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Guideline for the design and implementation of joint "industrial master" curricula in FS&T/E

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Dissemination Level		
PU	Public	**X**
PP	Restricted to other programme participants (including Commission services and projects reviewers)	
CO	Confidential, only for members of the consortium (including EACEA and Commission services and projects reviewers)	

Summary:

This report examines some important questions that should be asked when considering the design and implementation of a programme of study. The focus here is on an "Industrial Master" with an emphasis on a joint programme. A set of guidelines in the form of 20 questions covering aspects of programme design, delivery and assessment has been considered. Emphasis was also placed in identifying the role of industry through all stages of development and implementation. A preliminary survey was conducted to examine the views of industry. There was a general agreement amongst survey participants to 15 out of the 19 questions examined. Key findings were that (1) the subject area should be based generally on knowledge and skills required for working in specific jobs in industry; (2) innovative pedagogical methodologies should be used in the delivery of the programme; (3) Industry participants should be involved in the identification and formulation of the learning outcomes for the "Industrial Master" and also (4) in the delivery of activities that focusses on the development of cognitive, practical, soft skills and competences.

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1 Introduction

The main aim of this report was to develop a set of guidelines that higher education institutions might be able to use if they were to consider developing a joint programme of study, with an specific focus of an "Industrial Master" in Food Science & Technology and its variants. A document was presented to the consortium for discussion and a preliminary survey was conducted to seek the views of an industrial audience. Section 2 outlines the guidelines that have been developed and section 3 presents the results of the survey.

2 Guidelines

This section outlines provides some guidelines, that one might consider at different stages of the design and implementation stage of a programme of study, written in a format of a series of questions. The aim was to provide some aspects that might be considered, with an emphasis on the role of industry in the conception, design and delivery of an "Industrial Master". A final section also includes an examination of how the programme should be validated.

2.1 Where should we start?

When the project consortium presented task 4.4. on providing "***Guideline for the design and implementation of joint "industrial master" curricula in Food Science & Technology/Engineering FS&T/E"***, the main question was, what does the term "Industrial Master" signify? Understanding what an "industrial Master" programme might be, depends on what we perceive should be the type and level of involvement of industry during the conception, development, validation and eventual delivery of the Master programme. Does using the word "Industrial Master" instead of just "Master" programme suggest that the "Industrial Master" should be any different from the current offers of "Master" programmes in Europe and around the word?

There are many examples of different levels of involvement of industry in current Food Studies "Master Programmes", both at the undergraduate and postgraduate levels. Experts from industry provide lectures or practical training to students in full-time education. Industrial experts often sit on committees to provide universities with insight regarding the needs of

industry and might suggest what should be taught in undergraduate and postgraduate programmes. Students visit factories and might undertake industrial placements or internships in companies as part of their study programme. As part of this project, tasks 4.2 and task 4.3 has been developing training activities that include, online webinars, workshops, student team projects and joint practical training. All these activities can be currently found in existing "Master" programmes. So, the first question we should ask is,

(1) To what extent do you agree that an "industrial Master" should be different from existing "Master" programmes in Food Studies?

If most the consortium members "Completely Disagree", this would indicate that existing "Master" programme, that provide various levels of involvement of industry, can be considered to be the same as an "industrial Master". On the other hand, if members are more likely to "Completely Agree", this would indicate that to some extent that an "industrial Master" should provide something that is not currently on offer. What that is, we would have to determine further.

2.2 Conception of a new "Industrial Master''

The development of a new "Master" programme in any university demands that the university undertakes some market research of the current offerings. Different aspects would be considered. Subject matter might be the first to be considered and this could be decided upon based on (1) an area of study not currently being offered by the university; (2) an area of study not on offer by any other higher education institution. If the university does not currently offer a "Master" programme, it would need to examine the level of competition their new programme might have compared to existing programmes. If the proposed "Master" programme has a subject area not currently on offer, then there might be a good case for developing this programme, if there is a need for such a programme. In the case of an "industrial Master", who should choose the subject area? The second question we might ask is,

(2) To what extent do you agree that the subject area for a new "Industrial Master" should be provided only by Industry?

It might be logical to assume that if the suggested area comes from a single company, then this "Industrial Master" would be developed with only that company's goals in mind. Examples can be found where companies have developed their own "Master" programmes or they work with a university to develop and deliver it. So, if you "Completely Disagree" to question (2), then you might examine your existing programme offering and decide on the subject area. If answer tends towards "Completely Agree", then we need to examine if the goal is to develop the "Master" programme for a single company or for the general needs of the Food Industry in terms of knowledge and Skill shortages. The third question we might then ask is,

(3) To what extent do you agree that the subject area should be based generally on knowledge and skills required for working in specific jobs in industry?

If the answer is "Completely disagree", it would suggest that the next step is to determine what careers would graduates of this programme have besides working in industry. On the other hand, if you are more likely to "Completely agree", how should we proceed? We might consider examining the needs based on the sub-sector. There may be specific skills required for working the Dairy industry but not needed in the Wine industry or vice versa. Or we might consider focussing on a job function. Does industry need more food engineers? Or Food microbiologists? I believe that an "Industrial Master" should be one where the goal is to provide the graduate with the necessary skills to work in industry. A programme where the main subject area is focussed on a job function, makes the "Industrial Master" distinct from most current "Master" programmes, where the focus is on the scientific area and not the job. You may argue that this is just semantics, but I believe that starting from the job and the identifying the knowledge and skills needed to successfully perform the job functions defines what is an "Industrial Master". Therefore, at this point we should ask,

(4) To what extent do you agree that the starting point in the development of a new "Industrial Master" should be based on the requirements of a Job function?

A "Completely disagree" would again suggest that your focus would be not to develop a "Master" programme for training graduates for work in industry. A more positive answer, leading towards "Completely Agree", allows us to decide the next step in the conception of the "Industrial Master". Should we start with identifying the required knowledge first or the skills? If we examine the learning outcomes of most "Master" programmes, we see that the focus is first on knowledge, skills outcomes are considered as secondary outcomes. However, if our answer to question (4) was indeed to examine the requirements from the perspective of a job function, then our next step would be to identify the Competences, Responsibilities and Autonomy required by an individual working that job function. Having done this, we can then determine what skills, practical and Cognitive, are needed to perform various asks for that job function. Finally, we should consider the Theoretical and Factual knowledge needed to allow those skills to be developed and tasks to be performed with a solid understanding of the underlying scientific principles. These three areas, have been used in defining Job Profiles in the TRACK_FAST project. Therefore, it might be reasonable to ask,

(5) To what extent do you agree that the learning outcomes for the "Industrial Master" should be based firstly on the identifying the Competences, Responsibilities and Autonomy needed by an individual working for the job function?

2.3 Development of a new "Industrial Master''

After the learning outcomes for the programme has been identified, we should consider some of the practical aspects in the development of the "Industrial Master". The appropriate pedagogical methods should be used, depending on the type of learning outcome for the programme. This should be the next area of focus in the developing the "Industrial Master". What methods should we adopt? Should traditional teaching practices be adopted, where the teaching is mainly lecture based? Practical sessions and tutorials are provided to help student "better understand the theoretical concepts". Should we consider other pedagogical methods that emphasise development of Skills and Competences as their primary focus?

