7 Critical Thinking in Higher Education: How to foster it using Digital Media

Dirk Jahn & Alessandra Kenner

Abstract

Critical thinking (CT) is an integral part of education, notably in higher education. In times of misinformation, oversimplified answers to complex problems and populist agitators, critical thinking remains a vital skill, necessary to differentiate accurate information from manipulation. Although students should learn how to use digital media critically to not fall prey to false information, hasty actions or to the dominance of the smart devices, digital technologies can also be very supportive to foster critical thinking. Therefore, they must be imbedded discreetly in teaching and learning environments in a way that they become supportive for the different activities of the critical thinking process.

In this paper, we would like to unroll some ideas indicating how this could be done in higher education contexts. Fostering critical thinking demands quite a lot from teachers and students. Students, for example, must conceptualize and exercise different thinking modes, jettison dear beliefs and create new and substantial ways of thinking and acting. Teachers however need to get a very clear idea of what critical thinking means in their field. They must be able to model critical thinking, its criteria or strategies. Furthermore, they need to know and apply different instructional strategies that are helpful to bring students into the different activities of critical thinking.

To broaden the perspective on concepts, we will discuss different definitions and traditions of critical thinking and offer a synthesis. In the next step, we will examine process-models of critical thinking and introduce educational strategies and design-principles. A further chapter is dedicated to digital media and critical thinking. We will have a focus on why students should critically think about media. From there, we will go back to general strategies and design principles for fostering CT and show how digital media could be practically used in accordance with these principles.

Keywords: Fostering critical thinking in higher education, Concepts of critical thinking, Using digital media for critical thinking

7.1 The Fear of a Decline in Critical Thinking

Immersing into the endless streams and posts on Facebook and other social media channels, it sometimes seems that average citizens are no longer capable or willing to seperate facts from fiction, right from wrong, racism from criticism, demagogues from original thinkers or experts from maniacs. The internet, once praised as a medium of knowledge and empowerment, has come under suspicion with its bots, filters, tweets, feeds, fake news and shit storms. Its promptness, its easy access and selectiveness is part of the problem: a decline in critical thinking, various experts from different fields like neuro-, social- or computer science claim. It seems like some people just hear and see what they want to hear and see and some of them respond and judge immediately, instead of examining statements critically or proving validity and origin of information. Forums, blogs and social media contain loads of unchecked, unbalanced or even hostile posts – and some of them get shared virally throughout the web.

Some current and extreme examples: Reptiloid political leaders, Dangerous Chemtrails in the sky, the Federal Republic of Germany and its constitution nothing more than a con, a whole country controlled and led by foreign and even alien powers. The internet has become a source for conspiracy theories.

Besides the controversial public debate about an alleged lack of media-literacy and critical reflection in society, there are other and more silent, surprising cases, where experts proclaim the absence of critical thinking in places where it should normally dwell and thrive: in schools and especially in higher education. Wolf talks about an "educational catastrophe" referring to the poor study skills of students entering university; students that are socialized between Nintendo, iPhones and the internet (Wolf, 2013, p. 55). He has evidence on his side and quotes some of his own and other studies, which all show that many students in Germany are not only lacking basic knowledge in relevant subjects, but they also fall short in reading, writing and thinking. For example, beginner-students often uncritically copy and paste information from the net in their first papers, write in platitudes or fail in recognizing ideological perspectives in texts (Wolf, 2013, p. 56).

But the critique does not only refer to decreasing and inadequate study skills. Other authors complain about the uncritical spirit of students. Florin is asking why students are so conformed, apathetic and incurious these days. In her controversial book, she discerns a vanishing willingness of (her) students to engage in critical thinking and dialogue, e. g. developing one's own and rich arguments, dealing with ambiguity or taking on different perspectives (Florin, 2014, p. 23). Her students only appear to be critical when their grades and learning-outcomes are concerned. For a better grade, they wake up from lethargy and painstakingly start scrutinizing and challenging their achieved scores. Instead of putting the blame merely on the students, Florin reflects the conditions and contexts students have to cope with. She finds a system almost detrimental for critical reflection. A curriculum with little time to reflect, tests that detain deep learning and thinking, a teacher-centered learning culture where students only take over the given information and don't engage in thinking on their own, "schoolification" like strict timetables and so on. Apologists of humanist education like Liessmann (2006, 2014); Pongratz (2012) or Hauser (2012) go even further in their profound critique. They consider higher education as a realm of growing non-education, where the paradigms and restraints of the market and the ideology of neo-liberalism rule out critical thinking, aesthetical contemplation or lessons in *áskesis or ataraxia*. In their perspective, the conforming demands of employability and mobility have taken over teaching and thereby corrupted the idea of what education once meant.

