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Nielsen, Jan Alexis

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Assessment of Innovation Competency:  
A Thematic Analysis of Upper Secondary School Teachers' Talk

Jan Alexis Nielsen

University of Copenhagen

[janielsen@ind.ku.dk](mailto:janielsen@ind.ku.dk)

Abstract

This study employed a three-step qualitative research design with multiple instances of source validation in order to capture expert teachers' (n=28) reflections on which manifest signs they would look for when they assess students' innovation competency. This paper reports on the thematic analysis of the recorded talk-in-interaction that occurred in teacher-group discussion sessions at five upper secondary schools. Based on the analysis, it was possible to extrapolate assessment criteria for five sub-competencies relevant to innovation (Creative competency, collaboration competency, navigation competency, action competency, and communication competency) as well as assessment criteria for a number of skills relevant to these sub-competencies. These assessment criteria, it is argued, largely resonate with existing literature and they provide a detailed glimpse into how assessment of innovation competency could be concretised within the framework of the existing disciplines.

*Keywords:* Assessment, innovation, creativity, competency, skills, evaluation

## Introduction<sup>1</sup>

Over the last decade or so, policy makers in most societies have increasingly pointed to innovation as *the* lynchpin of sustainable economic wellbeing. Indeed, facilitating future innovation is one of the key areas of concern of e.g. the EU-commission (2010) and the Obama-administration (White House, 2011). The quest for fostering innovation is typically linked to proposed changes to the educational systems and standards. For example, the OECD recently emphasised the role of education in this regard: “The need to empower people to innovate [...] calls for high-quality and relevant education as well as the development of wide-ranging skills that complement formal education” (OECD, 2010, p. 3). Consequently, many countries have started to formulate innovation policies that stipulate the important role of educational systems in fostering innovation competencies.

Now, while the term ‘innovation’ is often related to the economic (Schumpeter, 1934/2004) or high-tech disciplines, the trend seems to be that policy-makers regard innovation as a potential goal for all educational levels and in most of the existing individual disciplines (Danish Government, 2012; Finnish Government, 2009; Nordic Council of Ministers 2011; Commonwealth of Australia, 2009; White House, 2011).

But even though calls for fostering innovation competency have permeated the political discourse for the last 18 years there is still the need of finding a way to properly transpose the political ambitions into the school context (Hobel, 2009). In particular, if ‘education *for* innovation’ (whatever that may be) is to become a pervasive practice in schools, teachers need useable guidelines for making formative and summative assessment of the competencies that could be central for students to engage in innovation processes. Indeed, one of the

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<sup>1</sup> This research was partly funded by the [Region in Denmark]

truisms in educational research seems to be that assessment influences what and how teachers focus their teaching on (Harlen, 2007; Nordenbo, Allerup, Andersen, Korp, & Dolin, 2009).

In order to take initial steps towards formulating assessment guidelines to be used in schools, the study reported in this paper sought to elucidate the following research question: *Which criteria for formative and summative assessment of innovation competency<sup>2</sup> do expert Danish upper secondary school teachers identify?*

### Background

Rather than there being a shared uniform understanding, there is a high degree of “fuzziness” to the construct ‘innovation’ (Fagerberg, 2006, p. 21); so there is a danger that teachers’ assessment practice of innovation competency become too diverse and thus essentially unreliable. For example, it would make an immense difference whether educational scholars work from a definition such as “innovation is the process of making changes to something established by introducing something new that adds value to customers” (O’Sullivan & Dooley, 2009, p. 4), rather than a definition such as “[innovation is the ability] to see opportunities and to be able to bring these opportunities to life in a value-creating way” (Darsø, 2011, p. 13; my translation). Clearly, whichever features one focuses

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<sup>2</sup> Following Blomhøj and Jensen’s (2003) succinct definition, the term ‘competency’ is taken to denote “someone’s insightful readiness to act in a way that meets the challenges of a given situation” (p. 126) – whereas the term ‘skill’ denotes a person’s ability to perform a specific (cognitive or physical) task. In other words, ‘competency’ and ‘skill’ are related in the following way: to have a specific ‘competency’ involves the ability to draw on relevant knowledge, skills and attitudes in order to deal with specific situations (e.g. Illeris, 2012; Rychen & Salganik, 2003).

on will have an impact on the kinds of assessment criteria that one would arrive at. (It must be noted that the aim of this paper is *not* to review literature in order to arrive at a definition of innovation which is viable in the school context, but rather to arrive at an empirically informed conceptualisation of how the development of students' innovation competency can be assessed during and after teaching).

While some generic guidelines for assessing innovation *do* exist (see e.g. Smith, 2006), these generic conceptualisations and guidelines seem difficult to transpose directly to the school context. First, there are a host of different assessment instruments designed to measure young persons' innovativeness or innovative skills by letting them respond to likert-scale or multiple choice items (Tan, 2009); Hurt, Joseph, & Cook, 1977; Leavitt & Walton, 1975; Chell & Athayde, 2009; The Conference Board of Canada, 2013). But as elaborate as such self-reporting instruments may be, it stands to reason that teachers need to translate them extensively into lists of criteria that can be used for formative and summative assessment in the school context. Second, some attempts have been made at presenting criteria for assessing innovation competency in the educational context (that is, presenting criteria for teachers to use, rather than construing self-assessment instruments). For example, Binkley and her colleagues (2012; for a different approach see Rasmussen & Nybye, 2013) recently discussed how educators can assess the aspects of the 21<sup>st</sup> century skills framework that concern "creativity" and "innovation", concluding that "measuring both can be quite challenging" partly because of the lack of "good benchmarks against which respondent output can be evaluated" (p. 38). Binkley and her colleagues (2012) devised a general operational definition of creativity and innovation pointing to skills such as students' ability "to elaborate, refine, analyze, and evaluate [...] own ideas in order to improve and maximize creative efforts" and to "[d]evelop innovative and creative ideas into forms that have impact and can be adopted" (p. 38). Such statements seem closer to the assessment criteria usable by

teachers than items on self-reporting instruments as the ones referenced above, but they may still need further elaboration and concretisation.

