

ASSESSMENT: THE DEVELOPING AND TESTING OF A TRIAL EXAM IN A CROSS-DISCIPLINARY FIELD USING BOTH FORMATIVE AND SUMMATIVE EVALUATION

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ABSTRACT

The purpose of this research project is to redesign an existing 1st year exam at The Copenhagen School of Technology and Design to enhance the students' vocational competency and hence to enhance the students' employability. Furthermore, there was a wish to make the exam focus more explicitly on the students' innovative competencies. This generates a need for guidelines and assessment tools in order to assess the innovation competences of the students. An exam form that combines both formative and summative evaluation has been developed and tested. Additional tool/concepts have been developed to support the process. This includes an innovation manifest, innovation taxonomies for the levels 4, 5 and 6 plus two development workshops. The overall applied process method used is The Experimental Cycle. Methods used include observations, qualitative e-mail interviews, open questionnaires, reflection logs and document analysis.

Important findings include the development of an innovation manifest, which resulted in a greater focus on innovation in the assessment of the students the following year. By the use of efficient didactical methods, the students were exposed to hands-on learning, a risk-taking learning environment, short pitches and a space for evaluation and reflection. The students and examiners found that the combination of a formative and summative exam gave a more fair assessment. The innovation taxonomy was found useful to evaluate and grade the students. These results can be useful to educations, which work with inter-disciplinarily tests and/or need to define and test the students' innovation competences.

Keywords: Formative assessment, exam, innovation taxonomy, assessment tools, EQF.

1 INTRODUCTION

1.1 Employability – a primary concern of the educational field

Danish/European educational institutions are at present concerned with the employability of the students. How are we preparing the students to function in and being an asset for the business community? How do we ensure that we teach the students how to work in a cross-disciplinary field? How do we help them develop an entrepreneurial mindset and start up their own businesses? And how can we measure and test their employability? What are fitting assessment methods within this area? [1], [2].

1.2 The context of the research

The setting of this research project is the education, named E-design, at KEA, The Copenhagen School of Design and Technology. It is a two-year entrepreneurship and design programme at a higher level in the Academy Profession Programme (AP). In order to reflect the labour market practice, the learning principles behind the teaching is *project based*, *problem oriented* and *interdisciplinary*. This also calls for all exams to be cross-disciplinary. As an education that focuses on educating entrepreneurs working in a design field, our goal is to ensure that the students develop an entrepreneurial mindset and in doing that *innovation* and the developing of *innovative skills* is central

cf. Schumpeter [3]. Simultaneously, a main educational and didactical focus and goal is the students' learning [4] and their reflexive skills concerning this achieved learning [5]. This research project started in May 2013, where our research showed that despite the great focus on innovation and entrepreneurship in the education sector, there were no clear rating criteria and rating methods for measuring the (achieved) innovation competences of the students at given levels according to the European Qualifications Framework (EQF). Furthermore, the exam forms did not reflect the real world that meets the graduated students [1]. Thus, none of our graduates are asked to do a synopsis with an oral presentation as entrepreneurs or employees. Therefore, there was a need to define innovation and innovation competences in an entrepreneurial design education context and to develop and test an exam form that was more related to the real world, and more vocational.

1.3 Research questions in the research projects

These issues lead to the following research questions: How can we make the current exam more related to the practice of the real world, and more vocational? How can we define, evaluate and assess the students' innovation skills and competences in an entrepreneurial context and add focus on innovation in the teaching and at the first year exam?

2 OVERALL METHODOLOGY: THE EXPERIMENTAL CYCLE

The research is based on empirical research from four case studies. Cases 1-3 were performed in cooperation with The Educational Experimenting Laboratory [6] and case 4 was co-funded by The Danish Foundation for Entrepreneurship [7]. The overall applied process method used in all four cases was 'The Experimental Cycle' [8] (see Figure 1) which was developed through The Educational Experimenting Laboratory. It is based on the work of Bason and Ravn and therefore incorporates the use of design thinking, stating "that research should have the explicit ambition to change and improve social conditions" [9] and that research should be based on practical problems including someone who needs a problem solved and with an inherent need for a solution. Furthermore, the practical effects of the problem solving should be measured and followed by stating improvement and change [9].