Some studies seem to confirm certain aspects of the critique on the bachelor- and master system. In a representative long-term survey, Bargel, Heine, Multrus and Willige (2014) continually asked German students about their contentment with their studies. The report concludes that students indeed acknowledge critical thinking as an important skill, but according to their views, its facilitation has come off badly and in addition waned in recent years. Of course, the Bologna process has brought conditions for studying, which seem impeding for critical reflection and deep learning. To criticize and to work on these flaws and problems is very important. On the other hand, with the Bologna Process university teaching and learning has become its own field of expertise and consideration that includes projects with financial state subsidies. Thanks to the "Quality Pact Teaching" for example, funded by the German ministry of education and science, many universities got the opportunity to set

up several projects on a large scale to improve learning and teaching, including projects to foster critical thinking skills via inquiry based learning, deeper learning or service learning.

Furthermore, certain aspects of critical thinking are officially a fundamental goal of university teaching, although the term `critical thinking´ is not used explicitly in the relevant documents. Just to give on important European example: The European Framework for Lifelong Learning, which is fully compatible with the qualifications framework for higher education developed under the Bologna Process, states that students on master level should gain "critical awareness of knowledge issues in a field and at the interface between different fields" (n. D., p. 3) or evolve "specialized problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields" (ibid., p. 3) or "take responsibility for contributing to professional knowledge and practice" (ibid, p. 3). These learning-outcomes could be referred to certain qualities of critical thinking.

What are the qualities of critical thinking and how can we promote them? In our opinion, this question is more important than the debate about if critical thinking is really "missing in action". Is critical thinking really on the decline in higher education? Was it really so much better in the past? We can't say that easily. Critical thinking cannot be observed like clouds in the sky or tested like a math-equation. It is difficult to assess and highly dependent on the concepts of the assessor. And even bad assessment results don't predicate bad thinking skills. A person, who achieved good critical thinking results in a test, can be very uncritical in a non-test-situation and vice versa. A person, highly critical in one domain, shows up to be very uncritical in another and so on.

In contrast to other countries like the USA, the concept of `critical thinking´ in Germany is often not elaborated, reflected or operationalized by teachers, lecturers or politicians. In clarifying its meaning and actions, its criteria, its demanded mind-set and attitude, we get the chance to bring life to a rather abstract term. Then, critical thinking gets visible, touchable and, thus, better addressable. What do we mean, when we say `critical thinking´ and how can we foster it appropriately with respect to our resources and partners? What role can digital media play? Here we enter.

7.2   Critical Thinking: An Approximation to a familiar but vague Concept

The origins of a thinking-style like critical thinking are rooted way back in ancient times. For example, Plato's ever questioning, contradiction-arousing and truth-seeking character Socrates is considered as the ideal critical thinker nowadays. His style of open dialogue and questioning even became a model for certain classroom-discussions and questioning-methods (see for example Boghossian, 2004; Weil, 2004). Germany's middle class intellectuals refer `critical thinking´ often to more modern (and often German speaking) philosophers and scientists. For example, Emanuel Kant, Martin Heidegger, Hannah Arendt, Ludwig Wittgenstein, Karl Popper, Paul Feyerabend or Theodor Adorno thought in their very own, distinctive and brilliant way critically about various issues, subjects or phenomena like perception, enlightenment, the connection of speech and reality, thinking itself, the darker side of enlightenment. Thereby, as a side effect, they shaped and clarified, what critical

thinking could mean, what it should cover and intent, where it comes to an end, how it is done well and where it should lead to. Their work and concepts have become a reference for many disciplines and of course for the few German-speaking authors who deal with critical thinking in a pedagogical context (for example Kergel & Heidkamp, 2015; Petri, 2003; Dubs, 1992). In everyday life, critical thinking is often perceived as negative, pejorative, annoying and destructive. However, being critical has nothing to do with being negative or insulting. Originally, `critique´ is derived from the Greek verb *krinein*, meaning to differentiate, to separate, elect, select or decide. Critique refers to the art of reasoning, to differentiate assumptions from facts or to question interpretations (Wohlrapp, 2008, p. 213). Instead of being negative, critique encourages one to think independently and to arrive at one's own conclusions and insights.