Before considering the selection of pedagogical methods, let's examine what alternative innovative teaching strategies have been identified in the deliverable 5.1 "Report on identification of Good Practices in Innovation in Teaching and Learning". The report highlights Problem-Based learning (PBL) as a teaching strategy ideally suited to the aim of development of soft skills, as students must interact with others in the learning process. An example is given on how to design and implement a PBL module, where desired soft skills and competences is used determining the learning outcome of the course module. PBL uses a problem scenario as the focus of the learning process. Project-led education (PLE) uses a series of projects that is design at developing competences in the required profession, with each project focussing on different scientific themes. One of the big differences between PBL and PLE is that PLE is programme based, where 50% of the time is spent on the project, 25% on project related modules that covers theoretical knowledge and skills necessary to enhance the learning process during the project work, and the remaining time spent on mandatory modules that focus on core sciences (Kolmos et al 2006). These two innovative strategies should be considered as the main teaching methods if the primary focus is on developing Skills and Competences for working in industry. You should now ask yourself,

(6) To what extent do you agree that innovative pedagogical methods, such as Problem-based learning or Project-led Education should be used in the delivery of the "Industrial Master"?

A "Completely Disagree" to question (6) would suggest that you intend to use main more traditional teaching methods. However, if you decide on the alternative, then you will find more details in the deliverable 5.1 on how to develop an "Industrial Master" using these innovative teaching strategies.

Some examples of e-learning pedagogical methods were also identified, in deliverable 5.1., that can be used to for collaborative learning, problem-based learning and for developing critical thinking (Newland and Byles 2014). That report also summarises the suggestions by Brower, Hedberd and Kuswara (2010) on how to use and select different online tools, such as Blogs,

Wikis, video, podcasting, image creation and mind maps. Should these methods be used in the "Industrial Master"? Ask yourself,

(7) To what extent do you agree that e-learning pedagogical methods should be used in the delivery of the "Industrial Master"?

Having decided on the possible methods of delivery, we should now look at some practical aspects for the delivery of the "Industrial Master", taking into considerations any additional requirements we might have. The description of the project work package calls for "guidelines to be used to implement FS&T/E curricula by tuning the industry involvement and to design joint degrees with strong industry involvement". In addition, details on the report for this task calls for the report to consider "including accreditation criteria ". What does "strong industry involvement" suggest? Consider,

(8) To what extent do you agree that industry participants should be involved in the identification and formulation of the learning outcomes for the "Industrial Master"?

(9) To what extent do you agree that industry participants should be involved in the design of the learning activities?

(10) To what extent do you agree that industry participants should be involved in the delivery of activities that focusses on the development of cognitive, practical, soft skills and competences (e.g., Projects, Problem-based tutorials, practical sessions, industry visits)?

(11) To what extent do you agree that industry participants should be involved in the delivery activities that cover theoretical knowledge and skills necessary to enhance the learning process?

(12) To what extent do you agree that industry participants should be involved in the delivery activities that cover theoretical knowledge considered to be core sciences, that may or may not be required for programme accreditation?

(13) To what extent do you agree that student peer assessment should be used to determine individual performance when a group mark is awarded for assessing learning activities?

(14) To what extent do you agree that industrial participants should be involved in individual student assessment?

The next aspect to consider is the question of "joint degrees"? There are several "Master" programmes in the food studies area, involving different universities in Europe. Students attend modules where each university partner is located. If this format of delivery is adopted, then have specific themes, where each location is responsible for the delivery and assessment during that period of study. This format allows for the use of the innovative pedagogical methods (PLE or PBL) or the traditional teaching methods. However, if PLE is used then each location would normally run a Project or the Problem-based learning module/s, in addition to the other mandatory or project related modules in the case of PLE. This does not prohibit the use of collaborative activities between locations, if for example, more than one location is used to deliver the same specific theme. Consider,

(15) To what extend do you agree that a joint "Industrial Master" must involve teaching delivered by more than one university partner?

(16) To what extend do you agree that for a joint "Industrial Master", students must attend modules delivered at each university partner's location?

(17) To what extend do you agree that collaborative activities (these can be university to university or university to industry) should be used in a joint "Industrial Master"?

Some joint European "Master" programmes include the involvement of industry participants. In some cases, students have an internship in the final part of the programme. What should the student do, during that internship? Do students benefit from an internship in more than one company during the programme, if each internship focusses on one of the specific scientific themes? If an internship is part of the programme, how much should it contribute to the final assessment of the student? Should the internship be used to validate the skills and competences of the student, as a final overall assessment? These are some suggestions on how to allow for a "strong industry involvement".

(18) To what extent do you agree that an internship must be part of the "industrial Master"?

(19) To what extent do you agree that an internship should be used as a final assessment of competences, skills and knowledge of the student?

2.4 Validation of a new "Industrial Master"

The final aspect to consider, with regard to the requirements set out in the work package description, is the "accreditation criteria". The ISEKI-Food Association is developing a CPD certification scheme that is based on Job profiles. Details of the scheme has been described in deliverable 3.2 Certification Scheme for CPD training. The proposed certification scheme on Job profiles, requires an applicant to achieve at least 70% of the learning outcomes (LOs) in each of the three criteria areas: theoretical and/or factual knowledge (criteria A), cognitive and practical skills (criteria B), and responsibility and autonomy in a job function (criteria C). These are the same three criteria mentioned earlier that should be used in defining the learning outcomes for the "Industrial Master". The CPD certification scheme describe has been proposed to be used with professionals working in industry and specifically in the job function similar to the area of the CPD certification area. In the case of the "Industry Master", the learners would be students in full-time education and would not normally work in industry. The "industrial Master" can be an alternative route to the certification of the job Profile for those learners that do not meet the requirements for applying through the CPD route. This idea has already been considered, in the framework of the CPD certification scheme that is being developed by the ISEKI-FOOD Association. The second advantage of linking the "Industry Master" to this scheme, is that it provides a clear route to further continual professional development in the selected area of the job profile. Our final question that should be,

(1) To what extent do you agree that the "Industrial Master" should be linked to the ISEKI-FOOD Association's Continual professional development certification process for job Profiles (job functions)?

3 Survey on the requirements of an "Industrial Master"

A preliminary survey was conducted during an EHEDG Austria Kick-off meeting on hygienic design in Austria that was attended by 32 participants. The questionnaire consisted of 19 questions that was developed under section 2. For each question, a 5-point likert scale was used to ask each participant to what extent they agreed to each of the statements.

The results of the survey were analysed with a bar chart, that shows the percentage of agreement, and a Wilcoxon signed ranked test conducted comparing differences in the medians of each scale category. The results indicated that the participants "agree" (median of 4) on 15 out of 19 statements. The summary (in the form of the bar chart) will be presented for each question.

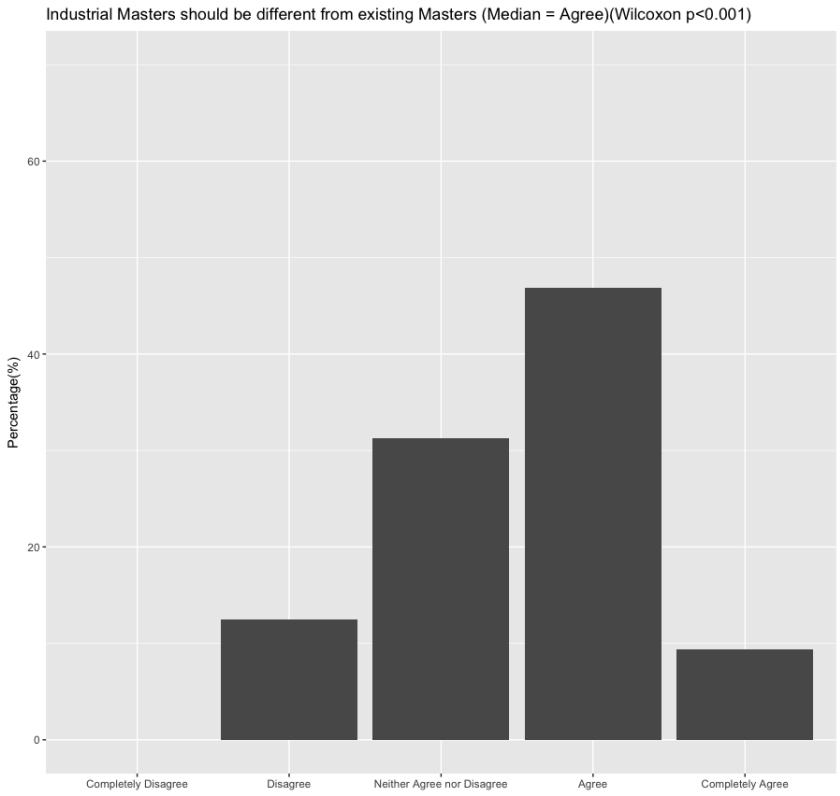

Figure 1. An "industrial Master" should be different from existing "Master" programmes in Food Studies?

