducing a short exercise on entrepreneurial competences/soft skills as part of a class conducte...nge (30 minutes, to reflect communication skills).
54 antwoorden

Legend:
- Yes, definitely
- Yes, but under formal permission
- Yes, but I need to improve my teachin…
- I'd rather try to avoid it
- No (please explain)
- Students already conduct biological e…
- Already included in some of my classes
- Yes, if my competencies allows for it a…

1/2 ▼

Provision of full teaching materials

We have asked the teachers if it would be helpful to receive full teaching materials for introducing such short exercises. Only 7.4 percent indicated that it would not make it easier to decide to introduce such an

exercise into their class, whereas 33.4% indicated that to some extend it would make that decision easier, and 59.3% definitely agreed that it would make it easier.

16. Would the provision of full teaching materials for introducing a short exercise on entrepreneurial competence...duce this exercise into your classes?
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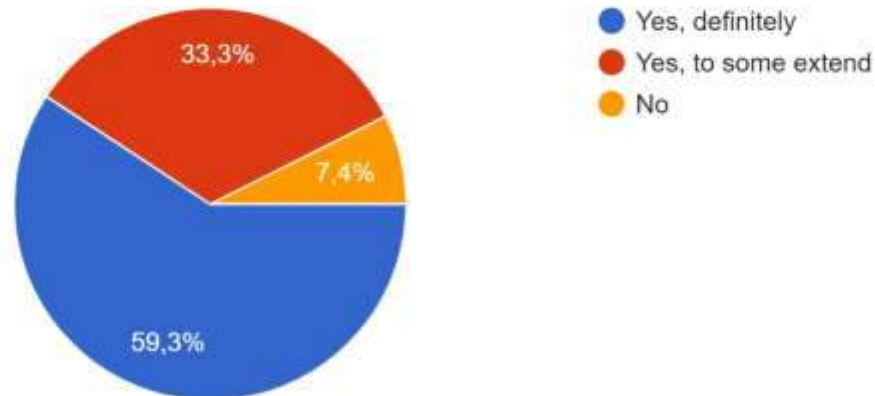
Duration (teaching time – in a classroom) of an exercise on entrepreneurial competences/soft skills

Furthermore, we have asked how much time an exercise on entrepreneurial competences/soft skills may take, to be considered to include in the classes of the teachers. More than one-third (37%) would be willing to include an activity of 30 minutes, and another third (29.6%) would be willing to go to 15 minutes. The longer the activities will be the less likely teachers will include the exercise in their class.

One teacher emphasised that soft skills are being improved permanently during different types of classes, according to the teaching effects described in the program of studies. Entrepreneurial skills improvement would require additional classes in his/her opinion, not an exercise during classes dedicated to other goals.

Another teacher continues the idea to give specific classes on entrepreneurial competences and soft skills, and shares that it then will take several hours, both in class as well as in their own time.

17. What is the duration (teaching time – in a classroom) of an exercise on entrepreneurial competencies/soft skills,....ider to include as a part of your class?

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- 15 min
- 30 min
- 45 min
- 45 min – 1,5 h
- 1,5 h – 3 h
- More than 3 h
- Soft skills are being improved permanently during differen…
- In a specific class it is several hours, in class and also on t…
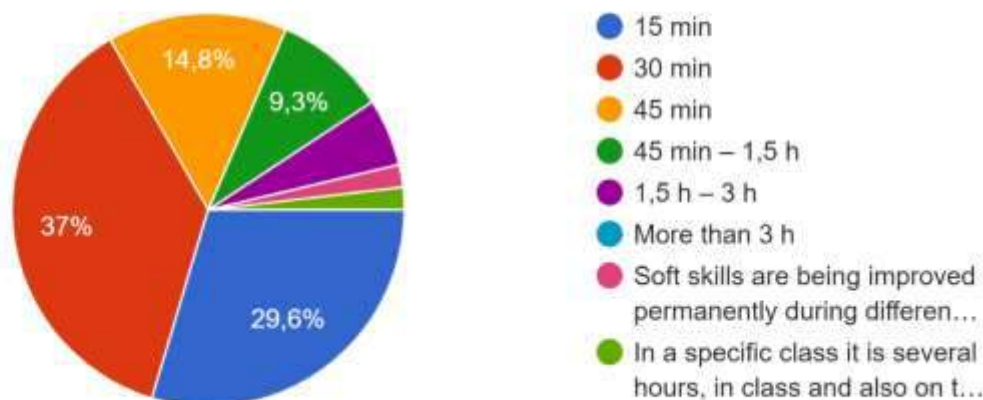
Need for formal curriculum change

Next, teachers have indicated whether they would need a formal curriculum change to introduce a new task on entrepreneurial competences and soft skills to their classes.

40.7 Percent can decide on their own. 25.9 percent would need to make minor formal changes, and 11.1% would need to make major formal changes. 18.5% indicates that the need for formal curriculum changes depend on how big the new task is.

One person is not sure, and one person is again indicating that it could be taught better in a separate class.

18. Do you need a formal curriculum change to introduce a new task on entrepreneurial competences/soft skills to your classes?