There seems, then, to be a niche for finding an operational list of assessment criteria concerning students' innovation skills that is highly contextualised in the teaching of the existing disciplines. In this context, it is interesting to note that a number of assessment scholars have argued that involving teachers in the development of assessment criteria an effective way of enabling the reliable use of the emerging criteria (e.g. Harlen, 2007). Beyond this it stands to reason that assessment scholars may learn much about how assessment criteria can be contextualised to the classroom context by letting expert teachers give voice to their experiences in the formulation of assessment criteria.

#### Method

##### *Context*

This study was carried out in the context of a project – [Project] (2012-2015) – involving five schools in the [Region in Denmark]. Over three years (the length of a traditional upper secondary educational programme in Denmark), these five schools will fundamentally re-organize the teaching of one class per school. The principals at the participating schools formulated the project and they steer it collectively during the three years. The main aim of the project is to make planned changes to how the teaching is organized in order to meet a number of success criteria (e.g. that participating students when compared to non-participating students acquire a higher level of innovation competency, acquire higher grades, to a lesser extent opt out; and that participating students as well as teachers experience a higher motivation and satisfaction). Among the implemented changes are (a) installing fewer but closer teacher-teacher collaborations, (b) persistent focus on student involvement and close teacher-student relations, (c) high degree of involvement of

collaborators and beneficiaries from outside the school context, and (d) a prominent focus on fostering students' innovation competency in all mono- and interdisciplinary teaching. This author had the role of liaised researcher – with (among other evaluation tasks) the task of using the experiences gained from the project to determine how innovation competencies can be assessed.

At each school, the teachers of the participating class form a relatively tightly knit teacher group that meet on a weekly basis. The five schools represented three different types of upper secondary schools – all of which grant admission to tertiary education: Two schools belong to the STX programme – the traditional upper secondary school programme – that focuses on a broad range of traditional disciplines, two schools belong to the HHX programme which beyond the traditional disciplines focuses on business and socio-economic disciplines, and one school belongs to the HTX programme, which focuses on technological and scientific disciplines in combination with general subjects. The student populations at these schools are demographically adverse. In two schools, the students are ethnically diverse, often come from families with limited educational backgrounds, and come from the working or lower middle class. In two schools, the students typically come from lower or upper middle class. In one school, students typically come from the upper middle class.

The project is built on a precursor project – [*Project*] (2009-2012) – in which the teachers spent three years developing teaching activities designed to foster innovation competency. Essentially then, fostering innovation had been *the* focal point in these teachers' professional development since 2009. Four of the teacher groups in this study participated in the precursor project. The fifth teacher group had one representative who was involved in the precursor project, while the rest of the teachers only had brief experience of fostering student innovation before the summer of 2012. At the time of this study, also the teachers who did not participate in the precursor project had participated in a wide variety of professional

development activities and had also designed multiple teaching activities aimed at fostering innovation in their disciplines. Of the participating teachers (n=28), four had less than five years of teaching experience, while the rest had more experience. About half of the teachers had employment experience from outside teaching (e.g. the private sector), this is usual for teachers at the HHX and HTX programmes. Two teachers had obtained a PhD degree, which is somewhat rare in the Danish system.

In the Danish context, this project is relatively large in terms of funding, and it is relatively radical in terms of which changes are implemented. It is definitely rare to find Danish projects that fundamentally change the teaching and the organization of the teaching for the entire duration of an upper secondary education. The project's focus on fostering innovation competency resonates with concurrent educational initiatives in the Danish context. For example, The Ministry of Education recently ran a project in which 53 schools worked on fostering innovation competency and creativity in an interdisciplinary course called 'General study preparation' which all students have to take. Further, the [Region in Denmark], that funded the present project, have fostering innovation as their explicit focus area.

### *Study Design*

In order to elucidate the research question, a qualitative case study (Stake, 2006; Yin, 2009) was designed so as to elicit reflections from the involved teachers on which signs to look for in the day-to-day teaching in order to assess a students' innovation competency in their disciplines. As argued above, the goal for this study was to create context-dependent knowledge building from the experiences of the involved teachers – a goal that invites a case-study approach (Flyvbjerg, 2006). Further, it was an explicit aim for this author to create knowledge about the particular, in a 'bottom-up' fashion, rather than deducing assessment



guidelines from a theoretical vantage point, in a ‘top-down’ fashion – this also invites a case-study approach (Schwandt, 2007). Further, it seemed natural to conduct a case study, since the participating teacher groups all participated in the same project (Yin, 2009). Further, since this author is involved in the said project as a liaised researcher and evaluator, many different types of information were available so as to secure the needed “in-depth understanding of the case” (Creswell, p. 98). Also, the present case study adheres to the general requirement that the study involves collecting many different types of data: This author, for example conducted interviews with groups of teachers, classroom observations as well as in-depth interviews with individual teachers, individual principals, groups of students, and external parties working with the schools. However, this paper will only focus on the data collected at particular kinds of group-discussion section at each of the five teacher groups (see below).

The data collection consisted of three separate steps (see figure 1) with multiple instances of source validation – i.e. instances where the teachers had the possibility to revise the researchers’ analysis of data from the preceding step.

[Insert Figure 1 about here]

In step 1, each local teacher group was interviewed. This, among other things, served as a way to elicit teacher talk about how they conceived of innovation competency. These interviews were conducted in a semi-structured fashion (Kvale, 2008) and were audio-recorded. Further, written documents and reports from the precursor project were carefully read. In step 2, the interviews from step 1 served as a backdrop for the design of an initial sketch of the construct in the form of a list of potential signs of a student having innovation competency. This sketch was then source validated by two teachers (from two different

schools) who were identified as key teachers (the two teachers had already made some conceptual work on innovation competency in the precursor project). The source validation in this step occurred through interviews and email communication. The first two phases of the study indicated that the teachers (to a varying degree of detail) thought about innovation competency as a complex that consists of five sub-competencies<sup>3</sup> (see e.g. Ralkov, 2012): *Creative competency, collaboration competency, navigation competency, action competency, and communication competency*. In the second phase of the study, the principal researcher and two teachers who had a key role in the precursor project worked on designing an initial list of signs for each of these five sub-competencies. This sketch was then used as a prompt for discussion in step three.