3.1 What aspects should be considered when developing a new "Industrial Master''?

There was a clear agreement amongst the participants that an "Industrial Master" should be distinctively different ($p<0.001$) than existing "Master" Programmes in Food studies (Figure 1). Although, they disagreed that subject area for the programme should be solely provided by industry (Figure 2), they agreed that focus of the programme should be based generally on developing learners

developing knowledge and skills that would be required for working in specific jobs in the food industry (Figure 3) and that the focus for the programme should start by outlying the requirements for a job (Figure 4). Thy agreed that this could be done by identifying the Competences, Responsibilities and Autonomy needed by an individual working for the job function (Figure 5).

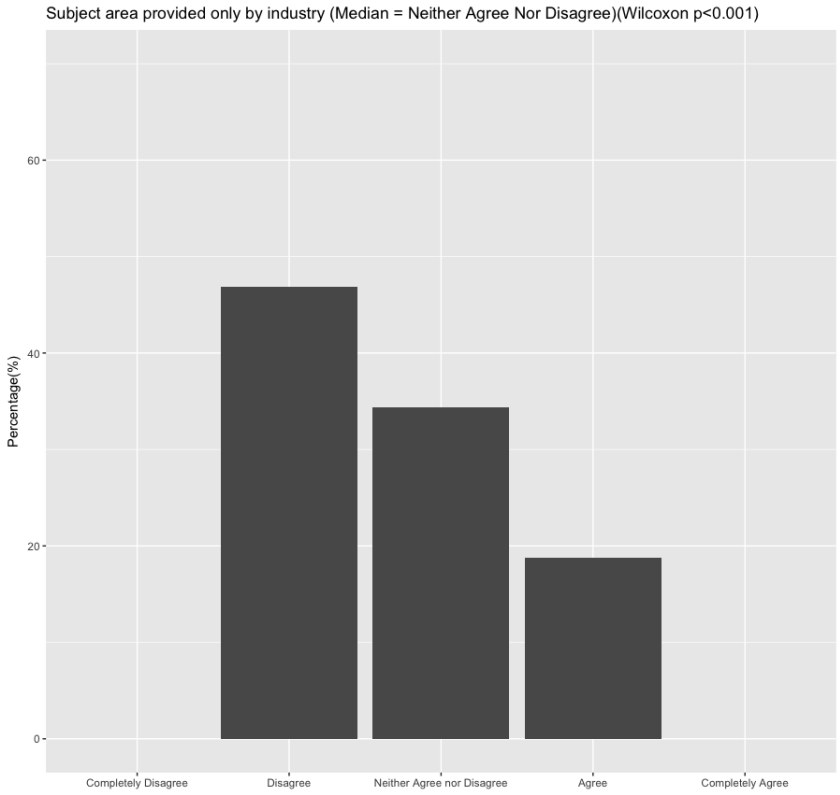

Figure 2. The subject area for a new “Industrial Master” should be provided only by Industry?

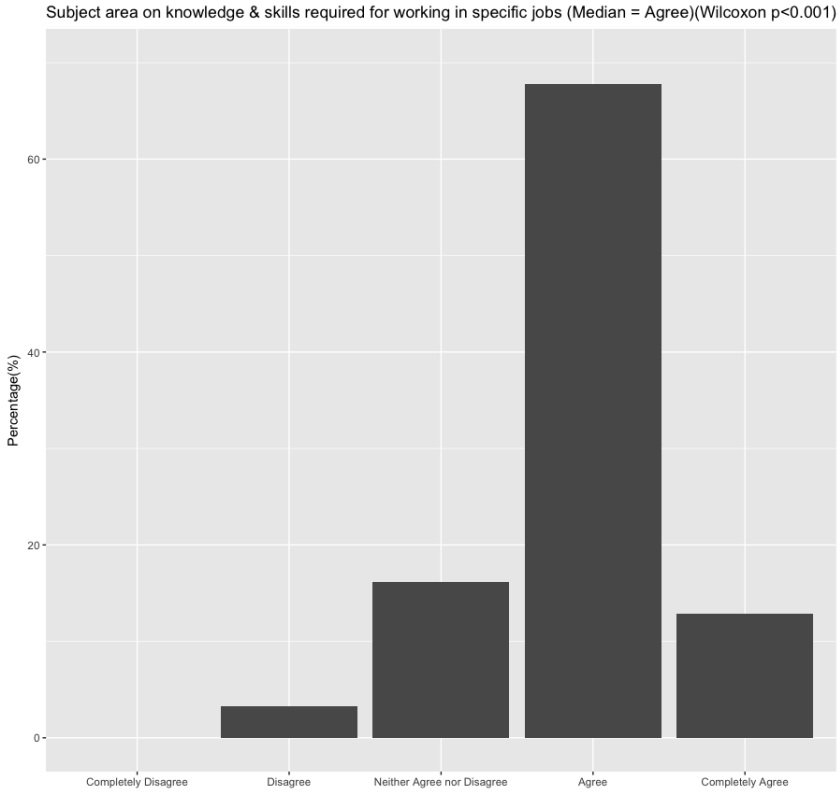

Figure 3. The subject area should be based generally on knowledge and skills required for working in specific jobs in industry?

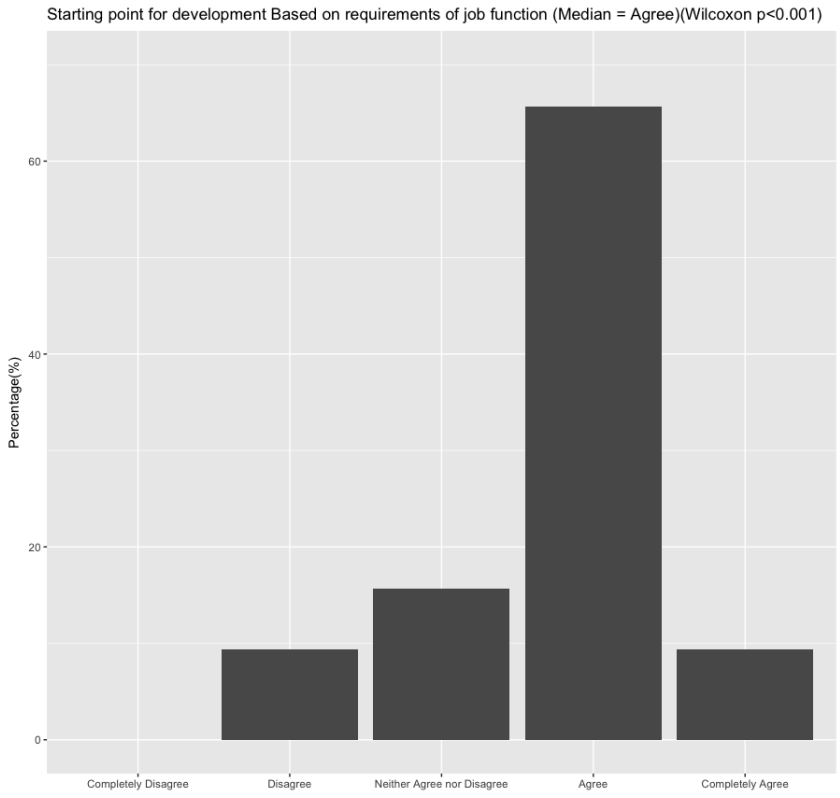

Figure 4. The starting point in the development of a new “Industrial Master” should be based on the requirements of a Job function?