In the US, where critical thinking is deeply imbedded in education on a national level, many authors from different fields have addressed it as a pedagogical concept ever since pragmatist philosopher and educator John Dewey published his book "How we think" in 1910, defining how pragmatist learning theory matters for epistemology and for pedagogy. He is often considered a founding father of critical thinking and its pedagogy as we know it today (see for example Garrison & Anderson 2003). Dewey was one of the first to come up with a process model of critical thought and a didactical concept to foster it, which modern pedagogy nowadays embraces. "Reflective thinking", his preferred term, is defined as "active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends" (Dewey, 1991, p. 6). It is about curious minds having their own, rich experiences, and deriving judgments by debating, observing, collecting and examining evidence. Systematically analyzing a problem, inductive and deductive reasoning, coming up with conclusions, testing them empirically, interpreting the results and other "rational" and epistemic activities are part of the thinking process. Reflective thinking aims both to authenticate existing knowledge and to generate new knowledge and thereby deepen the meaning of experiences (Garrison & Anderson, 2003, p. 56). Although Dewey has inspired many English-speaking authors in defining and setting up a pedagogy for critical thinking, there are still plenty of other influences and perspectives with their own accents available. Most of the approaches share a lot, like thinking-activities, thinking directions, methods, standards or criteria. But still some of them are idiosyncratic and vary in emphasis and focus areas, depending on the person who invented the definition and concept or the time and context, in which he or she lived (for a history of the critical thinking movement in the USA see Paul, 2003 or Resch, 2008). Let us have a look at older as well as more recent definitions on critical thinking:

- "As a root notion of critical thinking it is taken to be the correct assessing of statements" (Ennis, 1962, p. 83 cited in Resch, 2008, p. 32).
- "Critical Thinking is open rational dialogue among friends" (Schwarze & Lape, 2012, p. 3f.).
- "Critical Thinking is the use of those cognitive skills or strategies that increase the probability of a desirable outcome. It is used to describe thinking that is purposeful, reasoned and goal directed – the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and making decisions" (Halpern, 2007, p. 6)
- "[Critical Reflection] is the process of unveiling the social, economic, and political dynamics of oppression, that are embedded in everyday situations and practices

(…) Hence, in the radical tradition of adult education `critical reflection´ is fundamentally emancipatory since it involves social critique, addresses oppressive social structures, and results in a transformation of a comprehensive worldview and eventually in social change" (Schugurensky, 2002, p. 61).

Ennis, coming from a philosophical background, for example, stresses logical and reasonable thinking in his concept. Analyzing propositions, deducing, inductive reasoning, judging inferences – these are the activities to evaluate arguments and judge, whether they are true or flawed. This logic-oriented thinking (formal and informal logic, probabilistic logic etc.) has practical value, because it "is focused on what to believe or do" (Ennis, 2011, p. 1). Thinking about the formal correctness of arguments and judging them is also part of Schwarze and Lape's notion, but the professors of philosophy place critical thinking in a certain communicational context: `rational dialogue among friends´. In that dialogue, in a Socratic tradition, friends express their different viewpoints and perspectives on an issue and together they elaborate, clarify and enrich the most evident and convincing opinions and arguments. During that dialogue, some assertions might get refuted and abandoned, because they won't hold up to rational standards (see Ennis). Beside the element of rationality, the authors stress taking on different viewpoints in an open face-to-face communication situation, where the speakers feel confident. For Schwarze and Lape this kind of critical thinking is supportive for the life of the individual: Critical thinking helps people to live happier, more productive and even healthier lives (ibid., p. 3f.), because "critical thinkers tend to be more successful at meeting their goals" (ibid., p. 3). Halpern, professor of psychology, also interprets critical thinking as a resource for achieving different individual ends like solving problems, but she describes it as a specified bundle of cognitive and meta-cognitive-operations and strategies. Here, in a psychologist tradition, critical thinking is interpreted as a `process´ that can be divided into different `cognitive´ activities like analysis, evaluation, synthesis or self-regulation. By contrast, Schugurensky, professor for adult education, stresses not the process, but the purpose of critical thinking, which is dedicated to empowerment of the individual and transformation of society. In this Marxist tradition of Critical Theory, authors assume that not all individuals are free in so called `free´ societies (even if they may think they are), but many of them must face (hidden) oppression even in everyday situations. Critical thinking here questions the unquestioned and taken for granted practices, ideas, traditions and results of (capitalist consumer) society. To denote social injustice and try to break the shackles of (hidden) oppression is the focus of critical thinking. Hence, critical thinking in this tradition is certainly not a tool for a more prosperous, successful, happier and healthier life in general. More the opposite seems to hold true. Digging in the dirt for too long will take its toll, Nietzsche once recognized: "He who fights with monsters should look to it that he himself does not become a monster. And if you gaze long into an abyss, the abyss also gazes into you**" (Nietzsche, 1999, p. 892). But maybe critical thinking in this version helps the individual to live a freer life, not being governed like that (Foucault, 1997, p. 44). Having said that the conceptualizations of critical thinking in general have very much in common, these five definitions from Dewey to Schugurensky show how diverse accentuations can be. The same holds true for terminology. Other terms (just to name a view) that describe aspects of critical thinking or can be used as synonyms are critical reflection (Mezirow, 1997), scientific thinking (Crowley, 2003), critical awareness (Johnson & Freedman, 2005), high-order thinking