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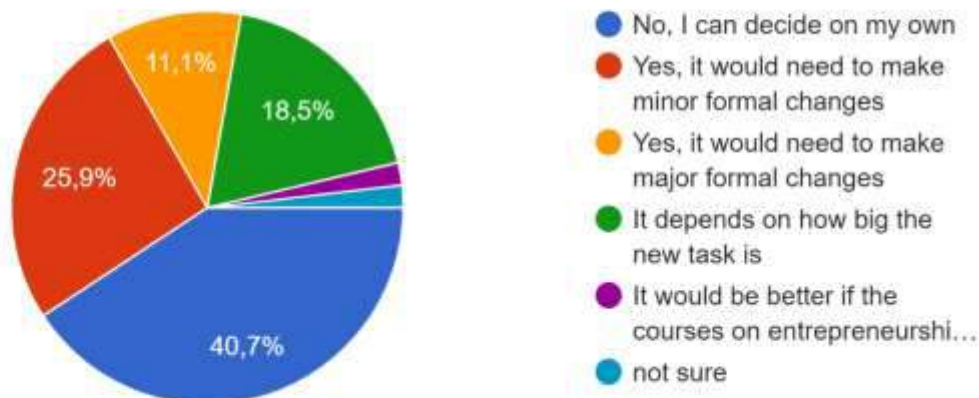
Need for improvement of your competences in soft skills and entrepreneurial competences

In line with an earlier question, we have asked whether the teacher believes if he/she should improve their competences to be able to include such exercises on entrepreneurial competences and soft skills. Only 11.1 percent indicated that they would not need to improve their skills. Half of them indicated that they need to improve their competences to some extent, and 13% to a large extent. For 18.5 percent it is just a minor issue.

19. Do you think that the possible inclusion of an exercise on entrepreneurial competences/soft skills into your curr...improve your competences in this area?
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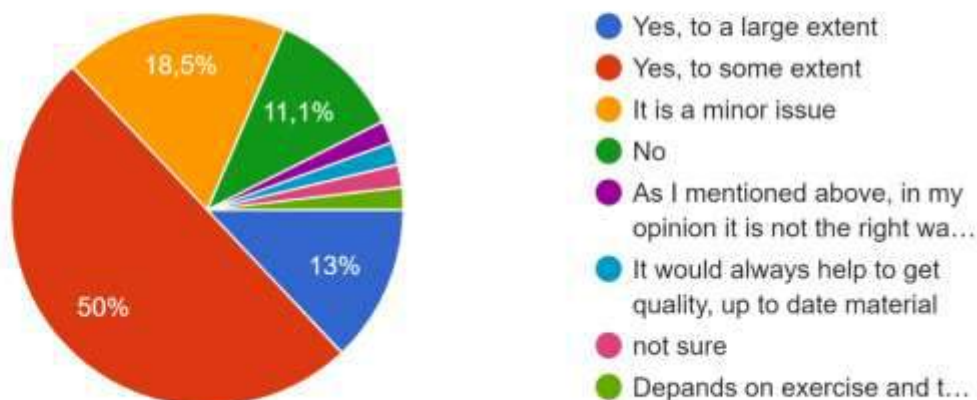
In what way do you think that soft and entrepreneurial skills could be taught in your institute?

Teachers

We have also asked the teachers to indicate in which ways they believe that soft and entrepreneurial skills could be taught in their institute. Most of the teachers think it is feasible to encourage collaboration and teamwork (59.3%) and half of the teachers believes it is possible to implement (short) activities that specifically target soft/entrepreneurial skills. Also, quite a lot of teachers think it is possible to use tools (42.6%) and to adopt critical thinking (37%).

One respondent suggested to develop podcasts/videos and 1 respondent suggested collaborative design charrettes and scenario playing for conflict resolution.

20. In what way do you think that soft and entrepreneurial skills could be taught in your institute?

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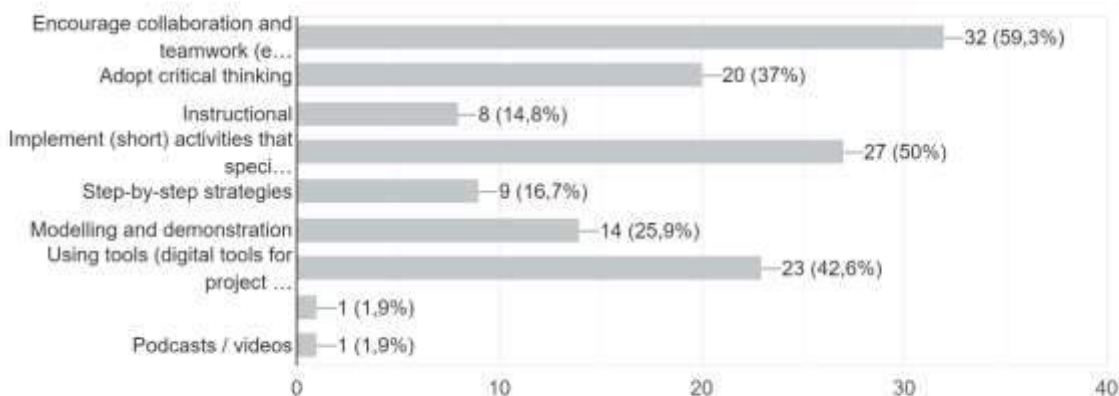
Students

We have also asked the students to indicate in which ways they believe that soft and entrepreneurial skills could be taught in universities (of applied sciences). 27.8 percent indicates that it would be an option to implement (short) activities that specifically target soft/entrepreneurial skills and 25.9 percent choses to encourage collaboration and teamwork (e.g., by activities). Then 14.8% of the respondents suggest using tools and 9.3% would suggest adopting critical thinking.

15. In what way do you think that soft and entrepreneurial skills should/could be taught in universities/universities of applied sciences?

54 antwoorden

Willingness to (learn how to) promote entrepreneurial and soft skills

Teachers

68.5% Of the teacher respondents indicate that they would be willing to (learn how to) promote entrepreneurial and soft skills in their classes in tech education and 27.8% may be willing to. Only 2 respondents were not willing to do this (3.7%).

Students

We have also asked whether they would be willing to participate in (short) exercises in the classroom to develop/improve their soft/entrepreneurial skills.