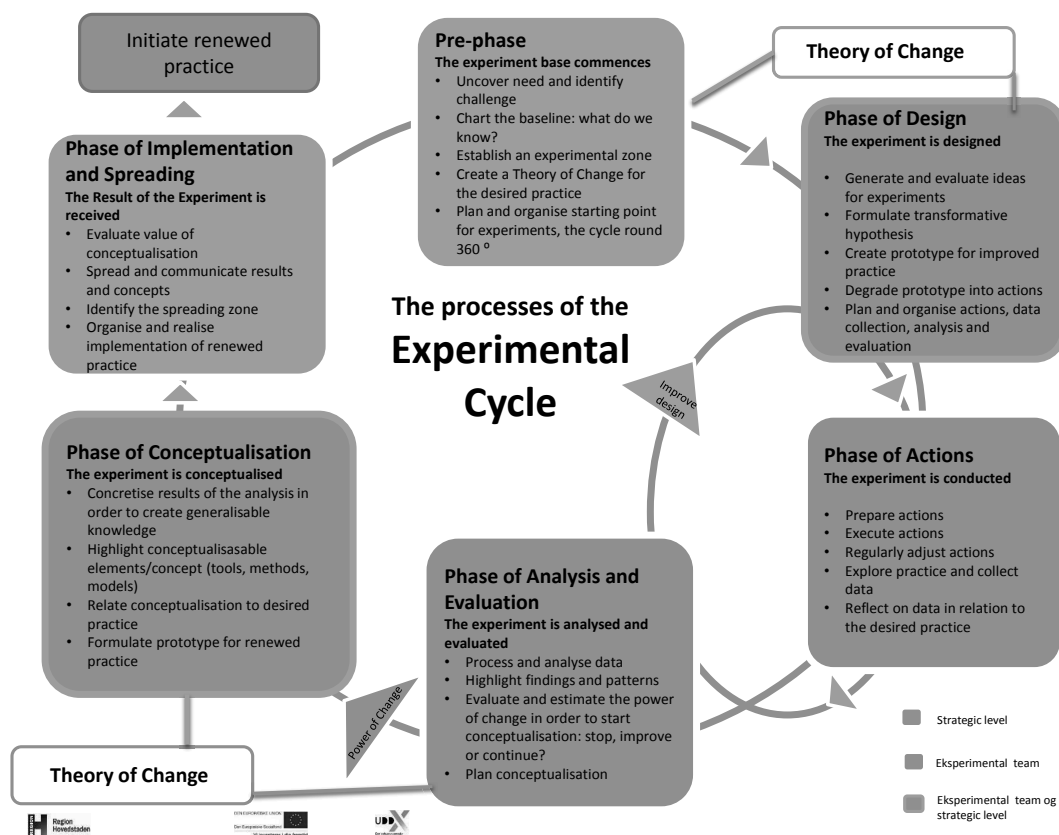


Figure 1. The Experimental Cycle

2.1 Methodology and data collection in the cases

Case 1 focused on teachers articulating innovation and the desired student innovation skills and competences in an entrepreneurial context. The empirical methods used were observation of exams and qualitative e-mail interviews with the teachers. *Case 2* focused on analysing the innovation course “4 white t-shirts” (a three week course where each student is given 4 white t-shirts and has to generate as much money as possible) with the purpose of spotting educational and didactical methods used, in order to detect the most effective methods, to articulate them and measure their effects. The empirical methods used were observations, questionnaires, a reflection log and document analysis. *Case 3* focused on developing a trial exam using both summative and formative evaluation. The empirical method used was observations of exams and the activity was a workshop, where ideas for a new exam form were suggested by different participating stakeholders. *Case 4* focused on testing the trial exam described in case 3 and developing an innovation taxonomy. The empirical method used was open questionnaires to the students, teachers and the second examiner involved in the trial exam and document analysis of the students’ papers and process logs. Overall, the four cases form a cascade experiment and each case serve as a loop in an iterative process with the purpose of improving the education and teaching at the E-design education and creating concepts that can be useful and therefore implemented at other educations cf. The Experimental Cycle.