(Williams, 2003), thinking socratically (Schwarz & Lape, 2000), reflective decision making (Truglio-Londrigan & Lewenson, n. d.) or complex critical thinking (Kincheloe, 2004).

These given definitions can be more or less categorized as belonging to certain `traditions´ of fostering critical thinking. With the described definitions, we have exemplified some of them. Jahn (2012) categorized them as *tradition of logics and epistemology* (see Dewey, Ennis, Schwarze and Lape), *cognitive psychology* (Halpern) and *critical pedagogy/critical theory* (Schugurensky). Again, these approaches share very much the same ground (logic, rationality), but differ in aspects like the purpose of critical thinking, assumptions about its capability (for example its epistemic limits), its effects on the individual, the used terminology, thinking-strategies and concepts and of course methods and guidelines in fostering critical thinking. In a synthesis, Jahn (2012) tried to bring the different styles of thinking, their approaches, concepts and criteria together on fertile plains for pedagogical purposes. It shows, that as a root notion, critical thinking engages in the identification, evaluation and appraisal of assumptions that underlie the ideas, beliefs, actions or values of different viewpoints, using different criteria and concepts (logic and epistemology; multiple perspectives; power relations; constructiveness). Other authors like Brookfield (1987) arrived at a similar categorization much earlier, inspiring Jahn in his work.

Assumptions are at the core of arguments. They can be considered as premises or propositions. However, to assume something means much more than drawing conclusions. Assumptions establish the singular and individual view on the world of a person. Weil defines them as "the beliefs we have – the ideas we have taken for granted – about ourselves, people, and the world around us" (Weil, 2004, p. 63). They are like windows, through which we look at reality. Assumptions shape our perception, our interpretation of reality, the actions we take (or omit), the feelings we have or the beliefs we stand for. Brookfield even goes further: "In many ways people are their assumptions. So much of what one thinks, says and does is based on assumptions of how the world should work, and what counts as appropriate, moral action within it" (Brookfield, 2003, p. 144). Other authors like Petri (2003) or Hamilton (2016) consider assumptions in relation to concepts from neuropsychology and neuroscience: So-called mental schemas (organized chunks of information linked with theory), derived from one's own experience or taken over from other sources, explain how certain aspects of reality are functioning or should function. These schemas also allow the thinker to predict. If the predictions work, the usefulness of the schema is reinforced and thus its validity for the person. Therefore, these dynamic schemas are the tools of constructing worldviews and grounds for actions of a person. In these tacit schemas, assumptions play a vital part as constitutions of worldviews, like axioms in theories.

There are different types of assumptions. Some of them are obvious to identify (explicit), others sometimes very hard to find (implicit; see mental schemas). Just to name some important examples (Browne & Keeley, 1986, p. 65ff.): *Descriptive assumptions* are beliefs or truths about (aspects of) the world, it's conditions and contexts, how things work etc. *Prescriptive or normative assumption* express, how aspects of the world or the world in general should be. *Definatory assumptions* depend on the individual's usage of language. They effect for example how certain issues are recognized and explained.

After this short excursus on assumptions, let's get back to synthesis of critical thinking. Jahn (2012) gives a short overview to four levels of critical thinking styles derived from the three discussed `traditions´ and exemplifies some specific thinking activities in these domains. Concerning and scrutinizing assumptions are essential in this concept. Please note that these

activities are related and depend on each other. For a more detailed description see Jahn (2012; 2015).

Table 7.1:   Four levels of critical thinking (own Figure).