Of the 54 respondents only 1 respondent indicated that he/she would not be interested. Eight respondents indicated that they may be interested, and the other respondents, the majority indicated that they would be interested (45 respondents, 83.33%).

In what way would you like to learn how to promote entrepreneurial and soft skills amongst students in tech education?

The teachers are willing to learn how to promote entrepreneurial and soft skills amongst students in a lot of different ways. For example, 53.8% sees online learning as an option, 51.9% practices-based learning, and 50% face-to-face learning as well. Business simulation game-based learning is also an option according to 38.5%.

22. In what way would you like to learn how to promote entrepreneurial and soft skills amongst students in tech education?

52 antwoorden
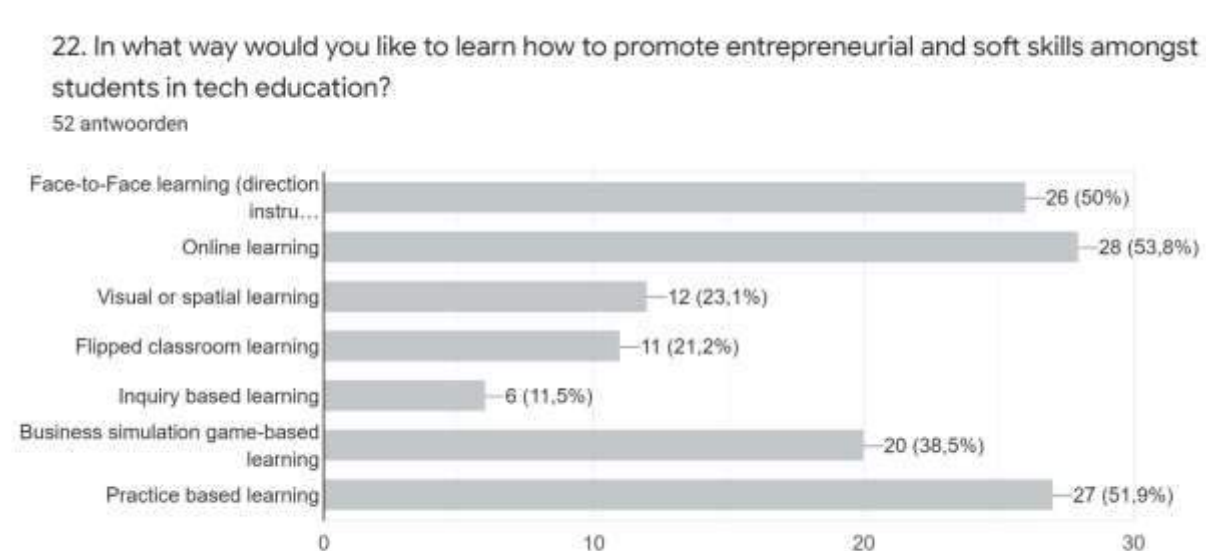
Any other restrictions / limitations

The teachers suggest taking into consideration the following extra restrictions/limitations:

- Lack of time (3x)
- The activities need to be inclusive in nature and consider vulnerable groups
- Preparational training for teachers
- Good materials which can be printed would be helpful
- It would be good to be able to choose between activities for different skills
- 'Selling it better'
- Online education at the moment

- Too little experience
- Knowledge of the subject
- Lack of conviction/openness to changes
- Students with special needs will require extra resources and time
- Easy to learn, hands-on instructions on how to implement the learning activities and how to perform them online.
- Equipment/software needed to be used, time of learning

Have you ever used any kind of tools to improve your students' soft and entrepreneurial skills?

Here the teachers have different experiences: 48.1% of the teachers have never used any tools to improve their students' soft and entrepreneurial skills and 44.4% of the teachers have used them. The other 7.4% indicated that that may have been using tools.

If yes or maybe, which ones?

Some of the tools mentioned in the survey are more popular than others, but in general, all type of tools have been used. Most popular have been presentation tools (64.8%), digital collaboration tools (57.4%), digital content creation tools (57.4%) and social media tools (57.4%).

27. If yes or maybe, which ones?
54 antwoorden
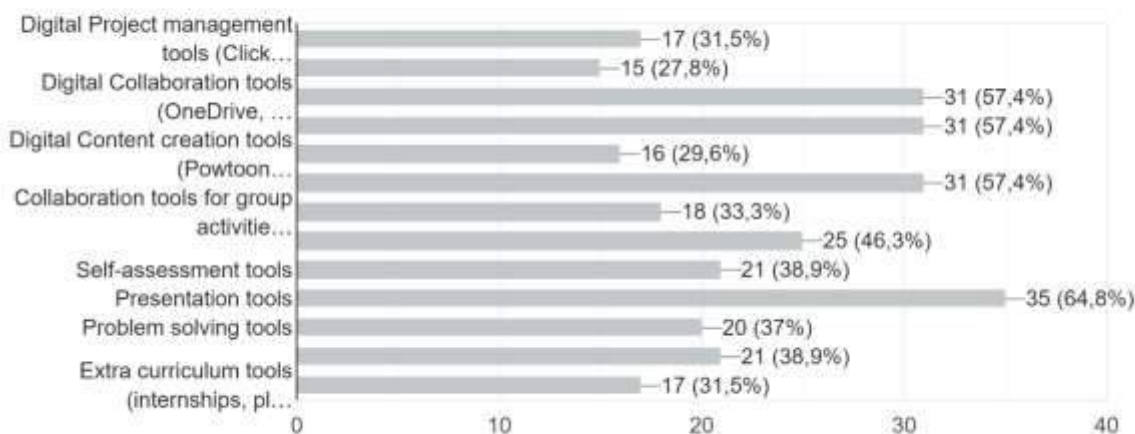
Possibility to use online tools in your classes

Only 9.3% of the respondents indicated that it will not be possible to use online tools in their classes, located on a server other than your university's server. One person indicated that it is possible, but only when the class is being taught in a dedicated room.

