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Sørensen, Birgitte Holm; Levinsen, Karin

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Evaluation as a powerful practice in digital learning processes

Birgitte Holm Sørensen and Karin Tweddell Levinsen, Aalborg University, Copenhagen, Denmark

[Birgitte@learning.aau.dk](mailto:birgitte@learning.aau.dk)

kale@learning.aau.dk

Abstract: The present paper is based on two empirical research studies. The *Netbook 1:1* project (2009–2012), funded by the municipality of Gentofte and Microsoft Denmark, is complete, while *Students' digital production and students as learning designers* (2013–2015), funded by the Danish Ministry of Education, is ongoing. Both projects concern primary and lower secondary school and focus on learning design frameworks that involve students' agency and participation regarding digital production in different subjects and cross-disciplinary projects. Within these teacher-designed frameworks, the students perform as learning designers of learning objects aimed at other students. *Netbook 1:1* has shown that digital and multimodal production especially facilitates student-learning processes and qualifies student-learning results when executed within a teacher-designed framework, which provides space for and empowers students' agency as learning designers. Moreover, the positive impact increases when students as learning designers participate in formative evaluation practices. Traditionally, the Danish school has worked hard to teach students to verbalise their own academic competencies. However, as our everyday environment becomes increasingly complex with digital and multimodal technologies, formative evaluation as a learning practice becomes central, requiring the students to develop a digital and multimodal literacy beyond the traditional, language-centred type. *Students' digital production and students as learning designers* is a large-scale project that follows up on the findings of *Netbook 1:1*. It experiments further with various evaluation practices in a digitalised learning environment that focuses on different phases of the learning processes and includes feed-forward and feedback processes. Evaluation as a learning practice in a digitalised learning context focuses on students as actors, addressing their self-reflections, responses to feedback from peers and feed-forward processes, and responses to feedback from teachers and feed-forward processes.

Keywords: Formative evaluation, summative evaluation, self-evaluation, peer evaluation, teacher evaluation, digital learning processes, multimodality, evaluation design

1. Introduction

Traditionally, Danish schools have worked hard to teach students to verbalise their own academic competencies. However, the advent of new media impacts on the representative forms of subject matters and calls for new subject knowledge. The representative forms are specifically changed through multimodality; the subsequent, new subject knowledge is needed not only because the technology is available, and multimodal competencies are core competencies of the 21st century (Organisation for Economic Co-operation and Development [OECD] 2008). New subject knowledge is also necessary because multimodal means of expression function as an externalising vehicle for reflection and construction of meaning (Sørensen & Levinsen 2014), in the same way as speech and writing externalise thoughts and enhance learning (Dysthe, Hertzberg & Hoel 2001). With multimodal expressions, the students achieve a broader repertoire through which to experience the world and express themselves while learning. Gradually, as education becomes more digitalised and multimodal, schools are challenged to provide new subject knowledge, together with professional capacities, to describe multimodal competencies and specify learning objectives and what must be taught and evaluated.

Since the 1990s, especially in the UK, there has been a growing interest in developing formative evaluation, since evaluation has proven to be a powerful learning practice in contemporary constructivist learning designs, such as cooperative, action or problem-based learning that aim at students' active participation and agency (Black & William 1998, Harlen & Deakin Crick 2002, Tanner & Jones 2003, Hattie & Timperley 2007). At the same time, formative evaluation functions as a means of navigation for the actors during the process of transformation undertaken in schools as digitalisation expands (Luckin et al. 2012). This development has led to an increasing interest in digitally supported, formative evaluation practices, a field marked by new ideas and innovation, such as experiments with mobile technologies and social networks (Ibid.). Summative evaluation has recently been actualised by the Programme for International Student Assessment (PISA) that ranks students' performance among the OECD member-countries. The PISA results and the ranking of countries have set the agenda for educational politicians, educators and researchers across Europe, shifted the focus from formative to summative evaluation

(Dysthe 2009, Shewbridge et al. 2011, p. 7) and released huge investments in digital, multiple-choice tests and measuring designs (called The Digital National Tests in Denmark). In both formative and summative digital evaluation designs, multimodality and students' agency stand weak (Wyatt-Smith & Kimber 2009); accordingly, the development and production of evaluation designs that encompass both constructivist and social constructivist, digitalised learning designs and the various modalities and their interrelations as representations, emerge as a major challenge. Moreover, since their definition 50 years ago, the concepts of formative and summative evaluations have become weakly defined (Taras 2008).