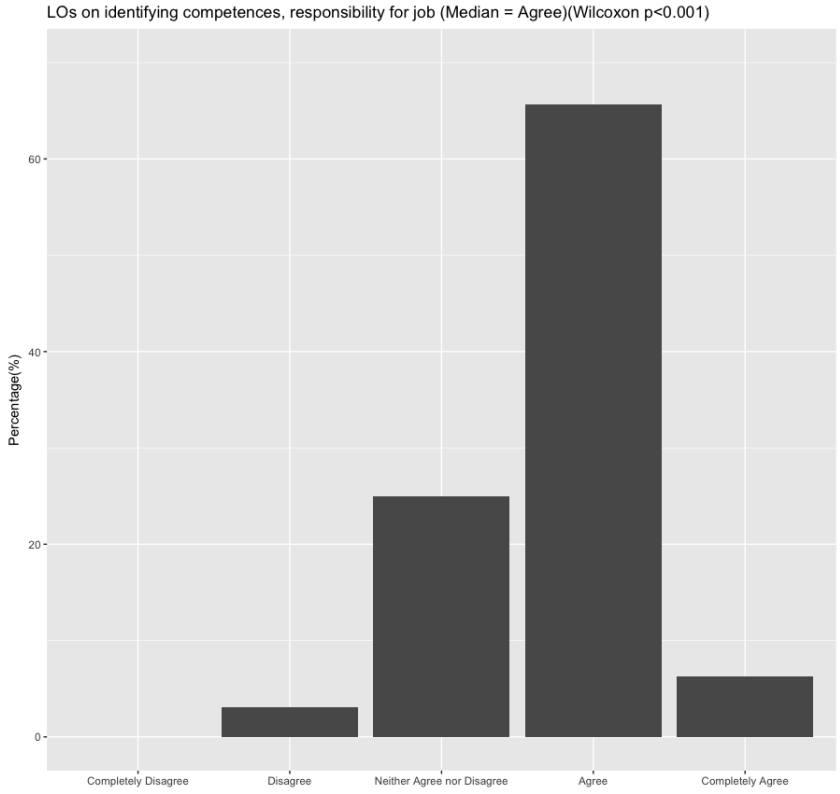

Figure 5. The learning outcomes for the "Industrial Master" should be based firstly on the identifying the Competences, Responsibilities and Autonomy needed by an individual working for the job function?

3.2 How should the "Industrial Master'' be designed?

The selection and use of appropriate pedagogical approaches should be considered to allow for learners to acquire the appropriate. knowledge and skills. Figure 6 indicated that 50% of the participants "agreed" and just over 35% "completely agreed" with the suggestion that problem-based learning or Project-Led education pedagogies would be appropriate means of delivery. Although, over 40% agreed that E-learning could employed, another 40% "Neither nor Agreed" to the suggestion (Figure 7).

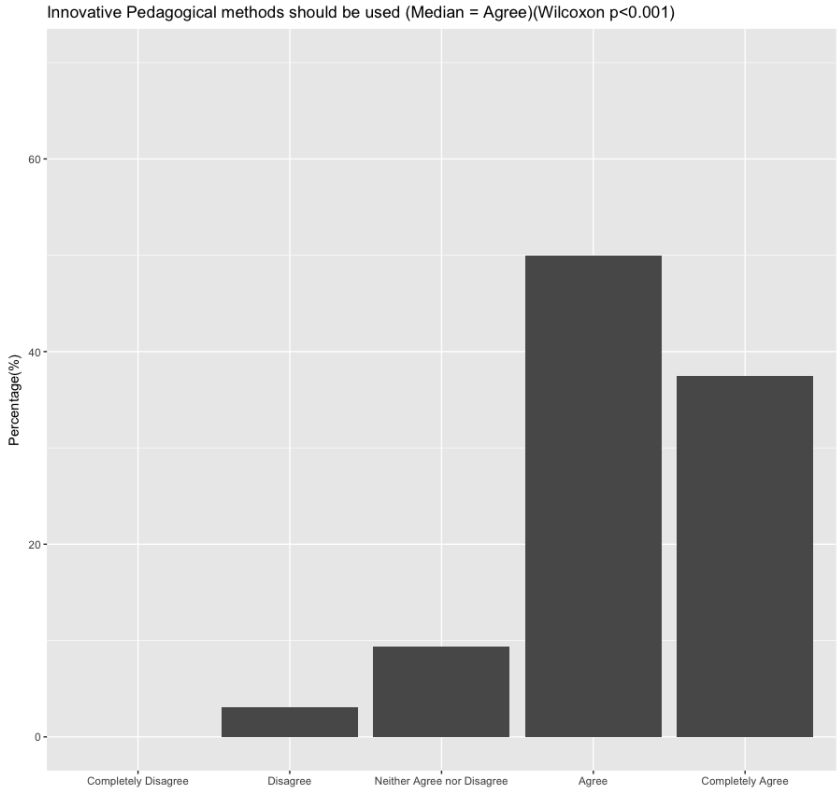

Figure 6. Innovative pedagogical methods, such as Problem-based learning or Project-led Education should be used in the delivery of the “Industrial Master”?

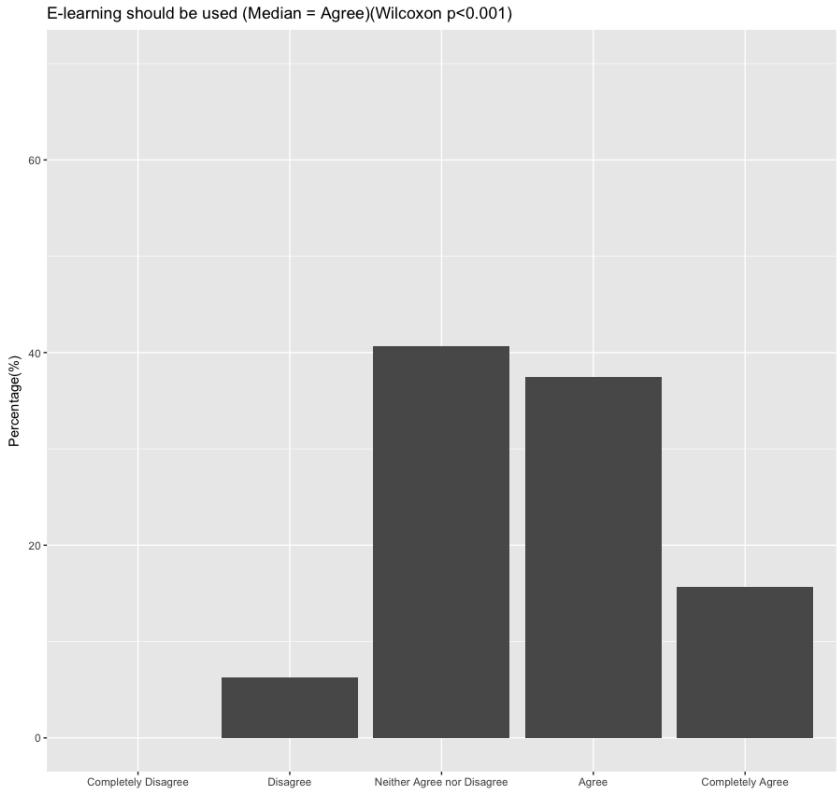

Figure 7. E-learning pedagogical methods should be used in the delivery of the "Industrial Master"?