One third (31.5%) indicated that it may be possible, 27.8% that it is possible with formal permission and 29.6% that it is possible any time.

Will you be interested to learn how to use any of the above tools?

Teachers

For this question we have asked the teachers if they would be interested in learning how to use a variety of tools. In the graph below you can find the results: blue means yes, I am interested, red is no, I am not interested, and grey is maybe interested.

The tools which are the most interesting to learn more about, are discussion panels/debates (29 respondents indicated yes, I want to learn more), digital collaboration tools (28 respondents indicated yes), digital project management tools (27 respondents), digital communication tools (27 respondents) and problem-solving tools (27 respondents). The least number of 'yes, I want to know more' were given to the digital financial management tools (17 respondents), social media tools (18) and extra curriculum tools (18).

The most resistance to learning about new tools was against digital financial management tools (20 respondents indicated no, I do not want to know more) and digital communication tools (18 times no).
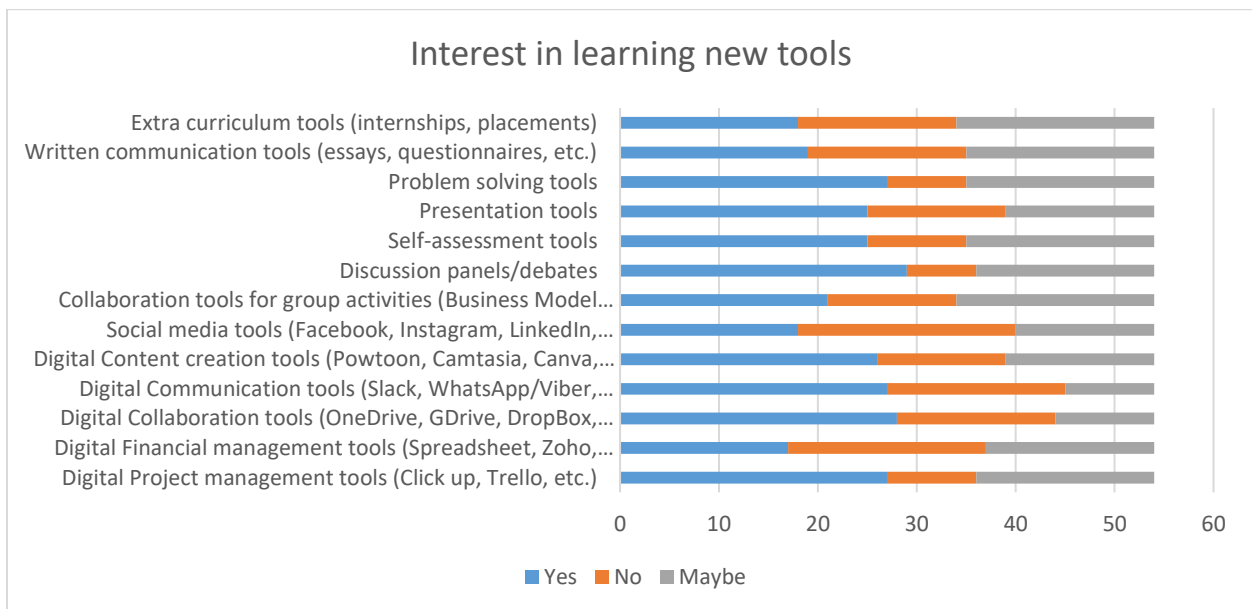

Students

We have also asked students if they would be interested in learning how to work with any of the following tools to work on their soft skills and entrepreneurial competences.

In general, all tools were viewed as quite interesting. The most popular tools were problem solving tools (83% indicates yes, I want to learn more), digital content creation tools (70%) and self-assessment tools (69%). The tools where least people said 'yes' to, were written communication tools (46%) and financial management tools (also 46%).

The tools where people said the most "no, I do not want to learn about it" were written communication tools (35%) and digital financial management tools (28%). The tools with the least resistance were digital content creation tools, self-assessment tools and problem-solving tools (all each 9%).