In the third step, each local teacher group (28 teachers in total) was engaged in structured discussion activities, and the teachers' talk-in-interaction during those activities was audio-recorded and transcribed. These scaffolding activities were used in order to elicit more detailed talk about which signs the teachers would look for in their day-to-day teaching in order to assess a students' progression vis-à-vis innovation competency. The discussion activities all began with a brief introduction of the discussion tasks by the principal researcher. Then the teachers discussed the list of signs from the initial sketch in pairs or triples. They were specifically asked to add signs to, and, if appropriate, reformulate signs on, the initial list of signs. Finally, the pairs and triples shared their discussions in plenum, while the principal researcher acted as moderator and took notes on a white- or blackboard. The notes consisted solely of formulations of signs (with an action verb) to which the teacher group reached a consensus to accept. For each group, the final lists of signs was sent back to the group in order to ensure source validation. In total, 157 signs were formulated and

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<sup>3</sup> In the teachers' talk, these skills were often also called "competencies", "skills" or "dimensions".

validated across the five teacher groups. So the data collected in the third step was in a sense multi-modal: They consisted both of complete audio records of the teachers' talk-in-interaction as well as the concrete end products of the activities – namely the consensus based formulations of signs.

#### *Analysis procedure*

The analysis procedure described here concerns the analysis of the talk-in-interaction that occurred in the five discussion sessions in step three of the study. In order secure that the study was data driven, highly contextualised, and based on a systematic analysis procedure, the transcribed teacher talk was analysed using *inductive semantic thematic analysis* (Braun & Clarke, 2006). The aim of the analysis was to find overarching, consistent, and prominent themes that emerged from the teachers' talk. In an attempt to perform an analysis that was a regimented as possible, the analysis procedure strictly followed Braun and Clarke's (2006) six-phased analytical tool for thematic analysis.

First, the recorded talk was transcribed and carefully read at least three times. In order to preserve the dialectical context (Nielsen, 2013) the transcripts represented all talk-turns and interjections in the recordings. In order to structure the analysis, the talk of each teacher group was divided into sequences of talk turns according to which of the five sub-competencies the sequence addressed. Second, in the transcripts from each teacher group the sequences of talk-turns that were relevant for each sub-competency underwent an initial coding process in which all talk turns (or shorter sequences of talk turns) were coded in accordance to that which was signified in the talk-turn. Third, in several iterative steps, the codes were scrutinised and combined in order to identify candidate key themes and sub-themes. A fellow researcher, who was not involved in this study, was able to successfully place each of the 157 signs (i.e. the signs that were formulated on the blackboards during the

interviews in step three of the study) under the candidate key themes. Fourth, the list of candidate key themes was reviewed, revised, and refined in order to secure coherence within each theme and minimise overlap between themes. Fifth, a writing process (Becker, 2007) in which the key themes were described carefully led to an identification of the essence of each theme. Sixth, an initial report was written that served the basis of the next section.

## Results

This section presents the results of the thematic analysis of the talk-in-interaction from step three of the study (see figure 1 above). The section is structured around the five sub-competencies – creative, collaboration, navigation, action, and communication competency. The key emerging themes that were identified can meaningfully be understood as abilities that are essential for a given sub-competency. In that sense, the key themes (and sub-themes) denote complexes of assessment criteria. The final list of assessment criteria that was extrapolated from the teachers' talk is presented in Table 1. Quotations – e.g. A01, 199 – from the data represent school (A through E), teacher at that school (01, 02, etc.), and sequential talk turn number from the transcript.

### *Emerging Themes Concerning Creative Competency*

The teachers rarely gave concrete examples of the types of teaching activities that would form the context of their assessment of a students' creative competency. Nevertheless, it seemed that the teachers, at all schools, had in mind situations in which students have to generate ideas or solutions to authentic problems or issues from outside the school context. In other words, the teachers treated creative competency as a competency that is pertinent in the initial phases of processes akin to authentic problem-solving processes.

*Students should be able to be open in idea-generating processes.* The teachers generally emphasised that one sign of creative competency is that the student, in light of a problem or task, is able to generate a *range of multifarious* ideas or solutions, rather than just coming up with one solution. For example, “[it would be] a good idea if [the students] developed multiple ideas [...] they should [...] have [...] a catalogue of ideas to return to” (C03, 52-4), or that a student “can often find many different suggested solutions” (D03, 5). The teachers often talked about signs of *lack* of creative competency – for example that a student who typically comes up with only few, and very similar, ideas or solutions only manifests a low degree of creative competency. As one teacher formulated it: “It [is] easy to find three suggested solutions [to a problem] that were almost identical [...] but it [is] difficult for them to go [in another direction] to find [...] a nice [solution]” (B04, 337-41). Indeed, the sample teachers argued that the key prerequisite for being able to generate a range of multifarious ideas is that the student has an *open* or *flexible* stance towards her own ideas and the ideas of others. Further, it was generally emphasised that students can manifest creative competency by being able to come up with ideas that are *novel*, or *unexpected* by the teacher.

*Students should be able to work with ideas in a critical fashion.* The teachers typically argued that students – when they have built a portfolio of possible ideas or solutions to a problem or task – should be able to critically assess, sort, or prioritise their ideas based on criteria (such as the degree to which an idea is realisable), as well as to be willing to discard an idea in light of new information, and/or to extend, adjust or further develop ideas. Indeed it was generally emphasised that a student should “not settle on the first idea that springs to mind” (B02, 396) or that a student “can sort her ideas [...] or assess the ideas” (A02, 540a). Also in this context, the teachers referred to students’ openness and flexibility. In this context, however, openness and flexibility was typically parsed as a willingness or ability to ‘kill your darlings’ – i.e. a willingness to *shift* one’s approach and the willingness to

*scrutinise* one's ideas – e.g. “that one is willing to discard something one has worked with for a long time, when one finds out [something new]” (B06, 411). In other words, a sign of creative competency would be that the student is able to *work with ideas in a critical fashion* – i.e. the ability to evaluate, sort, revise, expand upon, and even reject ideas based on some criteria. For example by checking the idea's realizability or utility.