3.3 What role should industry have in programme design?

The role industry plays in the design of an "industrial Master" will have a direct effect the focus of the programme. More than 80% of the participants wither "agree" or "completely agree" with the idea that industry should be involved in the identification of the learning outcomes (Figure 8) and almost 70% (about 55% "agree" and 15% "Completely agree") felt industry should be involved with the design of the learning activities for the programme (Figure 9).

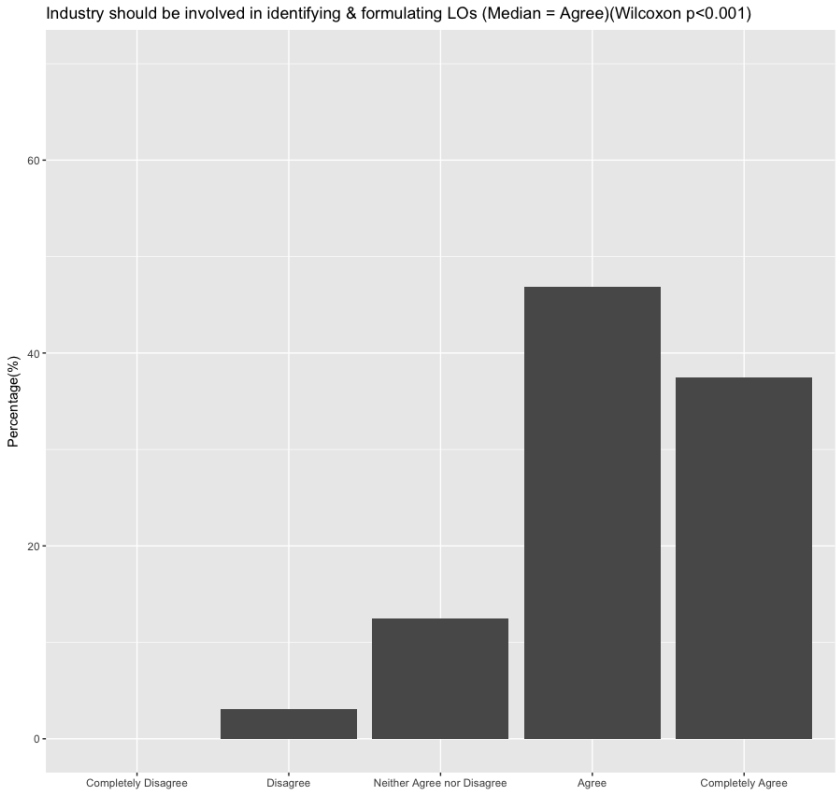

Figure 8. Industry participants should be involved in the identification and formulation of the learning outcomes for the "Industrial Master"?

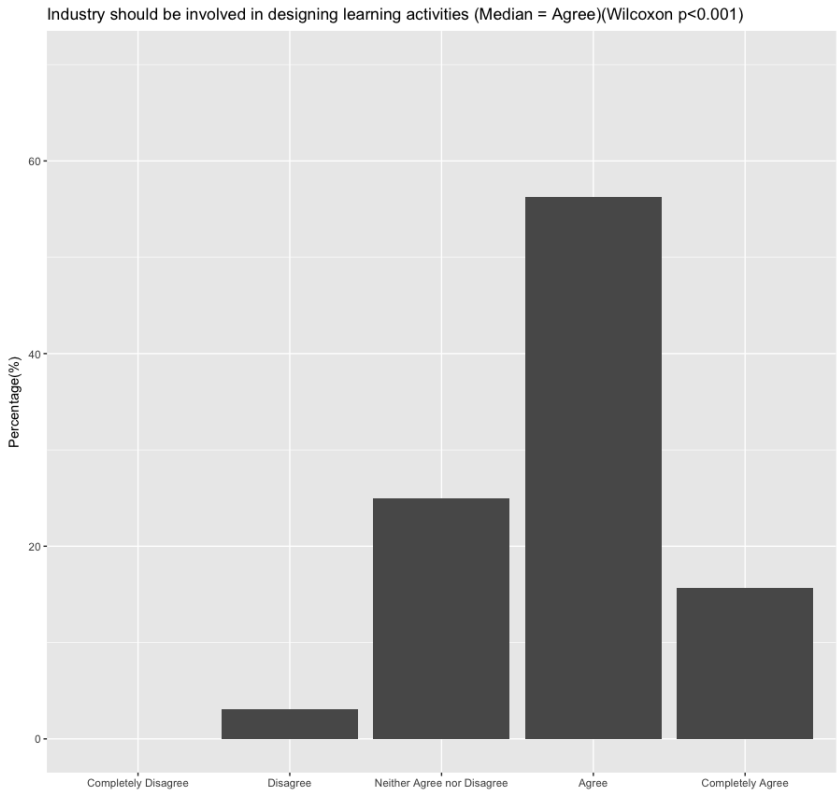

Figure 9. Industry participants should be involved in the design of the learning activities?

3.4 What role should industry have in programme delivery?

When it came to the aspect of delivery, participants unanimously agreed (more than 85% stating that they "agree" or "completely agree") that industry should partake in the delivery of activities that focusses on the development of cognitive, practical, soft skills and competences (Figure 10). The activities suggested were projects, problem-based tutorials, practical sessions and industry visits. However, when asked if "industry participants should be involved in the delivery activities that cover theoretical knowledge and skills necessary to enhance the learning process?" (Figure 11) and "Industry participants should be involved in the delivery activities that cover theoretical knowledge considered to be core sciences, that may or may not be required for programme accreditation?"(Figure 12), there was a shift in the level of agreement towards "neither agree nor disagree". Perhaps they believed that core knowledge should be covered by academics, whereas industry would provide better training when dealing with the application of knowledge and the development of skills.

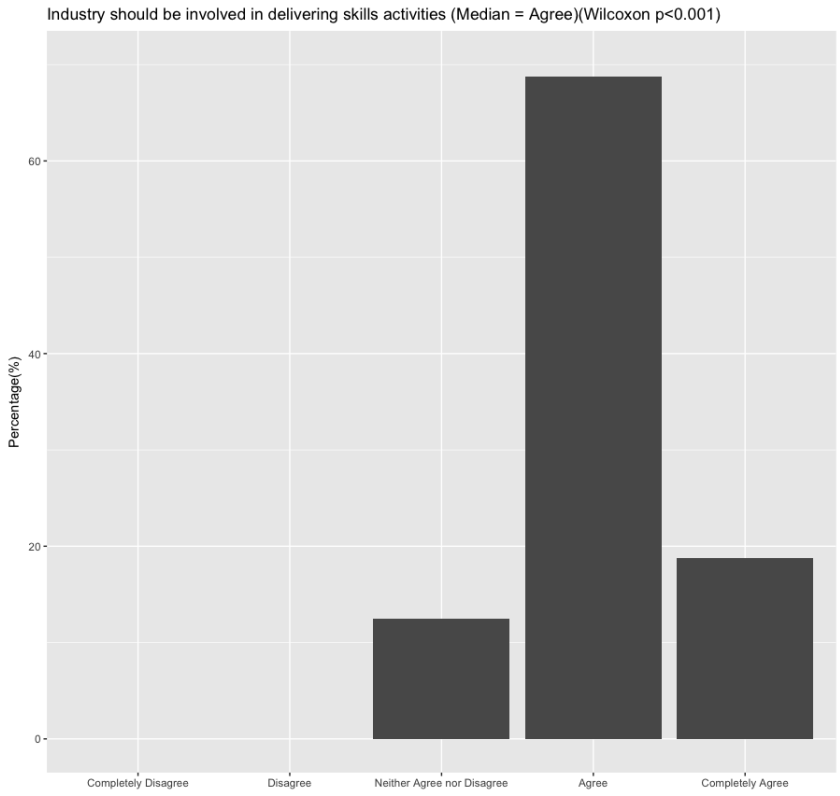

Figure 10. Industry participants should be involved in the delivery of activities that focusses on the development of cognitive, practical, soft skills and competences (e.g., Projects, Problem-based tutorials, practical sessions, industry visits)?