Interest in learning new tools
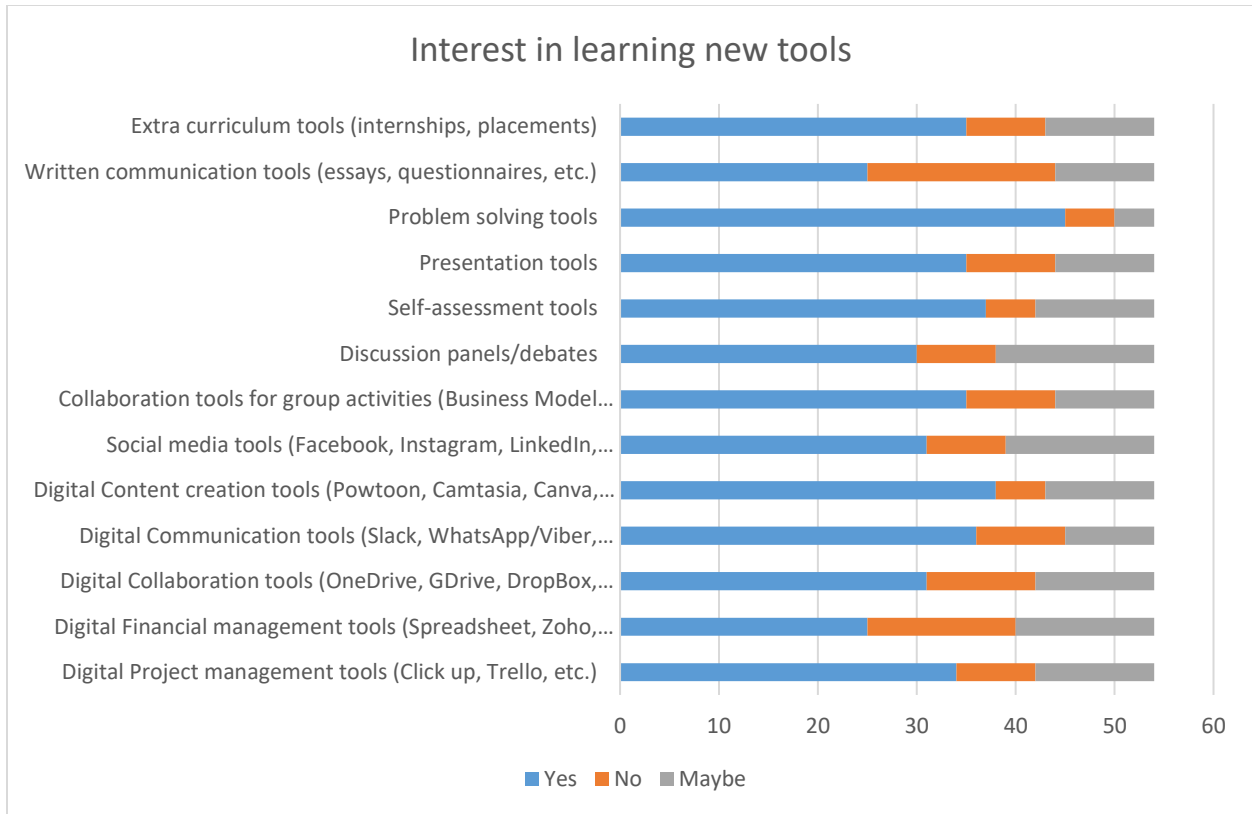
Online community about entrepreneurial/soft skills in technical HE

The survey ended with a set of questions about the community platform which will be created on the topic of entrepreneurial and soft skills in higher technical education and the technical sector.
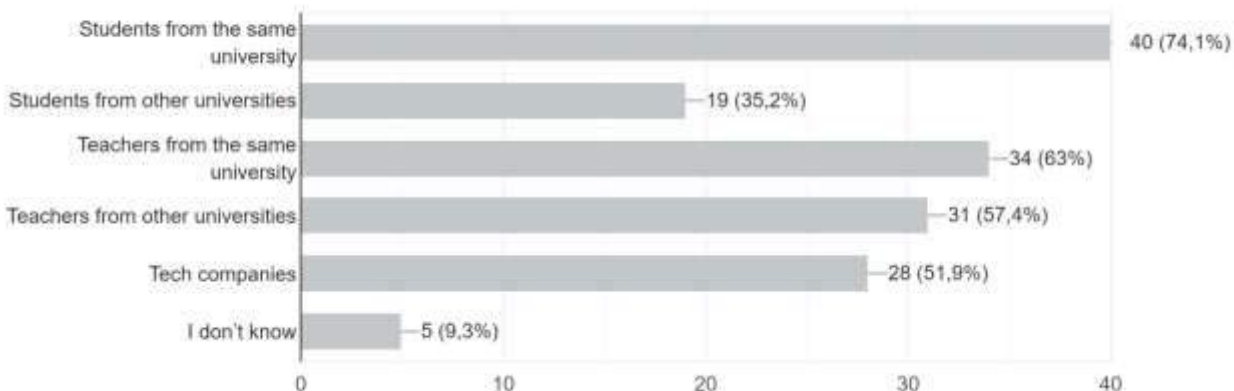
Interaction with whom?

Teachers

We have asked teachers with which target groups they would like to be in contact on such a platform. Most of the teachers are interested to be in contact with students from the same university (74.1%) but also with teachers from the same university (63%). Furthermore, they are also interested in being in touch with teachers from other universities (57.4%) and with tech companies (51.9%). They are less interested in being in touch with students from other universities (35.2%).

29. If a community platform existed on entrepreneurial and soft skills education in tech. With whom would you like to be in contact? Multiple answers possible.

54 antwoorden

Students

Also, students were asked with whom they would like to interact on an online platform for soft and entrepreneurial skills in higher technical education. For students it would be most interesting to get in touch with tech companies: 74.1 percent of the 54 respondents have indicated that they would like to be in contact with tech companies. They would like to be in contact with students from other universities as well (64.8%). The students were also quite positive about the other options, around half of the respondents would like to connect with students from the same university (53.7%), teachers from the same university (48.1%) and teachers from other universities (53.7%) as well.

18. If a community platform existed for soft and entrepreneurial skills education in tech. With whom would you like to be in contact? Multiple answers possible.