*Students should be able to independently interpret a task or problem issue.* The teachers often pointed to students' ability to independently interpret a task or problem issue as a third key aspect of creative competency. The primary facets of the talk about students' approach concerned students' ability to acknowledge an issue *as* an issue that calls for attention – i.e. that the student “can find challenges that needs to be solved (B02, 378) – and the students ability to reinterpret or challenge the boundaries of a given problem –e.g. “when [a student] tries to be creative with the task [...] with what at all the problem is” (E02, 180).

#### *Emerging Themes Concerning Collaboration Competency*

*Students should be able to take responsibility for, and facilitate, that the group finishes its tasks.* The teachers emphasised that a student can manifest her collaboration competency by actively taking “responsibility for a [task]” (E04, 137), and facilitating, that the group, to which she belongs, “performs its task” (D06, 293). While the teachers' talk was diverse, teachers generally argued that collaboration competency involves some sort of reflection or “consciousness of group dynamics” (A01, 714) on the side of the individual student – in particular, reflections about what the student herself and others can bring to the table – e.g. the student must be able to identify “complementary competences [so as to] find out how [...] the group really works optimally” (E05, 62). From the perspective of the teachers, such reflections have to be operationalized in order for the student to facilitate that a group

functions optimally through e.g. that the student can give “feedback” (A02, 653) or generally to “ensure a good working environment” (B03, 178).

*Students should be able to be inclusive and flexible in collaboration.* The teachers argued that a student could manifest her collaboration competency by exhibiting a range of quasi-social abilities or stances, in the sense of being able to be *inclusive and flexible in collaboration*. Primarily, the teachers seemed to agree that one sign of a students’ collaboration competency is that that student is inclusive of others and the ideas of others. Beyond the talk of inclusiveness, the teachers argued that students can manifest collaboration competency by being flexible in regards to both *who* they collaborate with and *their role* in collaboration. Indeed, it was often seen as a lack of collaboration competence, if a student is “just [...] able to [work ...] with those that [she is] comfortable with (C07, 429-31) or merely work in “her own little comfort group” (A05, 256a).

*Emerging Themes Concerning Navigation Competency.*

While this competency might appear as the most opaque competency of the five sub-competencies of innovation, the teachers across the schools talked quite homogenously about which signs to look for. The teachers primarily understood navigation competency as a complex of abilities that are put to use in the phase of a work process before final decision is taken about what to or which solution to carry out.

*Students should be able to functionally handle knowledge.* The teachers spent extensive time arguing that the main characteristic of a student with navigation competency is that the student is able to cope with complex, dense, or chaotic information when working with a problem issue. This seemed to be the premise for the talk about navigation competency at all schools: When students work on finding innovative solutions to authentic problems, the students will be in a situation where information is plentiful and maybe even heterogeneous.

Using this premise as a backdrop, the teachers typically began to specify what characterises a student who can cope with the complexity of information. According to the teachers, this ability to cope is tightly linked to the ability to *sort, structure* and/or *prioritise* complex, dense, and heterogeneous information based on a criterion of relevance – e.g. “it is essential to be able to assess [...] whether it is important to go into depth or whether [...] superficial knowledge is enough” (C07, 204-6). In other words, it was argued that a student, who faces a problem or task, could manifest navigation competency by ‘boiling down’ a knowledge landscape (e.g. from a discipline or from practically gathered information) to the essentials that are relevant for solving the problem or task. Further, it was argued that students could manifest navigation competency by making appropriate assessments as to which parts of a knowledge landscape are relevant to study in depth, and which parts can be brushed over somewhat superficially. Also, it was argued that navigation competency involves, on the one hand, that the students is conscious of situations in which she (or her group) needs more information, and, on the other hand, that she knows where that information may be found – e.g. “to find out where one must seek information, I would say is navigation competency” (E01, 200).

*Students should be able to master complex work processes.* The teachers emphasised that students will often encounter difficult authentic problems and that the students’ work processes will be correspondingly complex. Consequently, the teachers held that a student could manifest navigation competency by proactively structure such work processes and make informed decisions about both process and the use of resources. It was argued, for example, that students need to be able to “go into the different [phases of a process] and [say].. well, now we are in the creative [phase], now we are analysing.. now we go in to depth [...] it is about seizing control of the process [...] [by establishing] a work plan, breadth of view , [and] prioritising tasks [...] [and] make a time plan that is realistic” (B02, 656-70).



*Students should be able to understand the problem issues.* Third, the teacher groups shared the outlook that navigation competency can be monitored by observing a student's ability to decipher a problem or task or to identify exactly wherein the problem lies. This was typically either parsed as the ability to conceptually engage with a given task or problem using disciplinary language, or as the ability to identify what one is supposed to do when faced with a task, as well as to identify how one's work relates to the given task.

*Emerging Themes Concerning Action Competency.*

The teachers seemed to commonly agree that action competency essentially has to do with being able to carry out ideas and perform actions based on analysis and reflection. At times, the teachers talked about action primarily as a *phase* that follows navigation – i.e. that students in a project process first navigate *then* act – although it was often discussed that action competency is necessary in all phases of innovative processes. Often teachers, focused on students' courage and (informed) risk-taking as a necessary requirement for students to mobilize themselves to act in some way. Further, students' courage and (informed) risk-taking was typically made concrete in terms of students having the courage to e.g. obtain information from sources outside their usual comfort zone.

*Students should be able to take risks and put oneself and/or others into play.* Action competency was first and foremost parsed in terms of a student's ability to carry out her ideas, or simply to bring herself (and others) into play. As some teachers put it, action competence involves “the ability to get out beyond the classroom and to get into play, or to bring oneself into play” (B02, 73), or that the students can “bring their ideas into reality” (A06, 153a), or “can drive things forward” (D06, 901). Interestingly, the teachers often distinguished sharply between action and navigation competency. For example, B02 used herself as an example: “I am really good at making plans for action.. [but] I am really bad at carrying them out [...]

and that is because I am damned good at navigating and structuring, but I am not really good at doing things” (82). So having action competency was seen as being more than a purely analytical competency.

