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Development of Critical Thinking in Higher Education: A Didactic Approach to The Challenge of Developing Students' Critical Thinking Skills

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Abstract

Critical thinking (CT) is among the so-called 21st-century skills. This paper aims to discuss the specific conditions and didactical approaches under which university students may CT skills. To this end, the paper includes approaches from literature to supporting students' development of CT skills in higher education from a didactic perspective. Student activities calling for CT are pivotal since knowledge in itself is far from sufficient to handle the complexity of the modern world. We examine, from a didactic perspective, conditions that support the development of CT competencies in higher education and conditions that may impede their development. CT refers to understanding and thinking autonomously and independently. CT requires knowledge and the ability to connect with knowledge and theory critically. It requires higher-order skills and engagement, and a will to participate in teaching activities constructively and reflectively. However, the students' learning outcomes are often measured based on predefined objectives, and there is a general agreement that current performance management in education measures success as speed and effectiveness in achieving learning objectives, and that this may strongly impede critical thinking. In combination with high stakes exams, the development of critical thinking is under pressure and must be considered from an Academic Bildung perspective.

Keywords: Critical thinking, teaching environments, taxonomies, exam forms, learning culture.

INTRODUCTION

This is a theory-based paper, where we include a range of literature dealing with the concepts of learning, taxonomies, exam forms, teaching environments, Academic Bildung, and Critical Thinking. We ask which conditions allow students to develop critical thinking skills in higher education. From a didactic perspective, we examine conditions that may support the development of critical thinking competencies in higher education and conditions that may impede this development. To proceed in this; we need to investigate the conditions under which students develop skills, competencies, and Academic Bildung. Academic Bildung concerns the formation of a person as a responsible citizen and an independent thinker, in education and life in general (Solberg & Hansen 2015). Competence, in our understanding, concerns a personal, a social, and a societal dimension (Marton et al 1998, Bean 1996, Rose-Krasner 2006).

In the literature, critical thinking is conceived in various ways, but always with a focus on the personal approach and judgment. The term 'critical thinking' is used in a body of research literature to describe reasonable, reflective thinking, focusing on the task, people, or beliefs [...] As it is conceived, critical thinking involves *abilities in addition to certain dispositions*. They are brought to bear in identifying a problem and its associated assumptions; clarifying and focusing the problem; and analyzing, understanding, and making use of inferences, inductive and deductive logic, as well as *judging the validity and reliability of assumptions, sources of data or information available*. (Pithers et al 2000:239, our italics)

In line with this, we understand critical thinking as competence based on knowledge and higher-order skills and related to a more personal dimension and a supportive learning environment. We do not define critical thinking just as taxonomic requirements because we want to avoid a performance-oriented approach whereby the objective is to test critical thinking competencies. Furthermore, regarding the testing of critical thinking competencies, we find that it is hardly possible to capture the complexity or to predict their outreach.

As Paul et al. state in the following, education is about developing critical thinking in a very broad sense, not just for the work market, but for the personal development, for becoming responsible citizens:

Developing critical thinkers is central to the mission of all educational institutions. By ensuring that students learn to think critically and fairmindedly, we ensure that students not only master the essential subject matter but become effective citizens, capable of reasoning ethically and acting in the public good. (Paul et al. 2005:11)

Also per The European Qualification Framework, EQF, (European Communities 2008), the aim of education is not only to develop knowledge and skills for the labor market but also to educate critically reflective citizens with strong personal and social skills.

However, with the political focus on short term relevance, employability, and effectiveness, which translates into students completing their studies as quickly as possible, the personal development and Academic Bildung dimensions of education have been neglected (cf. Barnett 2007, Sarauw 2014, Andersen et al 2016, Solberg et al 2015).

We need a discussion about students' development and use of critical thinking, beyond exactly defined critical thinking performance controlled by, for instance, descriptions of

intended learning outcomes (ILOs). The question is how critical thinking can be "woven into curriculum content, structure, and sequence at all grade levels." (Paul et al. 2005:11).