54 antwoorden
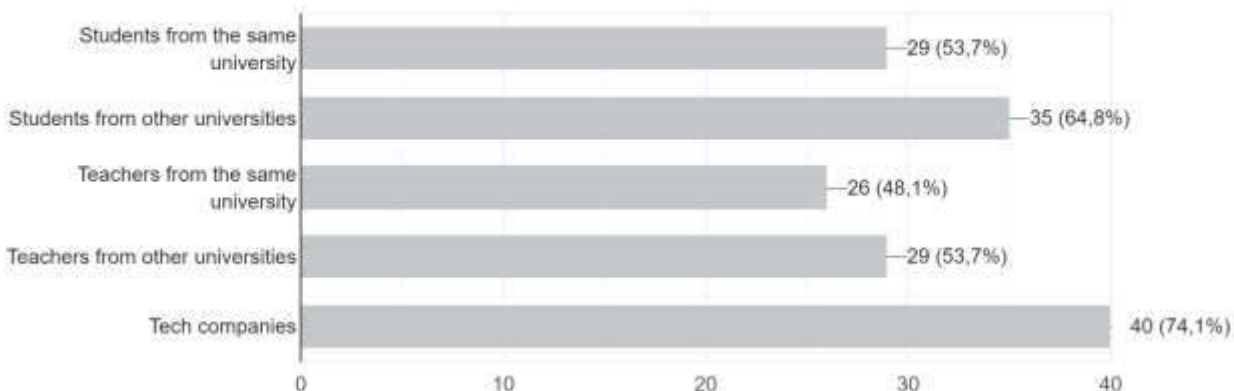
Companies

Companies have appointed a strong preference for being in contact with other tech companies (77.6%). To a lesser extent it is also interesting for them to be in contact with students from (tech) universities (61.2%) and teachers from (tech) universities (57.1%). One person has expressed the uncertainty how this would help him/her.

Preferred medium for the community platform

Teachers

With regards to the preferred medium, they have a slight preference for a web application (62.3%). However, the other options were mentioned as preferred medium also quite a lot: 50.9% chose for a mobile application, 37.7% for a desktop application and 32.1% for a social media group.

Students

Students prefer a mobile application (61.1%) or a web application (53.7%) for the community platform. A smaller part of the student respondents would choose for a social media group (38.9%) or a desktop application (37%).

Companies

Companies are less clear about the preferred medium for the platform (49 respondents had answered this question). A small majority chooses a web application (57.1%) or a mobile application (51%). 38.8 Percent of the company respondents had chosen for a social media group (38.8%) and 32.7% for a desktop application.

Way of communication

Teachers

Here the preferences are much more divided. 48.1% Prefers to have contact with other students, teachers, and entrepreneurs via e-mail, whereas 44.4% prefers a forum, threads, and posts. Then 35.2% likes chat messages and group chats, and 33.3 percent likes private messages and group messages. 20.4% also appreciates more profile-based communication, like Facebook and LinkedIn.

Students

For students, the preference of way of communication is mostly for chat messages and group chats (68.5%) and private message and group messages (61.1%). To a lesser extent e-mail would also work (42.6%), just like profile based (like LinkedIn and Facebook, 40.7%) and forum, threads, and posts (38.9%).

Companies

Also, for this question there is no clear preference for companies (n=49). A small majority chose for chat messages and group chats (53.1%). The other four options were also considered appropriate: forum, threads, and posts (42.9%), profile based (like Facebook and LinkedIn, 40.8%), private messages and group messages (36.7%) and e-mail (36.7%).

Log in preferences

Teachers

By far the majority prefers to login with e-mail and a password (85.2%) and quite a large group likes to login with a Google account (42.6%). Furthermore 22.2% likes to login with a LinkedIn account, 18.5% with a Facebook account and 14.8% with a Microsoft account. Only a very small group likes to login with an AppleID (11.1%) or a GitHub account (7.4%).

Students

The students prefer to login to the online community with e-mail and a password (63%) or with a Google account (61.1%). Also, a LinkedIn account would work (42.6%). Logging in with a Facebook account (29.6%), AppleID (18.5%), a GitHub account (7.4%) or a Microsoft account (5.6%) is not preferred by students.

Companies

A vast majority of the company respondents prefer to login with e-mail and password (77.6%). Also, a large group sees logging in with a Google account as option too (44.9%). LinkedIn (30.6%) or Facebook (18.4%) are less popular, and the other options are not preferred (Apple ID, GitHub account, Microsoft account). One person indicated that he/she does not want to login with an account, and one person optioned for a unique username and password.

Most important features

Finally, we have asked what the most important features would be.

Teachers	Students	Companies
A system that establishes one-to-one contact between entrepreneurs and students will encourage both students	Teams meeting	Community management, otherwise, it will die a quiet death soon
Easy to use	Networking	Usability and ease of use
Contribution of entrepreneurship and social skills to a startup firm	Being accessible on the platform and open to communication with students by experts in their field	Usefulness of the software
Participation in workshops/trainings	Activities/exercises	Share ideas and knowledge
Quality content	For free, competitive with other platforms	To be up to date
Communication	To learn how to start your business or to get examples for entrepreneurial business cases	Accessibility to different teams

Relevant platform links suggestions as an example	A practical approach on how to obtain soft skills and entrepreneurial skills easily	Trainings, workshops, and networking
Exchange of materials helpful in conducting exercises and workshops	Access to the platform at any time, the possibility of correspondence and calls in this application, as well as the ability to demonstrate your project in the application	General content to read up on, but also small hints and tips on a more regular basis. This could be forum updates perhaps.
Utility	Competent students, educators, and employees with a wide range of social and technical skills, focused on learning/development and a broad vision	Space where students can upload portfolios, projects, and publications
User-friendly, resources and materials for improving my teaching methods	Internship opportunities with different technological companies	To find talent through his platform, but I would expect the candidates to be interviewed first by people I trust, much like a recruiter would. Peer reviews would help too.
Relevant content	Motivation	Connectivity and discover
Exchange of ideas	Collaboration of different participants	Networking and peer-to-peer grading
Collaborative problem solving in context of physical planning and project reviews	Ease of use, including the most important information	Online workshops
On the cloud access	Forum with free selection of topics and advice	To receive a business advice or technical advice
Easy to operate	Online talks	Practical
One that could lead them to try	Speed in replies	To be aware of technological developments in time
Database with courses	Free access, reliable information, no advertising	Sharing tools for improving these soft skills
Exchange of practices with other teachers, but also for students to get in touch with potential employers and/or examples of entrepreneurs (to inspire to become an entrepreneur themselves as well)	There may be a part in the platform like possibilities and opportunities. From my experiences, until this time, the most difficult part was in a workshop environment or the use of high-priced devices. We have achieved success by establishing this environment under the structure that we created and sharing it with engineering students in our	Perhaps showing some materials which, I could use in a training prior to the job when I have hired people. Or perhaps where I can find tech graduates which have already invested time in their soft and entrepreneurial skills.