As mentioned, the teachers focused on key prerequisites for action competency. The talk primarily focused on, students’ courage and (informed) risk-taking. Consequently, these teachers regarded innovation processes as entailing a great deal of unknown factors, and that this means that students must be able to function under uncertainty – e.g. that they must “dare to make mistakes” (E05, 271), and is “not [...] limited by [the thought that] this cannot be done” (E04, 274). Further, it was often argued that action competency involves taking leadership and/or taking on responsibility.

*Students should be able to make informed decisions.* The teachers generally emphasized that action competency is parasitic to the ability to make decisions about how to act based on some analysis or assessment. For example, that a student is able to “assess consequences [of actions]” (D03, 993), or let her actions be guided by her “experiences and observations” (A02, 249b), in or more generally that the student can “make a decision [...] [about whether] to do one thing or the other” (E02, 246). The issue that these teachers discussed mostly was that action competency essentially involves the ability to *react* on the reflection of such experiences and observations: “I can realize what it is that stresses me out. [But] from that to then act on it and change it.. That’s the hard part, isn’t it?” (A02, 233b); “[when] they observe something, that it can’t be done... then we must act on it” (C02, 274). Clearly, the teachers at all schools argued to varying extent that a necessary, yet not sufficient, part of action competency is the ability to make decisions that are based on some sort of analysis, and that serve to qualify the students’ actions.

*Students should be able to actively seek information – also outside ones comfort zone.*  
One way in which the teachers talked about students courage or (informed) risk-taking

focused on students venturing outside their comfort zone typically in order to obtain information. For example, B02 gave this example of a student – Chris: “Action competency [...] [concerns] that one is able to get out of ones comfort zone [...] that is a little what Chris is doing, right? He [...] just [says] oh well, I’ll call [this or that source], I may be rejected, but that is ok” (111-3). B01 later elaborated, that the assessment of this aspect of a student’s action competency ought to be dependent on the individual student’s perceived comfort zone: “Claire might have to venture a smaller step before she is out of her comfort zone than Chris [...] and she should have points for that little step” (768). While the talk about obtaining information was often intertwined with the talk of risk-taking, the talk about students seeking outside the classroom to inform themselves or their actions was extensive enough to mandate an individual sub-theme.

*Emerging Themes Concerning Communication Competency.*

*Students should be able to assess how to communicate.* The teachers argued that the essence of having communication competency involves, on the one hand, the ability to assess a communication situation, and, on the other hand, the ability to make informed decisions about one’s communication. The context that the teachers talked about was typically a situation in which (groups of) students have to present or pitch their ideas or solutions to other students, teachers, external stakeholders or commissioning parties. Consequently, communication competency was essentially tied to students’ ability to decode such situations and then choose the best communication strategy for the situation. Here the teachers focused primarily on the students’ sensitivity towards their target audience. Indeed, the teachers put heavy emphases on the analysis of form and content that *precedes* actual communication. The teachers at school A used a concrete student as an example: “Mikkel is a fantastic example. He is just a salesman without an equal [...] the man can sell sand in Sahara [...] but

he is really not prepared [and his communication is often] without substance” (A05, 110-131).

*Students should be able to master communication techniques.* The analytical skills mentioned above were seen as requiring that the student is versatile with respect to ways of communicating. Indeed, at all schools, the teachers emphasized that students can manifest communication competency by exhibiting mastery of different communication techniques. In this context, the teachers primarily talked about students mastering “tools” (A02, 1011) or “techniques” (A06, 1015) such as “using models” (B03, 52), “Powerpoint” (A02, 1003; D06, 1088), “oral presentations” (A02, 1018), “webpages” (E02, 402), “prototypes” (D05, 1024), “posters” (D05, 1029), “IT” or “films” (D01, 1082).

*Students should be able to communicate in an engaging and convincing manner.* Third, the teachers generally argued that communication competency requires more than the ability to analyse a communication situation and master communication techniques. Indeed, the teachers at all schools emphasised that communication competency also requires a practical ability to successfully carry out communication – typically in the sense of being a convincing and engaging communicator. The main premise behind the teachers’ talk seemed to be that students need to be engaging and convincing even in situations where their solution or product is not ideal: “One could have made a poor project [...] but now there’s a politician standing here [...] who is listening [to you], then you have to sell it.. as good as you can [...] you just have to sell the shit as good as you can” (E02, 373-7). The teachers generally elaborated this ability in terms of having “rhetorical skills” (D01, 1078) and “argumentative skills” (B02, 19), and that this, in turn, involves the ability to be “precise”, and to “structure” and “nuance” the content that is to be communicated (B02, 840).

#### *Overall summary of the results*

Based on the emerging key themes and sub-themes, it was possible to extrapolate a list of potential assessment criteria concerning each of the five sub-competencies and the subordinate skills related to these sub-competencies. This list of assessment criteria is represented in Table 1.

[Insert Table 1 about here]

Three overall points from this study deserve emphasis: First, the sample teachers entertained a very rich discourse concerning the five sub-competencies. Only in rare instances did a local teacher group superficially brush over an aspect concerning the attempt to assess innovation competency. This indicates that the sample teachers were able and willing to engage in, often elaborate, discussions about assessment strategies and criteria. Second, as will be argued below, the assessment criteria that can be extrapolated from the sample teachers' talk generally resonate with existing literature from the different educational fields that thematise the sub-competencies that these teachers identified. Third, the sample teachers evidently found it meaningful to talk about innovation competency and the five sub-competencies as educational aims that can be embedded in the existing curricula for the individual subjects or disciplines in Danish upper secondary school.