We want to show that this implies a focus on teaching environments, and the inherent complexity of personal and social abilities, capabilities, and competencies, including the development of fruitful, sustainable, and persistent relations between students and teachers and between students. We have therefore chosen to include a self-efficacy perspective because of the importance of personal development and thinking skills – which is hard without inner motivation and self-confidence. We also would like to stress that even though students should be able to decode expectations in the university and teaching environment, the aim of academic studies is not only to deliver what is expected but to transgress and to add their insights.

However, reaching a consensus about what critical thinking means is a challenge, as Pethers & Soden (2000:240) demonstrate: "Lectures, tutors, and students seemed not to share an understanding of what it means to think critically."

The formulation of ILOs and the selection of exam and assessment forms are important parts of the framework, but not as sufficient when it comes to developing critical thinking competencies. We suggest taking a close look at traditional exam forms and their deficiencies when it comes to evaluating the students' critical thinking competencies and how they exert them in concrete and real contexts.

In this way, the paper takes a didactical¹ approach to the challenge of supporting the development of the ability to use critical thinking competencies in institutional teaching environments as well as in non-institutional contexts that generate critical thinking behavior.

Theoretical Approaches to Learning and Teaching

The approach that we have chosen in this paper is a constructivist approach to the very concept of learning, viewing the constructivist learning theories as a continuum from an individual cognitive oriented approach inspired by J. Piaget (Piaget, 1971) to a socially oriented approach (Vygotsky 1987). Cognitive constructivism is an individualized approach based on the notion that the construction of knowledge relates to the specific person's way of observing the environment based on already individually constructed knowledge. Social constructivism focuses on the internalization of culture and posits that the construction of knowledge is related to interpersonal learning processes. Learning has an individual and a social dimension, and in this continuum are included emotions, self-efficacy, and learning strategies related to the teaching environment in question.

Inspired by constructivist learning theories, we regard learning as a mental activity that can trigger individual knowledge construction and personal development. Learning refers to individual mental constructions related to the individually developed and achieved (new) skills and competencies. Skills are defined as the ability to use knowledge in relevant and

¹ We use the concept of didactics regarding the Scandinavian-German tradition (Hopmann 2007, Bengtsen et al. 2015).

constructive ways and thus in a variety of task forms, and individual competencies are defined as the ability to use knowledge and skills in new and unpredictable contexts. The concept of competencies encompasses a personal, social, and societal dimension (Mathiasen 2002).

Individual knowledge construction and personal development always happens and develop about an environment, a social system. We view teaching environments as didactically framed social activities actualized in the form of communicative actions. Teaching is a social event and conceptualized as a professional form of communication intended to give "nourishment" to the students' learning processes (Luhmann 1995, Luhmann 2002, Mathiasen 2008). Teaching relates to formats such as lectures, instructions, supervision, mentoring, feedback, and so forth, possibly mediated via the internet.

We understand the learner as a complex system acting in an institutional cultural context in which his or her learning is unpredictable. In principle, each student has specific preferences for both teaching environments understood in their broadest sense (von Foerster et al 2003).

Personal and Social Conditions for Learning in A Critical Thinking Perspective

Critical thinking requires not only knowledge and understanding but also the ability to connect with knowledge and theories in a critical and challenging way. It requires higher-order skills, based on theoretical and reflective thinking, which will often be much more challenging and time-consuming than rote learning (Biggs 2003, Marton et al. 1984). It is relevant to point this out because of the current performance management focus in education. By this term, we refer to general policies for quality of higher education, such as performance indicators, declaration of objectives, measurement of the value-added, quality assurance, accreditation, and audit. The performance management in education measures success as the fulfillment of objectives and speed rather than as robustness and longevity of learning or personal development. According to the existing policies in education, learning must be measured based on predefined goals that the system can assess, which in combination with high stakes exams at several levels may well overrule or threaten critical thinking aspects and critical approaches (Ulriksen et al 2015, Macfarlane 2017).