Four Levels of Critical Thinking			
Analysis and evaluation (logic & empirical evidence)	*Perspectives and ambiguity*	*Power relations and negative effects*	*Constructiveness*
Identifying explicit and implicit assumption in ways of thinking. Analyzing these assumptions on a logical and empirical level. Judging the accuracy and validity of given arguments and given pieces of evidence. Evaluating (own) derived conclusions and the hereby used criteria and standards of critical thinking with respect to the boundaries of knowing (e. g. the epistemic limits of logics and/or empirical evidence).	Extension of perspectives: trying to find alternating viewpoints on the issue, permeating them even if they may sound exotic or unsettling: walk in someone else's shoes. Looking out for inconsistencies or contradictions in and between these perspectives and elaborate them. Explicating your own view, your assumptions and standards in thinking.	Scrutinizing the found assumption with respect to power and negative consequences. Recognizing open or concealed power relations and elaborating them. Find out for example, if persons or other living beings are marginalized, objectified, manipulated, oppressed or in other ways bereaved from their liberty or expelled from their scope. Who or what is the oppressor and why? What kind of circumstances, thoughts or practices don't allow a free development?	Looking out for ways to check unchecked assumptions. Establishing ideas and specific plans to tackle the recognized problems Implementing the ideas and plans into everyday conduct (= walk the talk).
← **Interconnection of activities** →			

Critical thinking always draws on an issue that seems relevant, astonishing or even threatening for the thinker, an observation, a given argument, something somebody said, sang, preached or taught, a feeling of bewilderment, a slogan in the media, something seen in a movie or experienced in the streets and in everyday job routines. Critical thinking can refer to all kind of things. The neighbor's chit chat, the doctor's diagnosis, the outcomes of a study, the slogan of a commercial, the conclusions of the latest news report, a posting on Facebook, an instruction from the boss, the university teacher or the new girlfriend. In every case, critical thinking raises doubting and skeptical questions on the validity and the intentions related to the given source. Therefore, the thinker needs detachment from his experience in the form of contemplation. Reflection in solitude helps to cool down, suspend premature judgment, sort feelings out, clear presuppositions or think thoroughly about claims. Analyzing and evaluating

the logic of arguments and (empirical) evidence are the main activities of critical thinking. Are the statements correct? Do these conclusions really derive from the premises? Is there empirical evidence for this assumption and how was it gained? What kind of evidence is it? Does it really support the assumption? Raising these kind of questions leads to taking on different perspectives, exploring different and ambiguous paths to explain an issue, even if they might seem odd or exotic. Critical thinking questions statements of absolute truth: `A person/the brain/a tree/learning/x is nothing more than…´ Truth can be related to different forms, approaches and criteria. In science for example, a subject matter can be explained with diverse and even conflicting theories, notions, terminology or methodology. Yet within a tradition, let's say educational science, this subject matter (for example: what is human learning?) is considered diversely, using different theories and epistemic assumptions. Even facts spring from a context of justification and can be interpreted differently, depending on the person's viewpoint. The glass is half-full or half-empty. See the difference. The same holds true for the subject matter in this text, "critical thinking" itself. Therefore, thinking critically rests upon itself, scrutinizing its own criteria, theory, epistemic assumptions, truth claims or conclusions.

But critical thinking is more than a vehicle of veracity. It is not neutral. It is committed to reduce suffering, deprivation, alienation, exploitation and suppression, strengthening liberty and integrity. Critical thinking is committed to the protection of life and dignified living. For this difficult task, it must question power relations, envision negative consequences of actions and look out for constructive ways in dealing with social wrongs, threats or contexts of delusion. This also means thinking about negative side effects of consumption, capitalism or technology; for the individual, for society or nature. Critical thinking is concerned with respecting and upholding the dignity of living beings. This lifelong task requires the balancing of one's own interests with those of other beings: A famous quotation from Albert Schweitzer expresses both the insight and the dualism of that endeavor: "I am life that wants to live, in the midst of life that wants to live" (Schweitzer, 1963, p. 30). Hence, critical thinking is very much about considering the (possible) consequences of actions, words and thoughts in complex and interdependent contexts.[9] It demands for social interaction, not only to get in touch with the world and enrich one's own knowledge and experience, but also to look out for solutions and strategies to reduce distress, suppression and hardships.