Our research in *Netbook 1:1* (for further reading about research design, data collection and analysis, see Levinsen & Sørensen 2013 and Sørensen & Levinsen 2014) shows that evaluation formats, ranging from students' self-evaluation over peer evaluation to teacher-initiated evaluations in various designs, are crucial for students' subject-related and trans-disciplinary learning, the way they work and how they design and conduct presentations. In the ongoing research and development project, *Students' digital production and students as learning designers*, we experiment with various evaluation practices, learning objectives and criteria for evaluation. The present paper describes the basic framework for formative and summative evaluations and various evaluation formats that have been developed and tested in the project, illustrated by empirical examples. Additionally, we touch on theoretical approaches and discuss new challenges, such as student governance and multimodality in evaluations.

2. Literature study

The teacher's awareness of the students' knowledge (or lack of it) and abilities is pivotal to the design of a learning framework that involves students' agency. In practice, to facilitate learning, both the teacher and the student must be aware of the student's (pre)condition and progress. To achieve this awareness and transform it into a teacher's assessment and the students' understanding of their learning levels and challenges, the generally agreed practice is evaluation – a huge topic ranging from national tests to the kind of everyday classroom practices that are the focus of the present project. Evaluation is divided into two main categories: formative and summative (Shriven 1967, Bloom, Hastings & Madaus 1971).

The research literature regarding the respective roles of assessment and summative and formative evaluations in students' learning and empowerment as agents in relation to their learning is primarily produced in the UK. According to Tanner and Jones (2003), Taras (2008) and Black (2013), the research focus has mostly been directed towards formative rather than summative evaluation. Taras pointed out that the relationship between the two forms is weakly described: *"More seriously, the absence of this discussion has resulted in the distortion of this relationship, which has led to a misunderstanding of both assessment processes"* (Ibid. p. 173).

Taras (2008) and Tanner and Jones (2003) argued that the formative and summative concepts are often used to denote and distinguish between two types of evaluation: teacher and classroom assessment (formative assessment) versus external/national assessment (summative assessment). In contrast to the general definition, Brookhart (2001) emphasised function and purpose rather than type and claimed that both classroom and external assessments are applicable to formative and summative purposes. Tanner and Jones (2003, p. 276) defined an "assessment event" to include: *"...the preparation for the assessment by both the teacher and the student, the feedback from the assessment offered by the teacher, and the impact of the assessment on the subsequent learning behaviours of the student"*. Accordingly, the formative purpose of any evaluation or assessment should be to provide feedback that helps students identify gaps and assist in their learning progress and performance. Luckin and colleagues (2012) maintained that traditional understandings of evaluation are challenged by digitalisation in terms of various digital-supported evaluations, together with a range of modalities that expands the need for literacy beyond written texts and spoken words. The very notion of classroom assessment is also challenged by the hybrid space that emerges through mobile and wireless technology and dissolves the brick-and-mortar-defined limits of the physical classroom (de Souza e Silva 2006, Sørensen, Audon & Levinsen 2010).

The works of Black and Wiliam (1998, 2009) and Hattie and Timperley (2007) showed that positive impact on students' learning performance is strongly connected to interaction and continuous evaluation by the teacher as an integrated part of everyday teaching. Luckin and colleagues (2012) also found that evaluation as a learning practice, combined with digital production, strongly supports students' academic and cross-disciplinary learning,

the way they work and how they shape their projects and presentations, while their awareness of their own capabilities changes substantially as they progress. In the UK, the so-called assessment-for-learning movement had promoted formative over summative evaluation until recently (Taras 2008); the consequence has been a research focus locked on the negative effects of testing (Black 2013). Moreover, the term *evaluation* is currently preferred over *assessment* (Taras 2008). As a counter movement, the present PISA programme promotes summative evaluation as a driver for learning over formative evaluation (Dysthe 2009). In this situation, most research aims at producing evidence that either of the evaluation types performs better than the other, rather than focus on how they might enhance each other or how they should be understood or defined.