The teaching environments influence students' attitudes and learning strategies, and modern policy-driven universities have policy papers that describe ILOs and guide both teachers and students (Ramsden 1992, Hargreaves et al. 2001). In this perspective, ILOs may appear as a limitation with the students' opportunities to develop Bildung in general (Hammershøj 2018). Specific assessment forms may cause unintended backwash effects, and in the end, this may lead to "teaching to the test," which means directing students to concentrate their efforts on what the test will cover in terms of knowledge, skills, and competences (Taylor 2005). In such a regime, students focus on the content of the test and feel that critical thinking may be a barrier to reaching top results (Andersen et al. 2015). Students tend to become less independent, more focused on external demands, and less focused on putting their strengths, interests, and social responsibilities into action (Biggs et al 2007, Ramsden 1992).

Furthermore, there is a tendency to not include the affective and relational dimensions of learning. This concerns both the concept of self-efficacy, inspired by Bandura (1997), and the importance of paying attention to the relations between student and teacher and between students (Bereiter 2002, Wubbles & Breckelmans 2005). When the purpose is to develop critical thinking competence and use the achieved competence, the emotional and phenomenological dimensions of learning are of importance (e.g. Bandura 1997, Colaizzi 1973).

According to Bandura, self-efficacy is concerned with people's confidence in their capabilities to produce given attainments (Bandura 1997). In that sense, self-efficacy will necessarily influence a person's ability to face new challenges without performing self-censorship when it feels right to express critical thinking. With sufficient confidence in their ability, both in an individual and in a social dimension, as well as concerning their perception of professional ability in terms of knowledge, skills, and competencies, students are more likely to have the courage to actualize critical thinking and behavior. Critical thinking depends therefore also on the teaching environment offered and the 'openness' of the environment. For example, an approach to failure, as something necessary for learning processes. Critical thinking statements followed by academic arguments can be a fruitful way to participate in a teaching environment. These environments are always based on a culture, which often has an implicit domain.

The development of self-efficacy is linked to the experiences of success specific to the actual task (Bandura 1997). Self-efficacy is thus future-oriented but shaped by the past. The lessons a student has learned from previous educational experiences and teachers' or peers' communication about the student's ability in a concrete context may play an important role when the focus is on developing self-efficacy (ibid). Therefore, the concrete environment offered is important, when the focus is the facilitation of self-confidence, engagement, curiosity, and will participate. Furthermore, it is important to create a climate with room for intrinsic motivation where self-efficacy is stimulated by teachers or peers' recognition of the individual student's endeavor (Deci 1975, Marton et al 1984, Bandura 1997). The development of self-efficacy endeavor also depends on the teacher's personal approaches and ability to acknowledge students' efforts and originality in a learning culture.

Critical Thinking and Knowledge Interdependence – A Bildung Perspective

Bildung is an individuals' ongoing development process and at the same time a result of socialization. The kind of Bildung included in higher education could rightly be named Academic Bildung. We emphasize students' active choice of positions when meeting the world when we use the concept of socialization, and we take our starting point in "critical thinking society-oriented reflection and autonomy on the one hand", and "ethical dimensions of human formation and self-formation, existential- and being-oriented reflection and authenticity on the other hand." (Solberg et al. 2015:31). The concept of Academic Bildung includes autonomy and academic and social integrity and is therefore a necessary basis for critical thinking (Dam et al 2004).

Knowledge and critical thinking are, from our point of view, mutually dependent since there may be a fruitful relation between acquired knowledge and acting as a critical thinker in a concrete context. But "Knowing that one should think critically is not the same as being able to do so. That requires domain knowledge and practice" (Willingham 2007:13). Without the required domain knowledge and practice in concrete discussions, criticism becomes un-argued and unprofessional, and it is unlikely to develop critical thinking:

Indeed there is sound empirical evidence that good knowledge and good thinking are inextricably bound up. It seems important therefore that critical thinking is taught in the course of teaching discipline knowledge (Pithers et al. 2000:241)

In line with this, students need both knowledge and critical thinking skills to be able to make distinctions and judgments between fact and fiction: Without critical thinking skills, they may also lack information literacy and critical information behavior (Webber et al 2017). On the other hand, they need the motivation to view the ocean of information in a meta-perspective that will allow for a curiosity-driven search of information instead of a search motivated by the need to get a specific answer to a question more or less out of context.