To sum it up, critical thinking according to Jahn (2012) is an analytical, emancipatory, transformative, ecological and constructive thinking style, in which multiple viewpoints and their underlying assumptions on an issue are identified and evaluated in order to judge, decide and take actions more deliberately and independently. This investigative process of gaining insights, expanding perspective and changing conduct unfolds in turns of social interaction (experiencing and encountering reality to examine its diverse qualities) and reflection in solitude – to gain distance and digest experience. In the latter, critical thinking, its underlying assumptions, concepts and its outcomes are questioned. For example: Are the stated assumptions on the concept of assumptions and schemata accurate? Is this constructivist theory of making meaning adequate to describe human thought and behavior? Does my criticism of ideology spring from an ideological viewpoint itself? Do these logical conclusions

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[9]   For example: What kind of exploitative and oppressive systems do I support and how much suffering do I accept, when I buy mass-"manufactured" meat, fish, milk, clothes, technology or soya at the discounter? What kind of external effects and threats do I oppose on my environment, when I ride my big, gasoline-thirsty car, let's say my S.U.V?

really correspond with the evidence of the real world? These kinds of questions could be labelled `critical meta-cognition´. Critical thinking, conceived in this view, is not recommended to those who search for enlightenment or the best arguments and strategies to succeed. It produces many more questions than it can answer. It does not guarantee `better´ (more successful) decision-making or problem solving. It discovers more problems than it can solve. To think critically requires a lot of energy, rigidity, keenness, defiance and resilience with sometimes little reward in terms of utility and success. It can have negative effects on the thinker, his or her relationships, career or emotional security (Brookfield, 2003). Yet it is vital for a more self-determined, ethical and contemplative life.

7.3   How to Foster Critical Thinking. Theoretical and practical Implications

7.3.1   *What works best: the controversial Discussion on Critical Thinking Instruction*

Critical thinking is a western style of thinking, founded on the concept of rationality. It has a long tradition of different educational approaches. In some environments like higher education for example, logical and analytical thinking activities are highly embraced, requested and fostered. "If there is one thing that all college and university teachers want their students to learn, it is to think critically", Buskist and Irons notice (2008, p. 49). Nevertheless, the answers to the question of how to foster critical thinking and which approaches work best is as diverse as the different concepts of critical thinking. Depending on the aspects of critical thinking, its definition, the intended learning-outcomes, the audience and context, different instructional strategies are discussed. The debate on the best instructional strategies is still in progress, although many studies and even some meta-analysis have been conducted (for example see Abrami, Bernard, Borokhovski, Wade, Surkes, Tamim & Zhang, 2008). Furthermore, integrating digital media in instructional designs that aim at fostering CT, have become a new, promising and wide field of research.

To compare endeavors of fostering critical thinking in educational contexts, some authors introduced categories to label these. Ennis (1989) was one of the first, who came up with a concept of differentiation. He introduced a grid for instructional approaches, often referred to by other authors (see e.g. McKown, 1997). The *infusion approach* describes all efforts of inserting critical thinking directly within subject-matter instruction. The concepts of critical thinking thereby are made explicit in relation to subject matter content and become tools for better understanding and deep learning. While using them, students achieve certain subject-matter-related-learning outcomes. The *immersion approach* is quite like infusion, but in this instructional mode the concepts or strategies of critical thinking are not made explicit, so the lecturer won't talk about deduction, inferences or criticism of ideology and so on. But the instructional designs are arranged in a way, that it will provoke certain intended cognitive activities in critical thinking. Students, for example, think deeply about advertisement after analyzing a manipulative TV-spot. Then, in a roleplay they discuss different perspectives on advertisement, its purpose, strategies and effects. The CT-terminology is not used, but students are nudged to think critically by the chosen media, the instructional tasks, and prompts. In the *general approach*, fostering critical thinking is not combined with subject matter instruction. It is separately taught as a subject in an autonomous course or module. All

the theory and concepts of critical thinking are made explicit, using different kind of examples, which don't have to refer to subject content. Often critical thinking is demonstrated and exercised with non-subject-related-content. In the *mixed approach*, the general and either the infusion or the immersion approach is combined in different formats (for example an extra module in critical thinking (general approach) linked with normal class instruction in seminars etc.).

In these different and controversial approaches, several assumptions are made concerning the nature of critical thinking. Proponents of the general approach for example believe, that critical thinking is a generic skill. Context does not matter much. Once the thinking skills are acquired in one domain, the thinker can transfer and apply them in a different domain. In contradiction to that assumption, advocates of the infusion approach belief the opposite: Critical thinking skills are highly dependent on context and content and cannot be transferred lightly. Moreover, apologists of the immersion approach assume that knowing terminology and concepts of critical thinking is not very important for conducting critical thinking. You do not have to know the laws of gravities and force when you learn bicycling. In contrast, promoters of the infusion approach emphasize the conceptualization of critical thinking as a very important requirement for learning deep critical thinking. Understanding concepts and terminology in this view just enables and sharpens critical thinking.