The general research focus has been on the teacher-driven evaluation and assessment that aim to provide both teacher and students with knowledge that improves the students' performance, as presented in *OECD Reviews of Evaluation and Assessment in Education – DENMARK* (Shewbridge et al. 2011). The focus on the teacher as the main provider of feedback and feed-forward corresponds with the general view within the learning design theory that learning design – including evaluation and assessment – is the teacher's domain (Dale 1989, 2000).

In contrast to the generally accepted position, we discovered in our research (Levinsen & Sørensen 2013, Sørensen & Levinsen 2014) that even young students are able to act as learning designers. We found that practices ranging from students' self-evaluation over peer-evaluation to teacher-initiated evaluations in various designs are crucial for students' subject-related and trans-disciplinary learning, the way they work and how they design and conduct presentations. The students actively reflect on and use both the feedback and feed-forward produced in both ongoing evaluations during the work process and final evaluations.

In the ongoing project, *Students' digital production and students as learning designers*, we take these ideas a step further. We coin the concept of *students as learning designers*, meaning that students act as learning designers of their own learning processes, including forms of evaluations within a teacher-designed framework that empower students' agency through digital production of learning objects aimed at other students. In the project, we experiment with various evaluation practices with formative purposes, learning objectives and criteria regarding evaluations that:

- focus on different phases of the learning processes;
- contain feed-forward and feedback processes; and
- focus on students as actors and address their self-reflections, responses to feedback from peers and feed-forward processes, and responses to feedback from teachers and feed-forward processes.

3. Research design and methodology

The project is based on a combination of Action Research and Design Based Research using quantitative and qualitative approaches. The overall framework for the project includes interventions within different subjects. The interventions are in accordance with Design Based Research designed with increasing complexity from simple mathematic exercises to more complex trans-disciplinary activities that involve advanced technologies such as social media, robotics or location-based technologies. In accordance with Action Research, the researchers and the teachers collaborate closely when preparing the interventions locally at each school as the interventions must be integrated in the ordinary planning of the school year.

The project is complex in many ways and produce data using two main approaches within an overall mixed methods framework (for details see Levinsen et al. 2014): 1) Baseline measures are conducted as a long term diachronic quantitative survey combined with qualitative structured observations at the start, middle and end of the project; 2) each of the six interventions are followed through a combined synchronic and diachronic approach where the researchers as action researchers follow the interventions in order to document and identify changes and developments of the performed practice. Qualitative data are collected before, during and after the interventions in the form of individual semi-structured interviews, semi-structured focus groups and informal conversations with teachers and students, as well as video, photo and artefacts. The aim is to produce a complementary set of data that records and documents the interventions and allows for analysis of their impact on the students' learning and the teachers practice.

4. Formative and summative evaluations as learning practices

Luckin and colleagues (2012) mentioned two important processes to explore in using evaluation practices in order to identify what and how the learner knows and understands. The first is the student's reflection on his or her own learning activities. In doing so, the student develops an understanding and becomes empowered about how to improve his or her learning activities and strategies. These reflections are qualified through dialogue and practice. The second process is the teacher's evaluation of and reflection on the student's learning activities. The learning processes are qualified by the teacher's feedback and feed-forward to the student, as the student should learn to respond to critical comments and include them in the ongoing learning activities and reflections. If the learning design framework provides a basis for ongoing formative and summative evaluations, the evaluation activities may function as a driver for reflection and learning for both teacher and student.