## Discussion

This section presents a discussion about how the teachers' talk about each of the five sub-competencies relates to the existing literature. This will involve a discussion both of (i) the extent to which the assessment criteria that can be extrapolated from the sample teachers' talk are also identified in the existing literature, and of (ii) the extent to which the existing

literature identifies assessment criteria that were *not* identified in the sample teachers' talk. Finally, the limitations of the study are discussed.

*Relating the results to existing literature.*

The teachers' talk concerning creative competency resonates with what has become a key dictum in research on innovation policy and management – that “‘Openness’ to new ideas and solutions [...] is considered essential for innovation projects” (Fagerberg, 2006, p. 10). Further, the teachers' talk resonates with creativity research where aspects such as “Generating ideas”, “Openness and courage to explore ideas”, and “digging deeper into ideas” which concerns “cognitive characteristics commonly referred to as convergent thinking or critical thinking” permeate the research literature on creativity (Treffinger et al., 2000, p. viii). In particular, the evaluative aspect raised by the sample teachers does seem to mimic the standard notion of ‘convergent thinking’ – namely, the ability to select or deduce a single ‘best’ solution from alternatives (e.g. Clark, Veldman, & Thorpe, 1965). Interestingly, the sample teachers' identification of both open idea-generating and evaluative critical aspects neatly fits with a recent argument by Cropley (2006) that “creative thinking seems to involve 2 components: generation of novelty (via divergent thinking) and evaluation of the novelty (via convergent thinking)” (p. 391). In particular, Cropley argued, convergent thinking is essential for securing that creative efforts are “adapted to reality” by gauging them according to “criteria of effectiveness and novelty” (p. 391); a point, we recall, which was also emphasised by the sample teachers. A further point to note is that the sample teachers seemed to place relatively even emphasis on divergent and convergent processes. This is unlike some other studies of teachers' conceptions of students' creativity. For example, Aljughaiman and Mowrer-Reynolds (2005) found that “teachers generally place greater

emphasis on [...] ensuring that their students can provide accurate convergent responses versus divergent solutions” (p. 30).

The teachers’ talk about collaboration competency resonates with state of the art inquiry into how students’ collaborative skills should be assessed. For example, OECD (2013) recently published ideas for how the 2015 PISA test can include assessment of students’ collaborative problem-solving skills. That report, mentioned (among others) the following criteria: “Discovering perspectives and abilities of team members”, “[d]iscovering the type of collaborative interaction to solve the problem”, “[u]nderstanding roles to solve problem”, “[e]nacting plans”, “prompting other team members to perform their tasks”, “[m]onitoring, providing feedback and adapting the team organisation and roles” (p. 11) – again all aspects that were also found in the teachers’ talk-in-interaction. Further, the sample teachers’ emphasis on the ability to be inclusive and flexible, fits with recent attempts to outline the social skills needed for collaboration. For example, the Partnership for 21<sup>st</sup> Century Skills have defined collaborative skills in terms of (among other aspects) students’ “flexibility”, students’ ability to “work [...] respectfully with diverse teams”, and students’ ability to “[l]isten effectively to decipher [...] values, attitudes and intentions” (see Trilling & Fadel, 2009, p. 55). It is clear that the sample teachers regarded collaborative competency as essential for innovation processes. This is very much in tune with what scholars in various fields acknowledge – namely, that innovation is a “collective achievement” (Van de Ven, Polley, Garud, & Venkataraman, 1999, p. 149).

It is slightly more difficult to discuss the teachers’ talk concerning navigation and action competency because these terms are seldom used in the educational context. However, it is easy to see that the teachers’ talk about students’ ability to functionally handle knowledge is very much similar to parts of the ‘information literacy’ dimension in the 21<sup>st</sup> century skills framework (e.g. Binkley, et al., 2012, p. 50). Further, the assessment criteria

concerning the ability to sort, structure and prioritise information, which seemed to be a key criteria for the sample teachers, is also recognizable in e.g. the Australian National ICT Literacy Assessment Instrument (Ainley, Fraillon, & Freeman, 2005). The teachers' talk about students' ability to master complex work processes, seems to link neatly to the general discourse concerning *employability* as a curriculum aim – an emerging trend, in particular in higher education policy (e.g. Saunders & Machell, 2000). Now, the teachers' talk about action competency turned out to be peculiar in the Danish context. Since the 1980's, in Denmark, the term 'action competency' has had a somewhat specific usage, in particular within environmental and health education – namely as denoting a person's "ability and will to take part in democratic processes [...] in a critical way" (Breiting & Mogensen, 1999, p. 350). While both the traditional usage and the notion that emerged from the sample teachers' talk involve the aspect of mobilizing oneself to act (e.g. carrying out an idea, or acting upon reflection), the sample teachers' talk did not contain an aspect concerning democratic participation. As such, the sample teachers' talk about action competency had more resemblance with the general ideas put forward by The Conference Board of Canada (2013) concerning "implementation skills" – i.e. the "skills, attitudes, and behaviours needed to turn ideas into strategies, capabilities, products, processes, and services" (p. 3). In particular, the sample teachers' talk focussed on students' how students handle risks, an aspect which seems to be almost universally accepted as central for the innovative person (for a useful discussion of the phenomenon of risk in innovation and entrepreneurship see Drucker, 1999, pp. 109-17). However, the sample teachers' talk about students' risk-taking attitudes must be very much contextualised to the their teaching context. Indeed, the teachers mainly talked about risk-taking in the sense of students venturing out of their comfort zone – typically meaning venturing outside the classroom environment. Whereas the risk-taking abilities identified within e.g. management and entrepreneurial education seem to be generally more linked to



“deal with uncertainty and the willingness of risking to take a loss” (e.g. Oosterbeek, van Praag, & Ijsselstein, 2010, p. 446).

Finally, the sample teachers’ talk about communication competency resonates well with the communication aspect in the 21<sup>st</sup> century skills framework – although that framework seems to focus to a lesser extent on students’ ability to communicate in a convincing and engaging manner (Binkley, et al., 2012).