3 EXPERIMENTS – CASES, THEORY AND ANALYSIS

3.1 Case 1: Assessment of the innovation and performance competences of E-design students at the 1st year exam

Experiment hypothesis for case 1: The form of the 1st year exam does not reflect the entrepreneurial and innovative competences and learning outcome as described in the curriculum and therefore we do no test and evaluate the abilities of our students in this area.

Actions: Six students’ exams were observed in order to look for signs of innovation and to observe how the students were assessed. Focus points were: a) Whether the students show ability to vocational innovation (shows signs of innovation competences, mentions/uses innovation models/innovative work process/method of presentation/presentation abilities) b) Whether the examiner and second examiner look for innovation and ask questions about innovation. c) Whether students get feedback on the innovative part in their solution. d) Whether the level of innovation is measured. In qualitative e-mail interviews the teachers were asked different questions about innovation. The following discussion at the workshop in the teacher team meant that innovation, innovation competences and the assessment of these were jointly verbalised.

Analysis and findings: Generally, there was a lack of focus on innovation at the 1st year exam as it became clear through the observations and the e-mail interviews that the teachers haven’t had enough focus on innovation. There was very little innovation both in the students’ synopsis and in the oral presentation and the following discussion. Neither of the students, teachers or second examiners focused on innovation at the oral presentation, the following discussion nor the voting. Only one of the student’s examinations showed clear signs of innovation in the form of the student using technical terms and method. The teachers requested a common definition of innovation and they wanted innovation to be more present at the education. Surprisingly, all the teachers’ combined knowledge turned out to be a great catalogue of knowledge, methods and theory of innovation although this had not been verbalised jointly before. The teachers stated that the verbalisation and the joint discussion created focus on innovation. It became clear that the teachers possess a lot of knowledge that has been tacit and therefore not implemented in the teaching and at exams.

Results: The result was the formulation of “The Innovation Manifest”. It contains the following E-design definition of innovation: *“Innovation is when the student creates a(n) idea /concept/product/service – that has not been seen before and/or renews/improves something existing and/or combines something existing in a new way/creates a new process/does things in a new way – that creates (economical/social) value for somebody – where it is marketable/(economically) sustainable/durable/viable – and realized – and where the students uses design methods to look for new angles, redefines problems or identifies new possibilities.”* Furthermore the Innovation Manifest contains a definition of innovation competences, learning outcome, assessment criteria plus an overview of theories, models, literature and a catalogue of ideas with multiple suggestions to how we can teach and assess innovation. Based on the manifest, changes have been made to the curriculum,

the course descriptions of all courses and the handbook for the students at the E-design education and thus the manifest has served as a valuable strategic and normative tool in the development of the education.

3.2 Case 2: Signs of and testing the obtained innovation competences in the innovation course “4 white t-shirts” at the E-design education

Experiment hypothesis for case 2: By observing and analysing an exemplary course in innovation “4 white t-shirts” (described under Methodology) and by performing before and after tests of the course, we can develop an innovation taxonomy and document, including which didactical and professional actions that creates innovation competences, with the scope of qualifying and developing our teaching and enhance the employability of the students.

Actions: The students and teachers were observed during classes (2 days, 6 lessons each) and at the final presentations of the course (18 groups each doing a 3 minute pitch). 5 students filled out an identical questionnaire before and after the course, and all 65 students’ written evaluations were used as additional data. The observer also kept a reflection log. The data material was then analysed.

Analysis and findings: The observations of the presentations turned out to be a good way to document the students’ learning, their output of the project and not least the feedback from the teachers. The questionnaires pre and post the course gave a good insight to the students’ view upon innovation, innovation competences and their achieved learning plus their reflection upon this. By analysing the feedback from the teachers given after the pitches we managed to verbalise the qualities in the students’ innovation projects and could hereby easier create a basis for a taxonomy for innovation. The purpose of the document analysis was to validate the teaching praxis and to see if we achieved the described goals for the course.