In agreement with Brookhart (2001), we understand summative and formative evaluations as functions that may take place both inside or outside the (hybrid) classroom and with the purpose of providing both teacher and students with appropriate knowledge to strengthen and stimulate students' academic development. Along with Scriven (1967) and Bloom and colleagues (1971), we understand these functions as having different points of departure. Thus, summative evaluation lends itself to a backward-looking perspective that aims at evaluating completed tasks and whether (minimum) competencies have been achieved in relation to defined learning objectives. On the other hand, formative evaluation refers to a forward-looking perspective that aims at producing feed-forward that supports the students' future learning, ways of working and collaborating, and presentations and presenting performance. Thus, we understand evaluations as learning practices that are performed by both teacher and students as functions with a purpose. Summative evaluation is mostly conducted at the end of a learning process, while formative evaluation may take place both during and at the end of a learning process. The two evaluation practices are complementary; summative information is about the distance to the goal (learning objective), while formative information helps define and navigate the journey (learning) towards that goal.

As mentioned above, we find that design for learning is both the teacher's and the students' domain. *Netbook 1:1* (Sørensen & Levinsen 2014) showed that the students operate at all three levels of Dale's model (1989, 2000): practice, organising and planning, due to a teacher-designed frame, which centres on the students' learning process and subject-related reflections. The frame defines an arena, where the students take on responsibilities and act as learning designers under the teacher's supervision. We find that students evaluate and reflect on their practice during the process by using everyday language, while the teacher's reflection in action is based on his or her professional theoretical knowledge and competencies. From a design-for-learning perspective where the students' learning is driven by their reflections and evaluations as learning designers, we have further developed Dale's model into a four-level *Design for Learning Model*. In the new model (Figure 1), the fourth level belongs solely to the teacher's domain.

1. Practice	Teacher	Student
2. Organization and planning	Teacher	Student
3. Situated and practice-based reflection	Teacher	Student
4. Theory-based reflection	Teacher	

Figure 1: Four-level Design for Learning Model.

Taking the departure point from the students as learning designers, evaluation becomes a pivotal practice for both the learning process and learning results. Evaluation should be a core learning practice in any teacher-based design frame, explicitly formulated in terms of function and purpose, and actively integrated into the students' agency as learning designers. Apart from Luckin and colleagues' (2012) two processes, we work with three variations of evaluation practices:

- students' self-reflection and self-evaluation,
- peer response with feedback and feed-forward and
- teacher response with feedback and feed-forward.

Before we unfold the evaluation practices, we should explain the feedback and feed-forward concepts that are present in all three practices and form the basis for evaluation as a learning practice. Feedback aims to:

- take stock
- share knowledge
- evaluate a process and/or a result

Feedback is a practice where summative and formative purposes may function complementarily. When feedback aims at taking stock, it is often given during the learning process. However, feedback may also function as summative at the end of a learning process and provide an overview to the student about what is or is not learned and which competencies are acquired or not. When the aim is sharing constructed knowledge among students, feedback may equally be generated during and/or after the process. When the aim is to offer a critical or an appreciative response, evaluation is typically performed at the end of the process, when the work is completed and presented. Feed-forward aims to:

- proceed with a process,
- generate new ideas and
- produce changes.

Sometimes, feedback and feed-forward are intertwined, since feedback often leads to conversations about how to proceed, and knowledge sharing leads to new ideas. However, in our context, it is convenient to focus on feed-forward if the purpose is solely formative, such as if the students are at a standstill, the teacher finds a lack of subject-matter quality in their work, the organisation of their work does not function, and changes are needed. The teacher may choose to intervene and challenge the students to reset their usual ways of thinking and doing and inspire new strategies to proceed. Feed-forward may also occur spontaneously, for instance, if a student finds useful ways of using a program or an app or discovers information that may be shared with the class. As feedback, feed-forward may be given both during and after a learning process. For both teacher and students, feedback and feed-forward may function as drivers for redesigning both the frame and the learning design.

5. Students as learning designers, and evaluation practices

In this section, we present examples of evaluation practices from the projects *Students' digital production and students as learning designers* and *Netbook 1:1*, based on subject-related, trans-disciplinary and individual contemplative projects.