The fact that the assessment criteria that can be extrapolated from the sample teachers’ talk finds resonance in the existing literature could be seen as a sort of validation of the teachers’ talk. Above all, the richness of the teachers’ talk concerning assessment of innovation competency affords us with a very detailed glimpse into how the assessment criteria established by researchers and policy-makers look in the classroom context. Further research is needed in order to elaborate on the finer details concerning how the teachers’ talk concerning assessment of innovation competency fit with the growing body of research on innovation as well as with the discourse of stakeholders in general.

### *Limitations*

Since this was a multiple case study, the aim was not to establish generalizable findings that exhaust the data. In that sense, this study contributes to the growing tradition of conducting small-scale qualitative investigations involving teachers within the field of educational assessment (e.g. Howley, Howley, Henning, Gilla, & Weade, 2013). The explicit aim of the present study was to tap into the experiences and reflections of teachers in order to get a glimpse *from a practice perspective* of a list of assessment criteria concerning innovation competency. Needless to say, whether one accepts a given criterion from the list that was extrapolated in this study depends on both one’s disciplinary background and curriculum context. In that sense, it is to be expected that another sample of teachers would

not have arrived at exactly the same list of criteria. Crudely put, this study is as much a proof of concept of conducting such “bottom-up” investigations in the field of educational assessment, as it is a study that exhaustively answers the question of how we should assess innovation competency.

A notable caveat that needs to be made clear is this: The fact that the sample teachers omitted to talk about student abilities that, from the perspective of other stakeholders, *do* seem salient does indicate a slight bias on the side of the teachers. Reflecting on the teachers’ talk in general it seems clear that the teachers spent most time talking about student abilities that probably was pertinent for the teachers *at the time of the study*. So the teachers were possibly slightly biased by the present obstacles for their teaching. Indeed, the fact that the teachers spent extensive time e.g. arguing their students need to be more flexible in terms of not selecting an idiosyncratic solution or idea does seem to point to a shared concern among the teachers that their students are relatively unwilling to change their ideas. But while researchers definitely need to be aware of such potential bias, this is, maybe, the price that needs to be paid for a list of assessment criteria that are highly contextualised to the classroom context.

### Conclusion and Implications

This study investigated which criteria for formative and summative assessment of innovation competency expert Danish upper secondary school teachers identify. It was found that the sample teachers identified innovation competency as a complex competency comprising five sub-competencies, which, in turn, comprise a number of skills. The data showed that the sample teachers were able to give very rich descriptions of these sub-competencies and skills; and that the way in which the sample teachers talked about these sub-competencies and skills conforms relatively good to the existing literature. Further, the

data showed that the sample teachers found it meaningful to talk about innovation competency and the five sub-competencies as educational aims that can be embedded in the existing curricula for the individual subjects or disciplines.

While the list of criteria that could be extrapolated from the teachers' talk still needs to be validated and further developed by other stakeholders, it provides a very detailed glimpse into how assessment of innovation competency could take place in the context of upper secondary education. But there are evident obstacles for implementing the present list of assessment criteria in secondary education contexts. First, one might fear that teachers' formative assessment using the list of criteria becomes instrumental – a general point argued by Torrance (2007) – in the sense that formative assessment becomes a game of brining students to manifest signs of having met a range of criteria. Second, being a complex of what we could call *process* competencies, innovation competency may be difficult to test summatively in practice. Clearly, many of the skills, and sub-competencies put forward by the sample teachers are of a kind that students could only display *in the course of being in collaborative processes*. The next phase of the overall research project to which this study belongs will investigate how different kinds of summative test formats – such as collaborative project work – can be used to assess innovation competency within the context of the existing disciplines (in mono- and interdisciplinary settings). Further, large-scale EU-funded research projects – such as *ASSIST-ME*<sup>4</sup> – are currently investigating how process competencies like students' inquiry competencies can be assessed. The findings from such projects could shed light on how to assess innovation competency as well. Third, the sample teachers' reflections on how to assess innovation competency were very deep, but their reflection was facilitated by this study. It is doubtful that teachers will regularly have opportunities like the one the sample teachers had, to negotiate assessment criteria. So while

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<sup>4</sup> <http://assistme.ku.dk>

the sample teachers may *now* have a fairly well-developed assessment knowledge vis-à-vis assessing innovation competency, it is not certain that other teachers will find it easy to interpret, adopt, and operationalize the assessment criteria presented by this study.

These obstacles notwithstanding, this study is potentially valuable for the educational field worldwide. For teachers and curriculum designers, the synthesised assessment criteria may be an excellent list of concrete examples that supplement some of the existing generic instruments for assessing innovation competency – such as the one provided by the 21<sup>st</sup> Century Skills Program (Binkley, 2012). The list derived in this study is already being used in the Danish context as the background for a task force liaised by the Ministry of Education, which works towards constructing examination formats that can test students' innovative competencies. Clearly, policy-makers and parties responsible for summative examinations will benefit from this detailed bottom-up perspective on assessment practices concerning innovation competency. In other words, the list of assessment criteria extrapolated from the teachers' talk-in-interaction is potentially a strong vantage point for attempts to make changes to assessment practices so as to begin to assess a range of competencies that would fall outside the scope of many existing assessment methods.

Further, as Harlen (2005) has argued, there is a need for professional development concerning assessment in general. Teacher trainers and professional development educators may use the synthesised assessment criteria as a backdrop for fostering that teachers gain what Harlen (2005) has called a “genuinely professional role in assessment rather than one of merely following the directions of an external authority” (p. 266) – a role that is bound to be a key step towards a more professional assessment practices regarding innovation competency. Connected to this point, is the potential that the list of assessment criteria synthesised here for improving formative assessment practices concerning innovation competency. Teachers in the project that formed the context of this study have already begun

to use the criteria for collecting data about their students in order to make student-dependent criterion-referenced decisions as to what the next learning step will be for the individual students. Data from the practical usage of the criteria are currently being collected and analysed.

Above all, the study has shown that engaging teachers in discussions about assessment of competencies, which are usually treated as very difficult to assess, can lead to a very detailed and concrete insight into how different assessment criteria could be understood and operationalized in practice. As such, this study offers a strong justification for the involvement of teachers in research and policy-making on assessment practices.