	community. Although time and motivation are very important for the students. Especially for first year or preparatory university students, opportunities are always very difficult to find. Platform may help on it.	
E-mail and password	Interesting and different	Network security
Concrete communication, overview, easy to chat and communicate with others	Communication opportunities	Job offers
Simplicity of use, user friendly interface	Networking and seizing opportunities	Exchange of experiences and establishing cooperation
	Focus on students	Quick and fast chat option
	Layout, intuitiveness	Wide communication network
	Practical studies	How to start a business and relation to tax authorities
	Field or Lab applied science education	Easy and fast access of people as a connection in the network
	Interactivity	Practical exercises
	Collaboration with Apple	The ability to influence skills training topics
	User friendly platform and easy to understand	Soft skills
	Problem solving and Time management	
	To bring people who are members of the community platform together in common activities	
	Get inspired by other people's way of thinking/ideas	

Conclusions and recommendations

Overall, 177 individuals from 10 countries have participated in the TECH-STER survey. The teachers are mostly involved in education at master's level, bachelor/undergraduate level, and doctoral/postgraduate level. The students were studying mostly in master's level and bachelor/undergraduate level.

The teachers were mostly active in information and communication technology (ICT) and civil engineering & transport. The students were also mostly active in ICT, but also in logistics and chemical sciences. The

field of expertise from the companies was primarily ICT too, but also architecture and urban planning. The size of the companies was primarily very small (micro-entrepreneurs with less than 9 employees).

Entrepreneurial skills

In general, it can be said that all target groups value entrepreneurial skills as very important, scoring on average between 4.26 and 4.39 where 1 is not important at all and 5 is very important. The survey shows that when asking in general about entrepreneurial skills, but also when asking specifically about entrepreneurial skills. In the table below you can find the results on both how important the respondents believe these entrepreneurial skills are for tech graduates as well as the average level of skill mastery by tech students/graduates.

As you can see below, all average scores of the importance are above 3.5 on a scale from 1 (not important at all) to 5 (very important) and reach up to a maximum of 4.6. In general, it can be said that entrepreneurial skills are quite important for tech students/graduates for their future career in the tech sector. Furthermore, you can also see that the level of mastery of these skills in general is lower: between 2.6 and 3.8.

	Teachers		Students		Companies	
	Importance	Level	Importance	Level	Importance	Level
Spotting opportunities	4,1	3,1	3,9	3,3	4,2	3,2
Creativity	4,5	3,3	4,1	3,5	4,4	3,8
Vision	4,2	3,1	3,9	3,4	3,9	3,0
Valuing ideas	4,2	2,9	4,1	3,4	4,1	3,4
Ethical & sustainable thinking	4,1	3,1	3,7	3,2	3,8	3,3
Self-awareness & self-efficacy	4,1	3,2	4,0	3,2	4,2	3,4
Motivation & perseverance	4,4	3,2	4,2	3,4	4,5	3,6
Mobilising resources	4,0		3,9		4,0	
Financial & economic literacy	3,6	2,6	3,6	2,9	3,6	2,9
Mobilising others	3,7	2,6	3,5	3,0	3,7	3,1
Taking the initiative	4,2	2,9	3,9	3,1	4,3	3,3
Planning & management	4,2	3,1	4,1	3,4	4,2	3,2
Coping with ambiguity, uncertainty & risk	3,9	2,7	3,9	3,3	4,1	3,0
Working with others	4,3	3,1	4,1	3,6	4,4	3,8
Learning through experience	4,3	3,3	4,3	3,7	4,6	3,8

Regarding entrepreneurial skills, none of the respondents have disagreed with the statement that entrepreneurial skills of tech students need to be strengthened. A part of the respondents was not sure about this need, but a vast majority agreed with this statement (88.9% of the teachers, 90.7% of the students and 77.6% of the companies).

Conclusion and recommendations on entrepreneurial skills

Since there are only very small differences in the importance and level of entrepreneurial skills, we would recommend to not select the 10 most important skills, but to cover the development of as much as

possible of the entrepreneurial skills with tools and activities based on a ranking. To make this ranking we have averaged the importance and level of these skills according to the teachers, students and companies combined. In the table below you can find the combined scores of the importance of the entrepreneurial skills and the level of the skills. We also identified the gap between the importance and level. Based on the identified gap we have ranked the skills in the table below. We would recommend including as much as possible tools and activities to promote as much as possible entrepreneurial skills, considering that the gap between level and importance of 1 is the biggest and in 15 the lowest (although the differences are very small).

	Importance	Level	Gap
Motivation & perseverance	4,4	3,4	1
Planning & management	4,2	3,2	1
Coping with ambiguity, uncertainty & risk	4	3	1
Taking the initiative	4,1	3,1	1
Spotting opportunities	4,1	3,2	0,9
Financial & economic literacy	3,6	2,8	0,8
Learning through experience	4,4	3,6	0,8
Creativity	4,3	3,5	0,8
Vision	4	3,2	0,8
Valuing ideas	4,1	3,3	0,8
Self-awareness & self-efficacy	4,1	3,3	0,8
Working with others	4,3	3,5	0,8
Mobilising others	3,6	2,9	0,7
Ethical & sustainable thinking	3,8	3,2	0,6
Mobilising resources	3,9		

NB Due to an error the survey has not asked about the level of mobilising resources, so we are not able to identify the gap for this specific skill.