5.1 Students' self-reflection and self-evaluation

The teachers develop a digital *objective and an evaluation sheet* for the students to fill in at the end of a project. The evaluation sheet is included in the student portfolio and used during student-teacher and student-parent-teacher conversations. In the early grades, the students possess limited writing skills, so the sheet has a mix of check marking and a few written answers. The teachers plan the activity with a generous time frame and perform formative guidance while the students evaluate themselves in relation to the following categories

- Subject/trans-disciplinary learning
- Working practice – organisation, collaboration
- Product and presentation
- Technology.
- Modalities
- Working efforts

In this manner, the students' evaluation refers to the teacher-defined objectives for the project, which stem from the legislated learning objectives for Danish schools. These objectives are discussed with the students for their understanding and rephrased to *student-language* (Figure 2).

Do you mostly talk or listen when you collaborate with others?	Sepp	<i>I mostly talk but I also listen pretty much</i>
What is special about Ole Lund Kirkebys way of writing?	Alberte	<i>He writes many things and he writes something I can understand and something that explains and means something</i>

Figure 2: Example of a digital questionnaire in which second-grade students answer questions after studying an author and his books (authors' translation).

In the early grades or if the students are not yet used to evaluation as a learning practice, it is important to introduce the format thoroughly, since its purpose is to provide an arena for the students' reflections on their learning process and the learning itself.

It may be an issue of whether check marking supports reflection. However, in the early grades, it is important that all categories are present and allow the students to become accustomed to and build a repertoire of relevant criteria to master the evaluation of various learning objectives and the dimensions of the learning process.

5.2 Responses with feedback and feed-forward

Ongoing evaluations with feedback and/or feed-forward can be used as short time-outs, where students and/or the teacher show and tell something that others can learn from, for example, when students have found out how to animate a graphic element. A complementary summative and formative purpose may also be included at the end of a learning process.

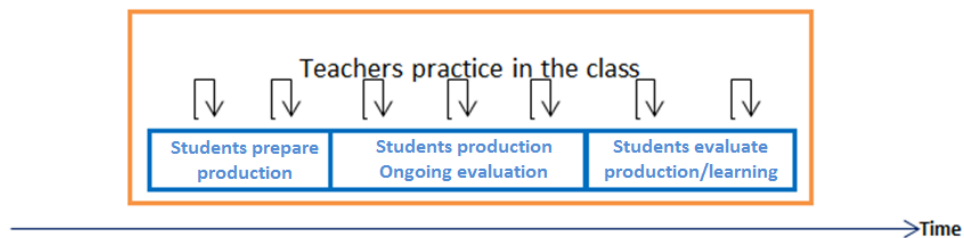


Figure 3: Ongoing evaluations with feedback (backward-looking critiques and comments) and/or feed-forward (forward-looking comments and suggestions on what can be done).

In our project, the students continuously uploaded their work or collaborated directly in the cloud. Therefore, all products, notes and stages in the processes were accessible for both the teacher and the peers at all times. They were both easily shared online and mediated using the interactive whiteboard during time-outs.

Peer response: During the process, peer response is provided as planned or as spontaneous time-outs where the students take stock of the progress in relation to the overall time frame. Short presentations using the interactive whiteboard allow for peer comments on the quality of the work and suggestions for improvements. The whiteboard can be used as a tool to add layers and comments directly on the digital work. As an evaluation practice with a formative purpose, peer response is both useful for subjects and trans-disciplines, working practice, and use of technologies and modalities, since it supports ongoing improvements. Peer response as a final evaluation of subjects and trans-disciplinary projects focuses on the students' digital products, the acquired subject or trans-disciplinary learning, and the working practice, including subject-related and social collaborative aspects. Peer response as a final evaluation of individual contemplative projects focuses on each student's final product and the way the student uses modalities to present and mediate the product and the content. During the peer response, the teacher stays in the background and guides the evaluation in terms of how to express relevant critiques without hurting the receiver and ensuring that all relevant aspects are brought into play. The students' self-evaluation is also an element in the final peer response as it is a driver for the formative function of peer response.