Learning Strategies for Critical Thinking

We relate the development of critical thinking to specific types of learning (Marton et al. 1984, Biggs 2003, Ford et al 2003, Heinström 2005, Webber et al. 2013). The surface learning approach relates to some extent to a behavioristic understanding of learning. Surface learning involves different types of "punishment" and "rewards" as incentives (extrinsic motivation) and leads to study with a focus on factual knowledge and memorization for examination preparation; thus, a student using surface learning approaches delivers what is expected according to the student's understanding of the requirements. On the other hand, even surface learning may trigger the student's curiosity and the wish to go in-depth. The deep learning approach depends on students' ability to use study and inquiry-based activities without focusing too much on external expectations and strategic learning approaches (Webber et al 2013, 2017), to follow their understanding more spontaneously. If such an approach is implemented by different didactical measures, it may help students grasp, for example, a text's subtle themes and deeper lines.

We must therefore consider the students' learning approaches along a continuum, going from surface learning to deep learning – depending on the complexity of context-related decisions, such as strategic approaches to assessment forms, subject interests, and expectations from oneself and one's classmates. The autonomy that a student may actualize through metacognitive attitudes to their choice of learning strategies can be an opportunity to practice critical thinking:

The assumption is that this metacognitive ability, for instance, involving perception, critique, judgment, and decision-making, allows people to orchestrate and self-regulate their learning strategies, and those abilities encompassed in the term 'critical thinking' (Pithers & Soden 2000:241).

Rote learning, surface learning, and strategic learning, respectively, are strategies that students may use in concrete contexts, following the specific requirements of the ILOs and the concrete exam form, and maybe survival strategies that cannot be ignored in a competitive world.

Therefore, students' learning strategies depending on the specific context for learning, and knowledge construction is grounded in the students' observation of the specific skills, knowledge, and competence requirements in the concrete teaching environment. A review of published research demonstrates that "curriculum design was seen as to influence university and college lecturers to focus on subject-matter content when teaching rather than on the development of critical thinking" (Pithers et al 2000:239).

Rethinking taxonomies from a critical thinking perspective

To understand critical thinking as an educational objective, it can be useful to integrate a taxonomic dimension and to relate it to concrete teaching and learning activities, exam forms, and values in education. Many attempts have been made to classify the various domains of human learning, such as cognitive, affective, and psychomotor (Illeris 1999). The resulting efforts have yielded a series of taxonomies for each area. As to the effective and relational dimension of learning, we refer to Bloom's cognitive and affective taxonomies (Bloom et al 1956) and his revised taxonomy (Anderson et al 2001) given that both the knowledge dimension and the cognitive and affective processes relate to learning in context. Especially the cognitive and the affective taxonomies are interesting in the present context since the development and use of critical thinking are closely related to the personal and emotional area (Ibid).

The group assembled by Anderson and Krathwohl showed how the taxonomy intersects and acts upon different types and levels of knowledge, including factual, conceptual, procedural, and metacognitive knowledge. They found that mental knowledge constructions relate to emotions and the will to act. The revised taxonomy goes from simple to more complex and challenging types of thinking. Most relevant is perhaps the repositioning of the last and highest category, from "evaluation" to "creating". In Bloom's taxonomy, evaluation is precisely the ability to judge, check, and even critique the value of material for a given purpose. In the newly revised taxonomy, the highest and most demanding mental function is the capacity to "put parts together in a new way or synthesize parts into something new and different creating a new form or product" (Anderson et al 2001). We suggest that critical thinking is linked to this capacity to produce new insights. Subsequently, the teacher must be ready and open to appreciating critical and creative approaches, proposed by his/her students.