Soft skills

Regarding soft skills also a vast majority of the respondents has agreed that soft skills are very important for tech students and their later careers. Teachers have not been asked this general question (which is an error of the survey), but the average score for students was a 4.09 and for companies 4.22.

As you can see in the table below, the general importance corresponds with the results on the importance of specific soft skills. The average scores of importance vary between 3.6 and 4.7 on a scale from 1 (not important at all) and 5 (very important).

	Teachers		Students		Companies	
	Importance	Level	Importance	Level	Importance	Level

Communication	4,5	3,5			4,4	3,7
Collaboration	4,5	3,4	4,2	3,3	4,3	3,6
Networking	4,4	3,2	4,1	3,2	3,9	3,4
Creativity	4,4	3,3	4,1	3,3	4,2	3,6
Critical thinking	4,4	3,0	4,2	3,2	4,5	3,4
Time management	4,4	2,9	4,1	3,2	4,4	3,4
Problem solving	4,7	3,3	4,4	3,3	4,7	3,4
Leadership	3,9	2,9	3,7	2,9	3,6	2,9
Adaptability	4,2	3,2	4,0	3,1	4,1	3,5
Motivation	4,4	3,2	4,2	3,4	4,5	3,9
Work ethic	4,4	3,2	3,9	3,2	4,1	3,7
Positive attitude	4,2	3,2	4,0	3,3	4,4	3,9
Listening	4,1	3,0	4,1	3,2	4,4	3,6
Empathy	3,9	2,9	3,6	3,0	3,8	3,5
Decision making	4,6	3,0	4,2	3,4	4,2	3,1

Overall, the respondents agreed that the soft skills of tech students need to be strengthened, although there are also some respondents who were not sure about it. Nevertheless, 81.5% of students, 94.4% of teachers and 69.4% of the companies agreed that there is a need for improvement.

Conclusion and recommendations on soft skills

Since there are only very small differences in the importance and level of soft skills, we would recommend to not select the 10 most important skills, but to cover the development of as much as possible of the soft skills with tools and activities based on a ranking. To make this ranking we have averaged the importance and level of these skills according to the teachers, students and companies combined. In the table below you can find the combined scores of the importance of the soft skills and the level of the skills. We also identified the gap between the importance and level. Based on the identified gap we have ranked the skills in the table below. We would recommend including as much as possible tools and activities to promote as much as possible entrepreneurial skills, considering that the gap between level and importance of 1 is the biggest and in 15 the lowest (although the differences are very small).

		Importance	Level	Gap
1	Problem solving	4,6	3,3	1,3
2	Critical thinking	4,4	3,2	1,2
3	Time management	4,3	3,1	1,2
4	Decision making	4,3	3,2	1,1
5	Motivation	4,4	3,5	0,9
6	Listening	4,2	3,3	0,9
7	Collaboration	4,3	3,4	0,9
8	Leadership	3,8	2,9	0,9
9	Communication	4,4	3,6	0,8
10	Creativity	4,2	3,4	0,8

11	Networking	4,1	3,3	0,8
12	Adaptability	4,1	3,3	0,8
13	Positive attitude	4,2	3,5	0,7
14	Work ethic	4,1	3,4	0,7
15	Empathy	3,8	3,1	0,7

Teaching entrepreneurial and soft skills in technical HE

This part of the survey we would like to conclude with statements that we should keep in mind during the development of the project's results:

1. Most teachers can include any short activity on entrepreneurial and soft skills, although some need formal permission or improvement of their teaching competence.
2. In a lot of cases teachers can decide on their own, but in also one-third of the cases minor formal changes or major formal changes need to be processed for the curriculum.
3. We need to provide full teaching materials, since over 90% of the teachers indicate that it would make it easier to introduce such short exercise, definitely or to some extent.
4. Activities should take up to a maximum of 30 minutes since teachers' willingness to implement activities longer than this time decreases.
5. Many of the teachers believe that they should improve their competences in soft skills and entrepreneurial skills.
6. According to the teachers and students we should develop/show (short) activities that specifically target soft/entrepreneurial skills and we should encourage collaboration and teamwork (e.g., by activities).
7. We know that teachers are willing to (learn how to) promote entrepreneurial and soft skills in their classes (68.5%) and that students are willing to participate (83.3%).
8. We should go for either face-to-face learning, online learning and/or practice-based learning and should avoid inquiry-based learning, visual/spatial learning and flipped classroom learning.
9. Half of the teachers have already used tools to improve their students' soft and entrepreneurial skills, but the other half has not (which tools have been used can be found on page 22).
10. Using online tools in classes is possible, but sometimes only with formal permission.
11. The interest in the tools differ quite a lot, therefore we should include as much as possible categories of tools, to make sure that the target group can pick and choose.
12. Teachers are most interested in being in contact with students and teachers from their own university, but also with teachers from other universities and tech companies.
13. Students are most interested in being in contact with tech companies and students from other universities.
14. Companies are most interested in being in contact with tech companies and students from (tech) universities.
15. Preferences for the medium for the community platform differ, but the preference of a web application or a mobile application is common for teachers, students, and companies.
16. Opinions on way of communication is very diverse, so if possible, we should combine several options based on the preferences of the target groups. Teachers prefer e-mail and/or a

forum/threads/posts. Students prefer chat messages and group chats and/or private messages and group messages. Companies prefer chat messages and group chats.

17. A preference for logging in with an e-mail address and password is common among all three target groups. Also logging in with a Google account is popular.

Any other restrictions and limitations which we should consider before developing/finding tools and activities can be found on page 21.

Furthermore, we have also asked what the most important features would be of the community platform. These answers were so diverse, that a conclusion is very difficult. All the answers can be found on pages 27-29 and should be decided on by the platform developer and the whole partnership.