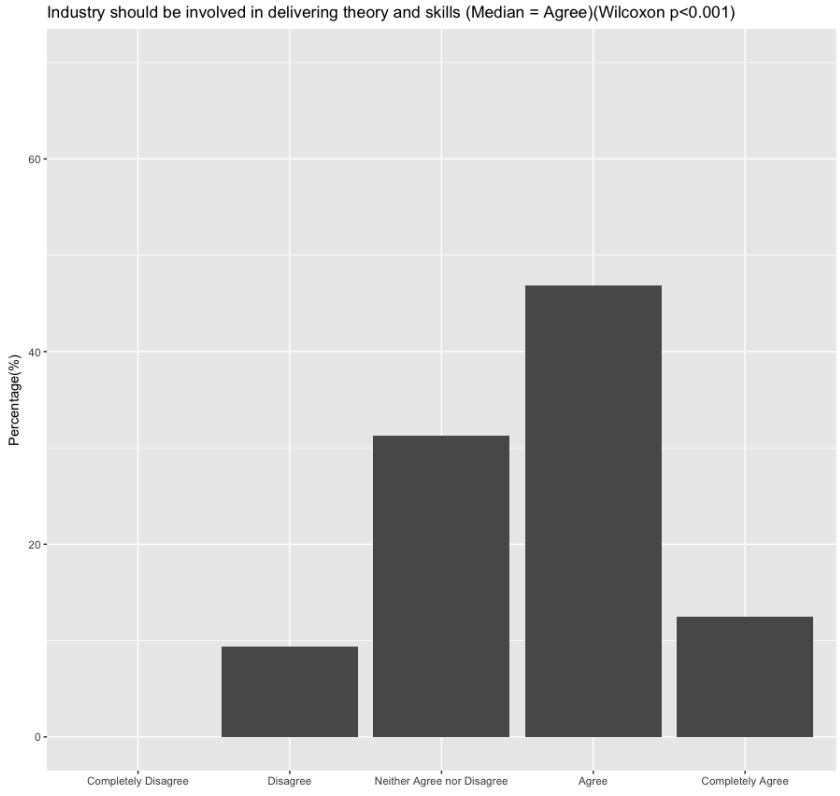

Figure 11. Industry participants should be involved in the delivery activities that cover theoretical knowledge and skills necessary to enhance the learning process?

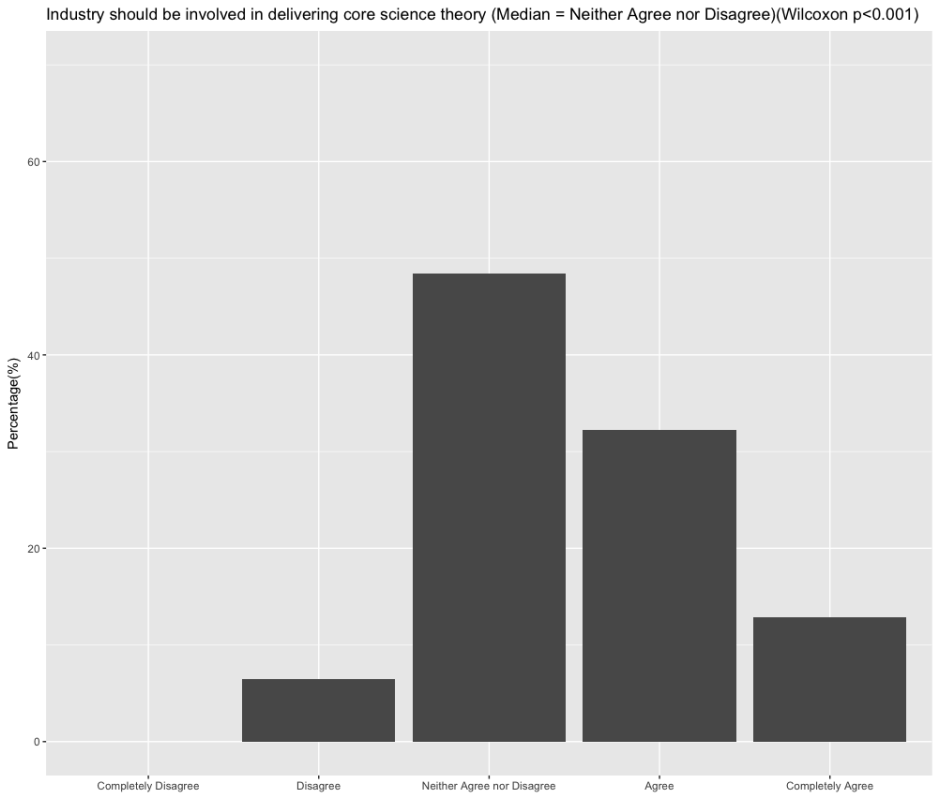

Figure 12. Industry participants should be involved in the delivery activities that cover theoretical knowledge considered to be core sciences, that may or may not be required for programme accreditation?

3.5 Student assessment

Figure 13 examined the idea of using peer assessment as a means to award individual marks for learnings from a group mark. About 55% “neither agree nor disagree”, with only about 30% in agreement. However, only about 50% (35% “agree” and 15% “Completely agree”) that Industrial participants should be involved in individual student assessment.

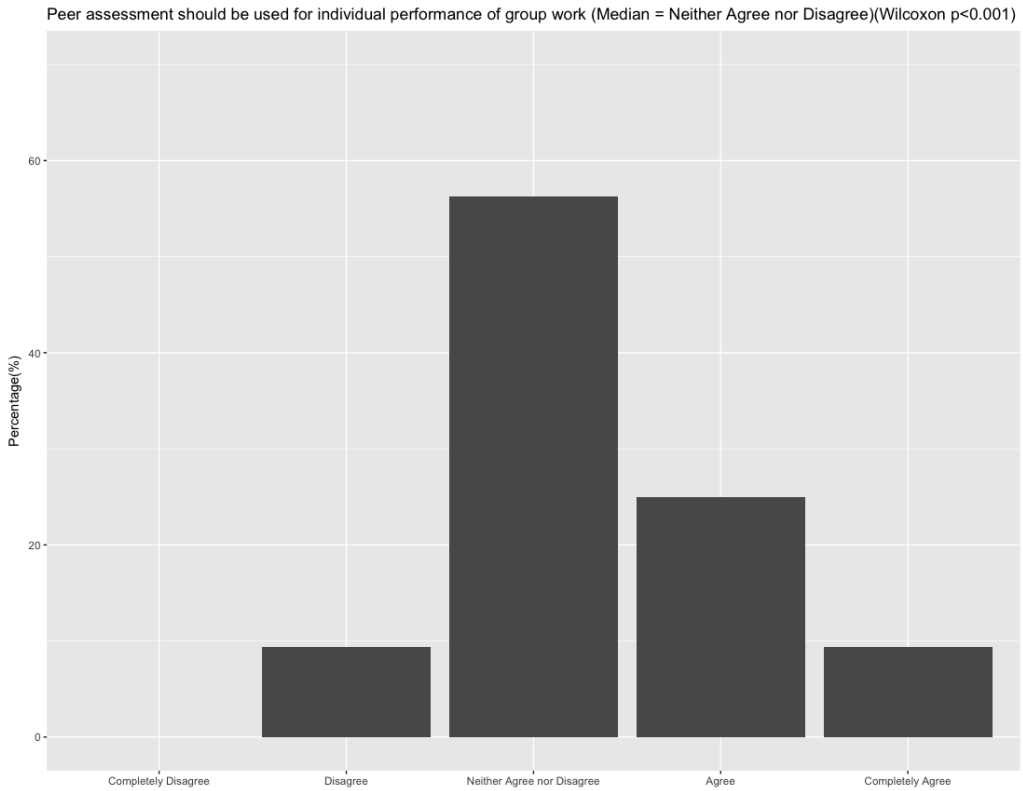

Figure 13. Student peer assessment should be used to determine individual performance when a group mark is awarded for assessing learning activities?