The often-used Structure of the Observed Learning Outcome (SOLO) taxonomy (Biggs et al 1982) builds on students' understanding of specific areas, from a few aspects ("uni-structural") to several aspects which are unrelated ("multi-structural"), to several aspects integrated into a whole ("relational") and, finally, to the whole seen and used in new applications ("extended abstract"). The idea is that for students to construct the necessary meaning, the teacher must align the planned learning activities and assessment with the ILOs. Learning activities and assessment must match learning outcomes to the extent that the verbs in the learning outcomes should match the activities that are undertaken. One could follow the

constructive alignment approach to a certain extent concerning exam forms and grading. Using the logic of backwash effects, we may define didactic challenges where critical thinking in terms of knowledge, skills, and competencies was tested and graded. However, we find this way of reaching didactic solutions unnecessarily rigid and predictable. Learning critical thinking primarily focusing on exams and grades is a contradictory venture. We argue for a more holistic approach and prefer to ask how we can establish and develop a culture and environment where critical thinking and behaving is a basic approach for students and teachers, in line with the theory presented about teaching and learning conditions.

Rethinking Learning Cultures, A Critical Thinking Perspective

Teaching environments offer a variety of working formats, learning resources, and institutionally generated communication platforms, and they often invite students into self-organized social media forums, where, among other things, knowledge sharing is actualized. Such differentiated didactic actions can lead to reflective, autonomous, responsible learners and citizens if the approach focuses on supporting a deep learning strategy as part of a respectful and individualized teaching environment building on human relations (both student to student and student to teacher).

This actualizes a focus on the teaching environment from a cultural perspective. In this perspective, students' self-confidence, in the sense of their development of self-efficacy in critical thinking behavior, is central. This aim thus involves rethinking learning cultures both at an institutional level and in the specific teaching environments offered in educational programs, hence in specific courses and didactic settings.

Key factors for success are the teachers' approaches, the relation between teachers and students, and the relations between the students. Students pay much attention to the teachers' signals, to their approaches to the required tasks, to their ways of communicating, and to the way they approach the various subjects and requirements in the concrete teaching environment. Recent research points to the fact that motivation is dynamic in the sense that attitudes, preferences, meaning, and motives can change depending on students' experiences, and can be changed through the student-teacher relationship (Skaalvik et al 2007, Boekaerts 2010, Wubbels et al 2005). These findings can be useful when creating teaching environments with a focus on the development of critical thinking. The teacher's role in developing motivation, self-confidence, and conditions for strong relations between students is a pivotal perspective, particularly when the aim is to develop critical thinking competencies and use these in teaching environments. This is closely related to the teacher's didactic capabilities as a designer of teaching environments, including selecting and offering learning resources, assignments, tests, quizzes, and so forth. Furthermore, the teacher must appear as a role model, a trustworthy person, an independent thinker, and a good communicator in a variety of interaction modes.

Related to this, important skills and competencies for students to learn are the ability to formulate relevant questions and problems; to gather and assess relevant information; to arrive at well-reasoned conclusions and solutions; and to think open-mindedly within alternative systems of thought and be able to recognize and assess their assumptions, implications, and practical consequences. In other words, the students have to be,

[...] able to enter and intellectually empathize with alternate ways of looking at things. They change their minds when evidence or reasoning requires it. They can internalize important concepts within a discipline and interrelates those concepts with other important concepts both within and among disciplines. They can reason well enough to think their way through complex problems. (Paul et al 2005:11)

As we have seen, these requirements are specifically relevant to the development of critical thinking. Therefore, an important exercise is to reconsider the existing learning cultures and their approaches to create space for students to reason, and to think independently, to discuss with peers, using evidence and well-planned argumentation, ready to listen empathize with other worldviews and to change minds and interrelate concepts with other concepts among disciplines.