Results: The before and after tests showed that all participants had made progress according to the learning objectives for the course. In the observations of the pitches, the questionnaires and the group evaluations, there were a distinct coherence between intention in the curriculum, implementation by the teaching and the realized yield of the students. The analysis of the data led to a verbalization of which didactical and professional methods that creates innovation competences and what is quality in innovation projects. The following efficient didactical methods were detected: 1. Learning by doing. 2. Risk taking/being brave – we throw them at the deep end on purpose. 3. The 3 minute pitch (presentation skills, awards in 3 categories and feedback from the teachers). 4. The time factor – a relatively short course period. 5. The post-processing/room for reflection. The following was detected as qualities in an innovation project: 1. Degree of realization (the more realized the better). 2. Risk taking/courage. 3. The creation of value. 4. The presentation (pitches). This verbalization of what is quality and what are successful didactical methods in an innovation course was a valuable help for the teachers to both qualify their teaching and to develop existing courses and the results were used to revise “The Innovation Manifest” and through that initiate renewed practice.

3.3 Case 3: New exam form that reflects vocational innovation

Experiment hypothesis for case 3: By comparing the observations from the 1st year exams of 2013 and 2014 we will be able to see a greater focus on innovation in 2014 and the teachers will be able to use the new assessment criteria and the innovation taxonomy when assessing and grading at the exam. By hosting a workshop for relevant stakeholders we can develop a new exam form that both in form and content reflects the innovative and entrepreneurial aim and that is vocational and practice-related.

Actions: The exam instructions were altered according to The Innovation Manifest so part of the assessment criteria referred to innovation. First year exams were observed and a workshop with stakeholders representing teachers, students, the business community, the Bachelor level, and the second examiners was held to give input to the development of a new exam form. The data from the observations and workshop was analysed.

Analysis and findings: The comparison of the exam observations from 2013 and 2014 showed an increased effect (a greater focus on innovation) at the 2014 1st year exam from students, teachers and second examiners. This was due to The Innovation Manifest and the following greater focus on innovation during the 1st and 2nd semester. By involving stakeholders in the workshop we achieved more inspiration and more ideas to develop a new exam form that simultaneously is more vocational and practice-related. The participants emphasized that the exam form should combine formative and summative evaluation and they came with valuable feedback concerning The Innovation Manifest, for

instance that it is important that the students understand the design process and its challenges and that they are able to reflect on that.

Results: The Innovation Manifest was revised adding the sentence “*and where the students uses design methods to look for new angles, redefines problems or identifies new possibilities*” to the definition of innovation and interpersonal skills were added as an innovation competence. The suggestions to a new exam form were used to formulate a prototype for renewed practice, the trial exam described in case 4.

3.4 Case 4: From summative to formative – a new exam form

Experiment hypothesis case 4: By developing and testing a new exam form that includes both formative and summative evaluation, that reflects the real world that the students will be working in upon graduation, that incorporates the constraints concerning financial and human/teacher resources at the education, we will be able to assess and evaluate the students’ innovation competencies.

Actions: Based on the inputs from the workshop in case 3 a new exam form was developed and a test exam was approved by the Ministry of Education (see Table 1).

Table 1. Overview of the current exam and the test exam

Current exam	Test exam
Two-piece exam: 1. Written synopsis. 2. Oral presentation.	Three-piece exam: 1. Process period with process log. 2. Written analysis. 3. Oral exam with pitch and reflection.
Guidance sessions: 2	Guidance sessions: 3 Process log is incorporated in guidance sessions.
Written synopsis: 5 pages.	Written analysis: 5 pages based on the process log.
Oral examination: 35 minutes including grading consisting of a 10 minute presentation of the solution by the student followed by a 15 minute dialogue with questions from the teacher and the second examiner.	Oral examination: 35 minutes including grading consisting of a 10 minute pitch of the solution and a 10 minute dialogue about the solution and 5 minute reflection about the process and acquired learning.
Assessment and weighting: The oral examination counts for 2/3 of the grade.	Assessment and weighting: Written analysis counts for 1/3, pitch and dialogue counts for 1/3 and process log and reflection counts for 1/3.
The second examiner is external.	The second examiner is external and it is a requirement that she/he has experience as an entrepreneur/intrapreneur and has worked with innovation.