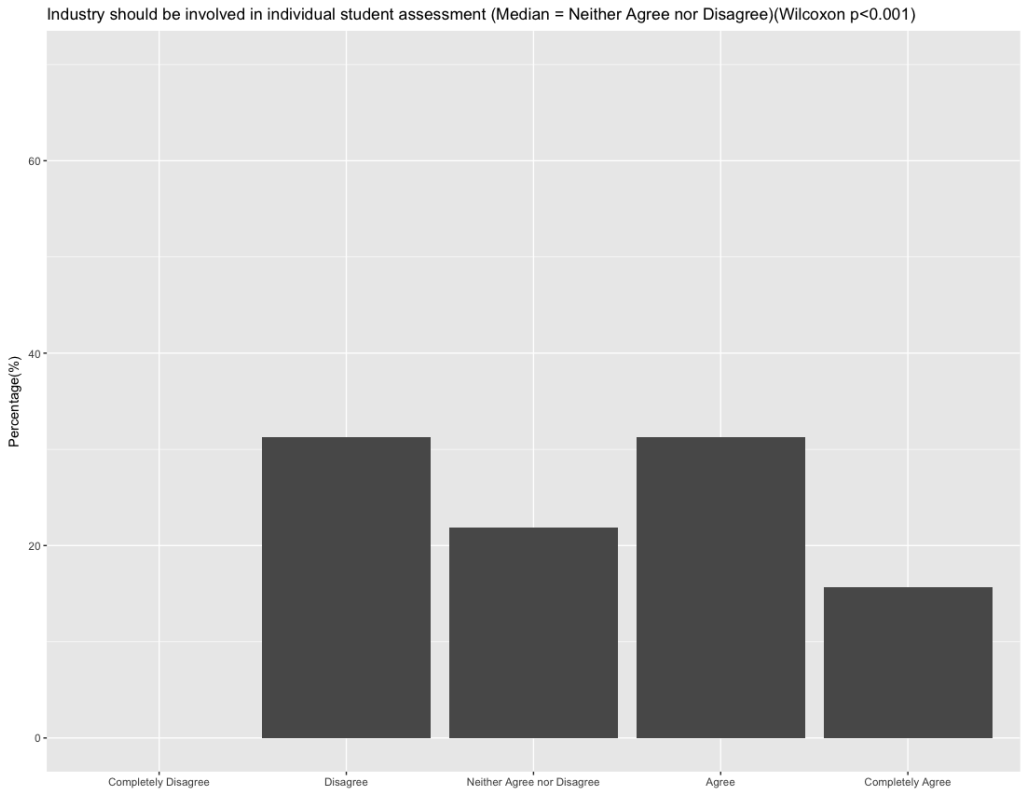

Figure 14. Industrial participants should be involved in individual student assessment?

3.6 The Joint "Industrial Master"

Three questions were asked with regard to the division of teaching amongst partners of a joint "Industrial Master". Just over 40% and 10% of participants indicated that they "agree" and "completely agree" for teaching to be delivered by more than one university partner (Figure 15). Secondly, nearly 60% was in agreement that students must attend modules delivered at each university partner's location (Figure 16) and there was also about a 80% agreement that Collaborative activities, defined as university to university or university to industry, should be used in a joint "Industrial Master.

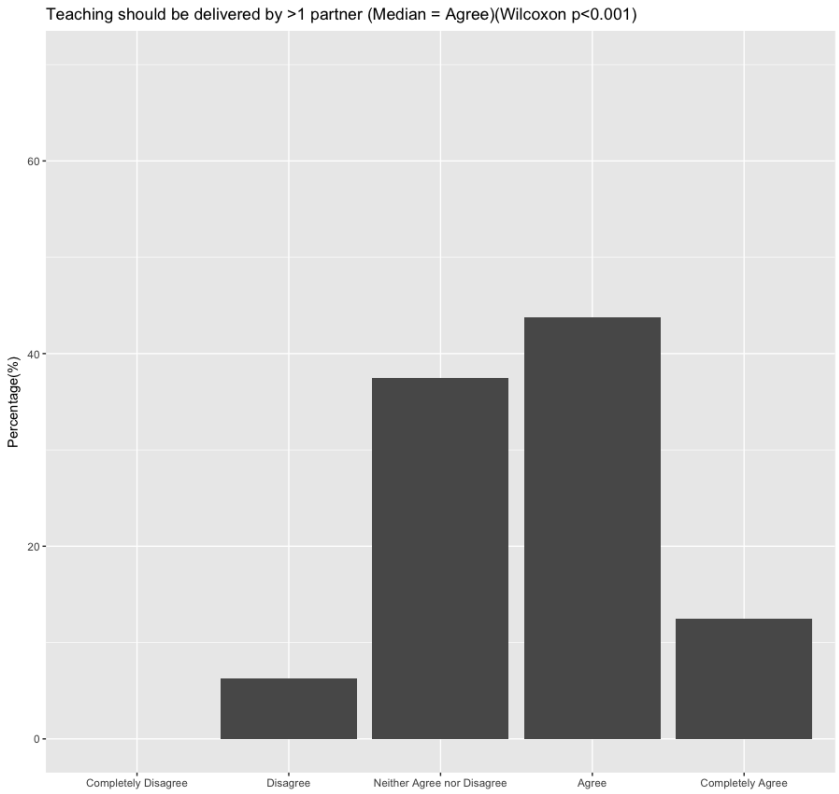

Figure 15. A joint "Industrial Master" must involve teaching delivered by more than one university partner?

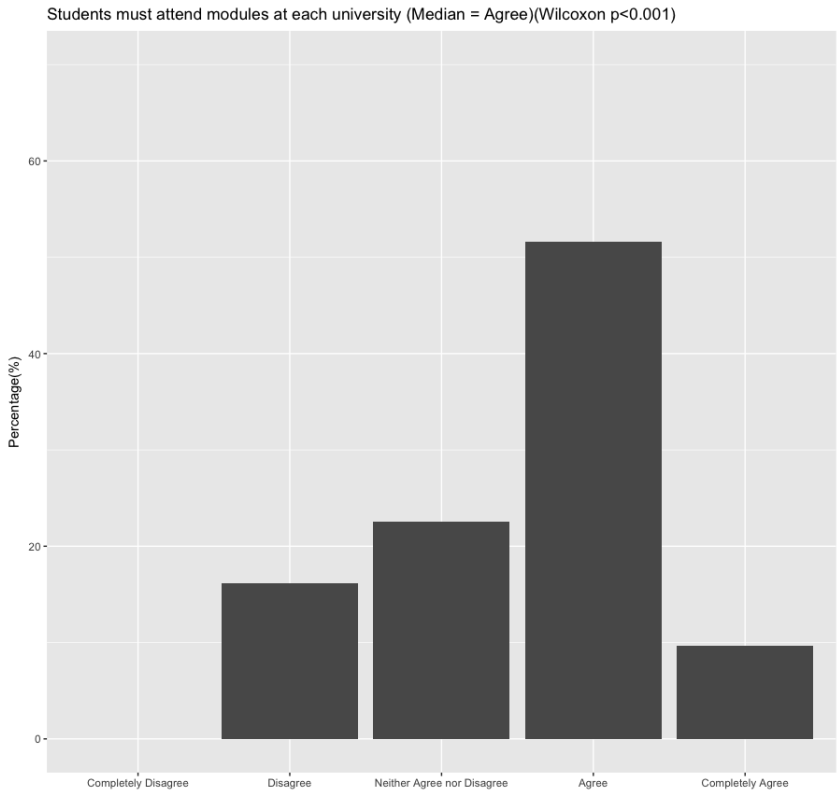

Figure 16. For a joint "Industrial Master", students must attend modules delivered at each university partner's location?