Rethinking Exam Forms and Attitudes, A Critical Thinking Perspective

We have discussed the value of the ILO's as a foundation for teaching practice in the broadest sense and as a direct reference to exam forms. Furthermore, we have argued that critical thinking is strongly dependent on personal and social conditions and cannot be put on a formula and thus cannot be programmed.

With the term exam form, we wish to refer to a certain type of exam, such as a written portfolio exam, oral project exam, written exam, multiple-choice exam, or oral group exam (cf. Andersen et al 2015, Boud 2010). Whereas the term assessment is used to describe the evaluation of the student's performance on the specific exam or test. Teachers may use tests in connection with teaching as a tool to establish knowledge about the level of student performance and may use these tools as a formative assessment approach, whereas the exam is the final and summative assessment. Assignments are required work that students do in connection with the teaching; assignments are not exams, but the assignment forms may very well mirror the exam forms.

You may distinguish between on the one hand open and independent assignments, developing and testing higher-level skills, as opposed on the other hand to closed assignments testing the level of knowledge or skills (Gibbs 1999, Johnson 2009, Rienecker et al 2013). The latter could be standardized exam forms such as closed book exams or multiple-choice exams, whereas the first could be case and project exams and are more complex and more difficult to evaluate or grade. Thus, testing critical thinking requires rethinking exam forms. Alternative ways of looking at assessment systems can challenge and maybe alter the specific institutional culture.

It is a common assumption that specific culture and the specific knowledge of a test or an exam form influences both teachers and students so that the students adapt their learning approach to it. A too strong adaption to exams and learning objectives may develop into "teaching to the test" whereby teachers adapt their teaching methodology and lesson content to reflect the test's demands or into "learning for the test" whereby students develop their approach to studying in the direction of the test more than in the direction of their curiosity or interest. Several researchers have studied the latter phenomenon and labeled it as surface learning in

opposition to deep learning or strategic learning (Webber et al 2013, 2017). The strategic and the surface approaches are typically non-critical and prefer the format that most explicitly matches the task, the intention being simply to reproduce (surface approach) or to succeed (a strategic approach). A deep learning approach, on the contrary, would have the intention to understand and may not have, a priori, a focus on the test or the exam. Students with a deep learning approach may challenge the culture at an institutional level as well as the specific course level. They may also challenge the teacher. Moreover, vice versa, the students can be challenged if e.g. the teacher does not appreciate their approach.

If critical thinking is evaluated as factual or declarative knowledge *about* critical thinking, it is not critical thinking "in action," like knowing about swimming in theory but not necessarily being able to swim in the water. Even though critical thinking with a focus on psychological process words – for instance, from Bloom's taxonomy – may be relevant to understanding critical thinking, this in itself cannot develop critical thinking.

If students are to learn critical thinking skills, it is not sufficient to develop standardized or predictable knowledge or thinking as measurable skills that can be tested in predictable ways. Such an approach is closely related to the principles of teaching to the test and the understanding of testing as part of learning understanding.

The point is that you get the answers you ask for, and that is why there is still a vast research and development domain creating assessment forms and concrete questions that encompass what is required to be measured when it comes to skills and competencies that are hard to measure because they are and must be unpredictable. This is, of course, important, but we think it is relevant to take an alternative route of argumentation, so we will pose the question: Is it possible to make and use an assessment form that assesses critical thinking and acting competence? In the following, we present some suggestions.

But no matter how suitable the assessment form is, it might still be understood as superficial and unrewarding. We see the learning of critical thinking as a case or problem-oriented activity including a personal and social dimension. Social relations are central in an affective and cognitive understanding that applies to both teacher-student relationships and student-student relationships. The challenge lies in the conditions of the measurement and in the difficulties identifying to what extent certain dimensions influence the concrete performance.

Our first suggestion is to base assessment on a case requiring students to act about specific activities introduced – for instance, within the context of a social media discussion. The point is to have a basis for indicating the students' ability to act on an independent basis as critical thinkers and to create exam forms that allow for several solutions.