The four approaches are either backed or disputed by popular authors in the field (for an elaboration see McKown, 1997). The debate is led with strong arguments for each approach, but often without broader empirical evidence. Some studies and meta-analysis have pointed out that the general approach leads only to modest results (Van Gelder, 2000; Abrami et al., 2008). This could be an indicator that critical thinking is rather a specific domain related skill and not generic, applicable to all kinds of contexts. On one hand, there is some convincing empirical evidence available, that the infusion approach is an effective instrument to foster critical thinking skills (Swartz, 2003). On the other hand, there are studies that suggest that a strong focus on thinking concepts and strategies could be detrimental for the agility of thinking, resulting in poor thinking achievements (Prawat, 1990). Then, critical thinking becomes a rigid routine. The concepts and strategies could hinder free thought, like an emphasis on grammar can impair free speech in a foreign language, some authors argue. Abrami et al. revealed that the immersion approach also showed only modest positive effects. It turned out to be least effective. But other authors like Warren, Memory and Boldinger (2004) concluded differently in their research: "The immersion approach is a more effective vehicle for developing students' higher-level critical thinking abilities than approaches that stress specific skills or operations without attention to knowledge and attitudes" (Warren, Memory & Boldinger, 2004, p. 209).

For a practitioner, these kinds of comparisons and rankings are unrewarding and bland, because they are too abstract and unspecific. What seems to matter is not so much the chosen approach, but how an instruction is carried out in detail in a certain context. The problem is: What works for one singular group in one unique context and in one irreversible point in time can fail with another, even similar group in a similar context. The underlying definition of critical thinking, the intended learning outcomes, the audience and the teacher as persons, the occurred interactions, the different methods of instruction and assessment used – these and many more terms make every educational enterprise unparalleled, complex and open. So rather than asking what works best, we should ask what works where, when, how, with whom

and why? This perspective is more about the specific design principles in relation with the different constraints and conditions of a context (see Jahn, 2012; 2014).

7.3.2   The Process of Critical Thinking: Food for Thought when developing Instructional Strategies

Jahn (2012) suggests that for every specific context an individual solution should be developed and refined through educational experience. It is very important to have a clear, tangible and context-aware concept of CT in mind, from which concrete intended learning outcomes, instructional approaches or assessment-strategies, can be derived. For this, it is helpful to elaborate the aimed thinking activities as processes of actions. From there, the teacher can develop appropriate instructional strategies. As an inspiration for educational purposes, established models of critical thinking process can be very helpful (e. g. see models of Brookfield, 1987; Wolcott, Lynch & Huber, 1998; Ennis, 1989; Halonen, 2008; Jahn, 2012). A prominent and useful model by Garrison and Anderson (2003) refers to Dewey's concept of reflective thinking. In this model, the focus is on experience and what springs from it: perception, deliberation, conception and action, carried out in two "worlds"; the private world of reflection and the shared world of discourse.

In the practical inquiry model, the process of critical thinking starts with a cognitive or emotional dissonance/disequilibrium of the thinker, a **triggering event** in the `shared world´. Something (an experience) seems odd, ambiguous, inconsistent, perplexing, puzzling, overwhelming or unsettling and demands for further thought. Why is that so? Is that correct? How can this be explained? Why me? Questions like these may come to mind. Thinking becomes more skeptical. Although many models imply negative experience as inducement for critical thinking, Brookfield (1987) states that positive, affirming triggers like fascination or being amazed also can commence the thought process. The philosopher Karl Jaspers points out three origins as occasions for critical thinking: Wonder, doubt and experiencing boundary situations (Jaspers, 1992, p. 16ff.): Wonder leaves the individual amazed and astonished. Something seems so peculiar, fascinating and incredible at first sight that it demands for further attention. Through wondering, the individual becomes aware of his or her lack of knowledge to explain – a lack, he or she wants to overcome. Hence, wonder can be a positive trigger, speaking in psychological terms. When claims are challenged and the opposite is claimed, doubt, despite wonder, prompts the individual to question his dearly held assumptions and beliefs. Once trusted knowledge seems to disintegrate and decay. Certainties suddenly turn out to be uncertain. Only raising skeptical questions may bring back new grounds of trustful knowledge. The most powerful impact on the individual and his or her thinking, however, arises from situations, that challenge existence. Jasper calls them "boundary situations". The loss of a love, a letter of dismissal, a tragic accident, the diagnosis of a serious disease. In situations like these we can't control, suddenly we witness our own weakness, vulnerability, fallibility, finiteness or dependency on others. The unsettling experience is breaking up our thinking. Essential questions about the world and life, often avoided in daily routines, are now addressed seriously and with a new quality.
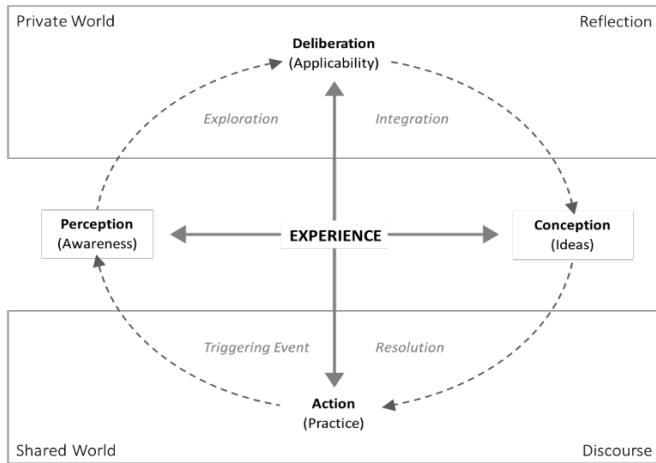
Figure 7.1:   Practical inquiry model (Garrison & Anderson, 2003, p. 59).