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Figure 1. Schematic overview of the three steps in the data collection and the analysis process.

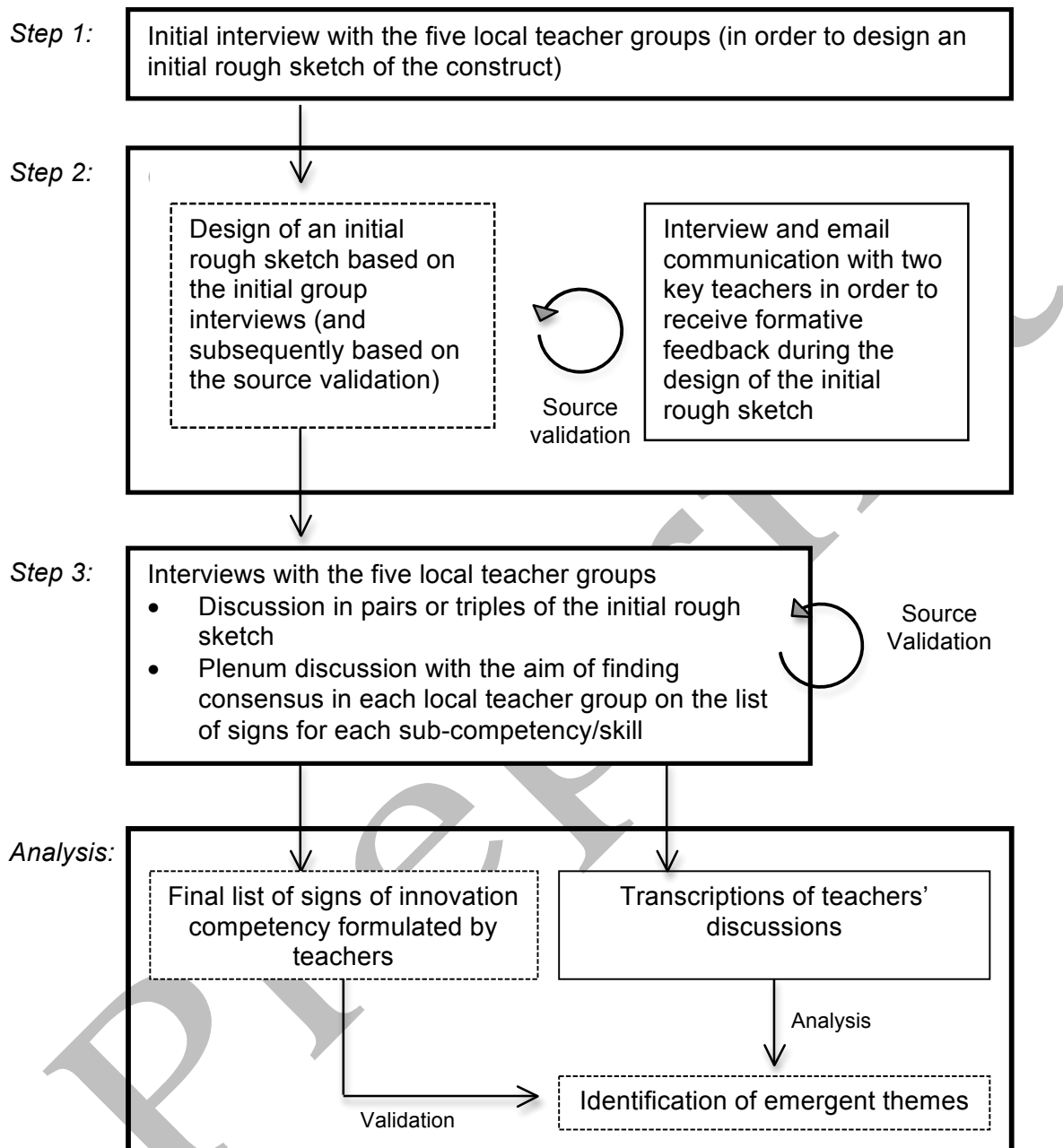


Table 1. Comprehensive list of assessment criteria extrapolated from the teachers' talk.

	Assessment criteria (sub-competencies )	Assessment criteria (skills relevant to sub-competencies)
Creative competency	The student is able to be open in idea-generating processes	The student is able to generate new/unexpected ideas/solutions
		The student is able to generate different and non-idiosyncratic ideas
		The student is able to be open to ideas from oneself and others
	The student is able to work with ideas in a critical fashion	The student is able to sort and select ideas according to criteria
		The student is able to extend upon and further developing ideas
	The student is able to independently interpret a task or problem issue	The student is able to be sensitive to problems/issues in real life
The student is able to have a fundamental curiosity		
The student is able to find a novel/own interpretation of a problem		
Collaboration competency	The student is able to take responsibility for, and facilitate, that the group finishes its tasks	The student is able to take responsibilities
		The student is able to be conscious of the dynamics of the group
		The student is able to facilitate a constructive work environment
	The student is able to be inclusive and flexible in collaboration	The student is able to be inclusive of others
The student is able to be flexible in terms of types of collaborators		
The student is able to be flexible in terms of own roles in collaborations		
Navigation competency	The student is able to functionally handle knowledge	The student is able to work with information density
		The student is able to sort, structure, and prioritise knowledge
		The student is able to handle missing knowledge
	The student is able to master complex work processes	The student is able to have and operationalize, an understanding of work processes
		The student is able to have a constructive approach in complex processes
The student is able to understand the problem issue		
Action competency	The student is able to take risks and put oneself and/or others into play	The student is able to carry things out by bringing herself and/or others into play
		The student is able to have courage, taking risks, and being able to leave her comfort zone
		The student is able to take ownership of and/or responsibility for actions
	The student is able to make informed decisions	
The student is able to actively seek information – also outside her comfort zone		
Communication competency	The student is able to assess how to communicate	The student is able to analyse a communication situation
		The student is able to make an informed choice of how to communicate
	The student is able to master communication techniques	
The student is able to communicate engagingly and convincingly		