An innovation taxonomy was developed based on The Innovation Manifest and the EQF and the test exam was carried out in a test group consisting of 10 students and 4 teachers plus 1 second examiner. Students, teachers and the second examiner have filled out questionnaires with their evaluation of the project and the exam projects have been collected (written analysis and process logs) for analysis. A generic innovation taxonomy for level 4, 5 and 6 in the European Qualifications Framework has been developed.

Analysis and findings: All respondents were positive about the trial exam. The students and examiners found that the combination of a formative and summative exam gave a more fair assessment and some students even found that the exam form lessens exam anxiety because it is less result oriented and more process oriented. The second examiner noted this: “*At the trial exam there was a significantly higher focus on reflection upon work process and on the degree of innovation. I experienced that the students generally had more focus on the degree of realization of their solution than the existing exam form. I also experienced that the students had a greater understanding of that one isn’t finished after presenting the solution but first when the solution is realized.*” Some students found it challenging to incorporate the process book and reflection during the oral examination and they suggested it should

be a part of the pitch, to which the teachers agreed. The teachers and second examiner found the taxonomy useful in order to evaluate and grade the students.

Results: We have developed and tested a new exam form that combines formative and summative evaluation and that includes a second examiner and the business community as means to enhance the student's employability. It shows the student's learning and progression in innovation in a design and entrepreneurship context. One student described it like this: *"It is very positive that you get the possibility to tell how you have ended up with your solution and that you can document what you have selected and deselected. I think it is an exam form that makes more sense in relation to the positions we are educating ourselves to manage."* A formalised setting for the testing and measuring of the students' innovation competences, including an innovation taxonomy, has been developed. Different tools (exam instructions and a taxonomy) in relation to the new exam form have been developed and tested. The questionnaires from the participants have been analysed in order to evaluate the test exam. The suggested improvements are that the formative assessment should also be placed in the project phase and not just at the oral exam. The third guidance session should be placed after the written assignment is handed in and the reflection about the process and the acquired learning should be a part of the pitch. Furthermore, the students asked for a clearer guide to how to use the process book and how to verbalize their reflections upon their learning.

4 CONCLUSION

The development of The Innovation Manifest resulted in a definition and verbalization of the wanted innovation competences, learning outcome and assessment criteria, which lead to a greater focus on innovation in the assessment of the students at the exams the following year. Observations of an innovation course led to the documentation of efficient didactical methods; making the students experience through doing, creating a risk-taking learning environment, training short pitches and allowing a space for evaluation and reflection. By including relevant stakeholders in a workshop to develop a new test exam, valuable ideas and feedback from the participating stakeholders led to a test exam that was a combination of a formative and summative evaluation and that included a process log to ensure reflection about the achieved learning plus a second examiner who is required to have experience as an entrepreneur/intrapreneur and who must have worked with innovation. The students and examiners find that the combination of a formative and summative exam gives a more fair assessment, plus the taxonomy was useful to evaluate and grade the students at the test exam. Since the teaching at the E-design education is project based, problem oriented and interdisciplinary it reflects the reality that will meet the graduates when they are out working and therefore enhances their employability [1] and the test exam was developed to reflect this and based on the feedback from the participants it seems to be a fitting assessment method to use at an entrepreneurial design education. The work and research with the four cases has provided useful generic tools and concepts such as The Innovation Manifest, development workshops and the innovation taxonomy that can be useful for educations that work with and tests inter-disciplinarily and/or need to define and test the student's innovation competences and lack useful assessment guidelines and tools.

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