Our second suggestion is to use some type of Problem Based Learning (PBL) or Problem-oriented Project learning (PPL) since the approaches carrying these labels normally focus on collaborative skills, self-organization, and critical thinking. The intention is to allow students to learn what is required through problem definition and solving. Problem orientation and project work, whether individual or in groups include problem formulation, information search, and assessment, analysis based on relevant theory and methodology. In these approaches, students typically go through a consecutive critical and self-assessing process. As

an example of how to facilitate and assess the development of critical thinking, we suggest focusing on the students' ability to participate in problem formulation and real-world problem solving

Another challenge is to change traditional course exams in a way that makes them more valid and supports a critical and independent approach to knowledge construction. We need to investigate how to place more focus on collaboration, peer learning and peer feedback, self-responsibility and reflection, problem orientation, and authenticity, in aligned learning activities. We need this to change from a strictly performative perspective into a personally meaningful activity, organized with more open-ended exam forms (e.g. Skov 2013, Macfarlane, 2017).

New exam forms including these perspectives require deeper learning strategies (e.g. Ramsden 1992). In higher education, students' deeper learning strategies and critical thinking competencies are connected. A slightly simplified way of putting it is that the students choose the performative way of acting in a performative university. It is more about gaining "the necessary self-confidence to fulfill their potential as learners and thinkers" (Macfarlane 2017:4).

CONCLUSION AND PERSPECTIVES

We have shown some of the current challenges in university education when it comes to supporting the development of critical thinking competencies and hence to create autonomous, responsible critical thinkers capable of acting on a strong knowledge base and equipped with self-awareness and social competence. Critical thinking requires knowledge, understanding, and the ability to connect with knowledge and theories in a critical and challenging way. Critical thinking requires higher-order skills based on theoretical and reflective thinking.

We argue that with sufficient confidence in one's ability – both in an individual and a social dimension, and about one's perception of professional ability in terms of knowledge, skills, and competencies – students are more likely to have the courage to actualize critical thinking and behavior.

The teaching environment offered and students' 'openness' to actualize critical thinking are therefore primordial. Developing critical thinking depends strongly on the learning and teaching environments, in the sense that students need to find that teachers appreciate critical thinking and questions outside the curriculum or the learning objectives and that it is rewarded in the exam situation. However, critical thinking might count negatively when the objectives are given, and when critical thinking competencies is not in focus. Students may therefore be motivated to use adaptation strategies so that they match what is required.

Given the washback effect of tests and exam forms on the general teaching environment, it is useful in educational development to study and develop exam forms that can integrate learning activities associated with critical thinking in a Bildung perspective. Based on our conceptual starting point, it is important to avoid creating a system that will inevitably facilitate surface or strategic approaches undermining deep learning. This is actualized by too frequent use of closed exam forms, but also by establishing too much focus on exam results,

by high stake approaches. Literature findings concerning consequences offering teaching environments with a focus on measurable knowledge, skills, and competencies provide rethinking teaching environments to focus on supporting deep learning. According to our definition, critical thinking and Academic Bildung are necessarily part of the deep learning approach, and deep personal learning cannot be fully measured.

One suggestion is to base assessment on cases, activities, and projects requiring students to make judgments and act based on their knowledge and skills, in an online or face-to-face context.

We cannot prompt the students to have specific personal or social competencies but must respect the strong cognitive, affective, and social dimensions of learning. The assessment form is never enough. We have to think more broadly, including the initial learning environment and the teacher's role and choice of didactic approaches.

We have shown that Academic Bildung and critical thinking are linked to personal and social domains. The relationship between the teacher and the students is central as well as the relationship between students' peers is pivotal.

Critical thinking involves actualizing students' autonomy and academic and social integrity. We find it important to further develop an understanding of what can and what cannot be measured by the most commonly used assessment forms. This is a domain that we will leave for future investigations. We find it important in this connection to study the links between learning cultures, teacher's roles, and didactical choices and exam forms. The solution is not in one of these, but in the complexity, they form.

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