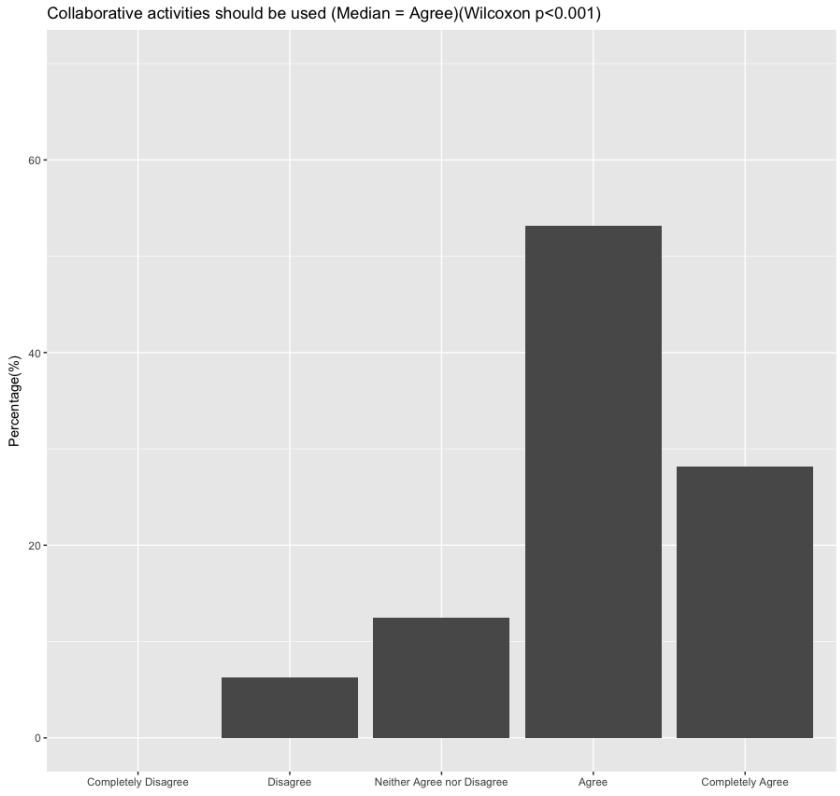

Figure 17. Collaborative activities (these can be university to university or university to industry) should be used in a joint "Industrial Master"?

3.7 The importance of student Internships

The final two questions on the survey examined the importance of student internships. Figure 18 indicated that about 35% and 30% were either “agree” or “completely agree” that an internship should be part of an “Industrial Master”. Finally, around 50% of the participants were in agreement to the idea that an internship should be used as a final assessment of competences, skills and knowledge of the student.

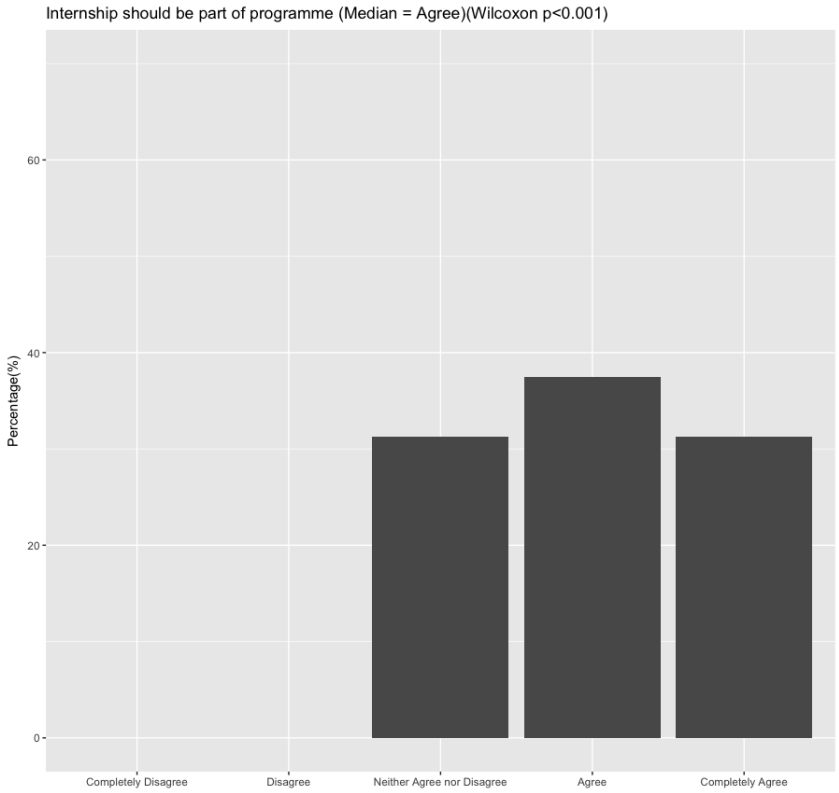

Figure 18. An internship must be part of the “industrial Master”?

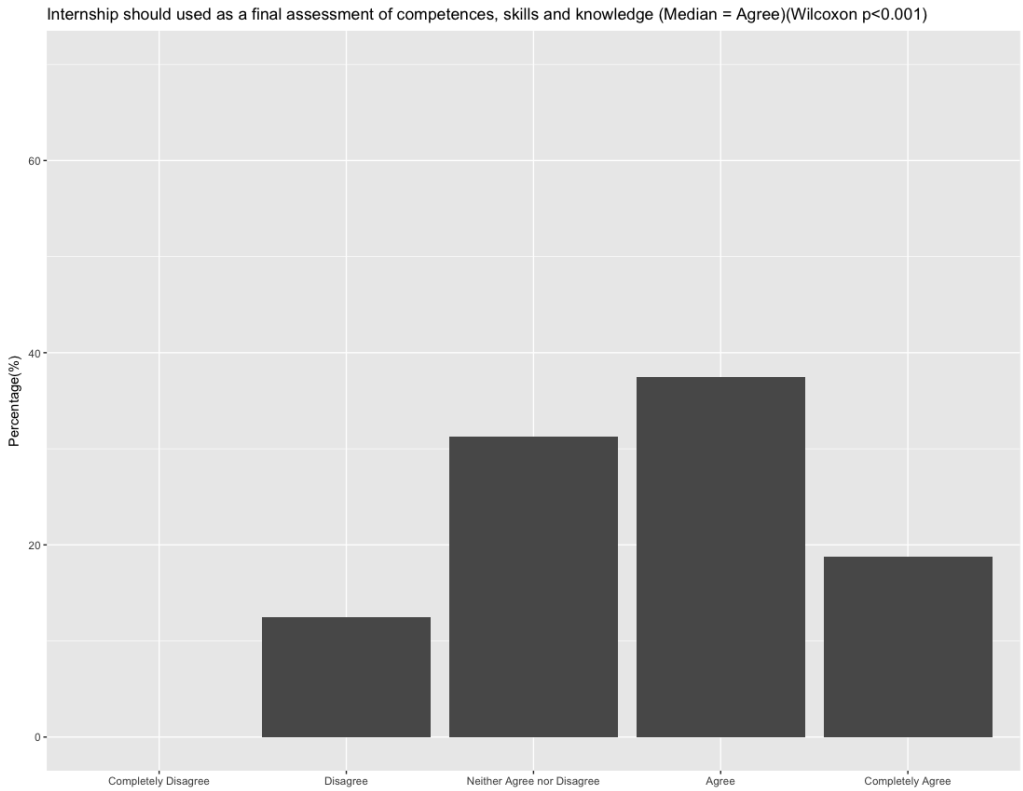

Figure 19. An internship should be used as a final assessment of competences, skills and knowledge of the student?