Teacher response: The teacher may both produce process and final evaluations and hold summarising conversations with individual students. As the learning manager, the teacher needs to maintain awareness of the various aspects of the learning processes and the students' challenges, then uses this knowledge to select important issues for either process or final evaluations. The teacher's professional background and knowledge about the students help him or her select what to allocate to the plenum and individual conversations, respectively. The evaluation may be organised in various ways; accordingly, the teacher must possess a repertoire of practices that suits the evaluation purposes, such as: Are there only right or wrong answers or alternative possibilities? Is the purpose to reflect on a subject or to inspire more in-depth work with the subject matter? What kind of evaluation enhances the students' future learning processes, and what may be vulnerable?

For a full week, 10th-grade students work on trans-disciplinary projects, using art and architecture in their neighbourhood. They employ various digital production tools to produce short videos, texts, photos, etc., about the neighbourhood. These are published through the social location-based, mobile gaming platform SCVNGR that allows users to build a game-layer on top of the world. During the week that also includes peer-response sessions, the teacher accesses the digital productions and takes stock of the students' process, progress and challenges. This knowledge is used to provide formative input to the students in the form of feed-forward regarding the thoroughness of their mediating content and the functional and aesthetic use of their modalities. At the end of the process, the final file constitutes the students' delivery of the assignment for the teacher's assessment.

6. Concluding discussion

The use of language bears an impact on whether the students take the evaluation as a formative input for future work. Littleton and colleagues (2005) developed the concept of "thinking together", addressing various forms of dialogue and questioning that may either enhance or hamper collaboration and learning. "Thinking together", combined with an explorative manipulation of digital representations, is also useful in evaluation processes, especially when language functions as a vehicle for exploration and construction of knowledge and as a driver for reflection. The underlying reason is that the teacher may use the students' articulation of and work with the digital product to identify challenges and exploit the acquired knowledge to reorganise the frame or details in the learning design. In the Danish school, similar to higher education, no tradition exists for evaluating the teacher's work as an evaluator. Nonetheless, we note an advantage in involving students in this aspect of the teacher's practice, for instance, the learning design and the teacher's communication and interaction with the students.

Digital technology offers a wide range of options for developing evaluation as a learning practice. We found that teachers and students used shared networks and cloud technology to create new dynamic frameworks for both the teachers' work with evaluations and for the students' peer evaluation. Accordingly, there is a need for research and development regarding how technology may support summative and formative evaluation practices during and after learning processes. It is also necessary to explore and develop digital solutions that enhance the analysis of evaluation results and support the teachers and students decision making on how to transform produced knowledge into efficient practices. Teachers are already exploring digital options; Luckin and colleagues (2012) specifically cited social media.

We have already mentioned the beginning impact of digitalisation on the forms of evaluation such as digital, national summative types and the competitive approach used in the PISA programme. However, other dimensions such as multimodality, creativity and innovation that are actualised by digitalisation also influence evaluation. When students' approach to subjects become multimodal, and subjects are mediated digitally through multimodal representations, multimodality becomes part of both the subject matter itself and the related academic competencies. As mentioned in the introduction, the Danish school has aimed at teaching students to verbalise their own academic competencies. However, the advent of new media and their impact on representative forms and competencies call for new subject knowledge, not only because the technology is available and multimodal competencies represent a core competence in the 21st century (OECD 2008). New subject knowledge is also needed because multimodal modes of expression function as an externalising vehicle for reflection and construction of meaning, together with speech and writing (Sørensen & Levinsen 2014). Thus, multimodal means of expression provide students with both a broader repertoire for expressing themselves and a more nuanced tool for experiencing the world. This means that multimodal means of expression not only have to be part of the articulation of evaluations in a digital learning environment, but the students' use of the former should be evaluated as a competence with defined learning objectives. This issue is an important dimension in future discourses on any subject and its related knowledge regime. For the teachers, it is a major challenge to develop learning designs for *evaluation-as-a-learning practice* in a digitalised learning environment and to include both the modalities and their interrelations.

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