In the **exploration phase**, an evaluation of the situation follows the trigger. Understanding the nature of the problem, searching for relevant information and meaning, looking for different viewpoints or finding possible explanations are characteristic for this phase (Brookfield, 1987; Garrison & Anderson, 2003; Jahn, 2012). This phase is marked by a several shifts from reflection to social interaction and vice versa. Brainstorming, talking to and negotiating with certain people, reading certain books or articles, watching certain videos, writing down different arguments, making notes, checking and testing sources. Activities like these define exploration.

The **integration phase** is characterized by delivering judgments, developing solutions or makings decisions. Brookfield describes it as follows: "Having decided on the worth, accuracy, and validity of new ways of thinking or living, we begin to find ways to integrate these into the fabric of our lives" (Brookfield, 1987, p. 27). This phase is all about constructing an own and sound perspective and derive plans to deal with the gained insights. This could also include developing reasonable solutions to address recognized problems.

The **fourth phase** describes "*the resolution of the dilemma or problem*" (Garrison & Anderson, 2003, p. 60). Now the new and discussed ways of thinking or acting and the plans for solving a problem are carried out and tested. Actions speaks louder than worlds. Reality is responding. Assumptions now can be confirmed, new ways of thinking or acting can turn out to be successful or at least acceptable. Often, however, new ways of thinking and acting are challenged by the environment (because the individual shows divergent behavior). Then, new triggers for critical thinking might take place. During the process, the individual moves from awareness of experience to the development of ideas, from reflection to action, from the inner realms of deliberation to the shared world of discourse. New experiences start off a new cycle of critical thinking.

Models like these are often criticized (in detail see Jahn, 2012): too simple, too abstract and artificial, too idealistic, too linear or static, not sufficiently grounded in context and experience, too much dedicated to problem-solving. Many of the underlying assumptions that

guided the development of the models can be criticized. But aside from these objections, process models can give pragmatic insights for educational purposes. A model with different phases and delineated actions can be helpful to find the specific educational strategies that "fit". Models prompt specific questions on the nature of critical thinking, how to foster conditions and activities that are important in every step or phase. For a pedagogical professional, it is important to use an own model for their field and context, from which concrete instructional strategies can be legitimated, explained and developed. Many authors from different educational domains have contributed with their own models and concrete educational guidelines. These models and guidelines are fruitful to develop own approaches on fostering CT, because they address a certain professional practice. They give hints, how it could be done, for whom, when, where and why. After all, critical thinking remains an abstract concept every educator must bring to life in his or her context for himself or herself.

7.3.3   Critical Thinking Instruction: Preliminaries, Requirements and Guidelines

In the following we will discuss important guidelines for CT-instruction in accordance with the presented model. A comprehensive synthesis can be found in Jahn (2012). In books, articles or videos many experts talk about appropriate triggers or the most effective methods. Though before even a single method is applied, critical thinking first needs the right climate and setting to unfold (Garrison & Archer, 2003; Brookfield, 1987). In the practical inquiry model, the critical thinker operates under ideal conditions (e. g. the skills and the attitude of the thinker, certain circumstances in the shared and private world). In daily routines of everyday life however, the given conditions often are detrimental for critical thought. For example, as mentioned before, somebody being critical often is perceived as a wet blanket and avoided by others.

Remember one of the discussed CT-definitions: Schwarze and Lape wrote that "*Critical Thinking is open rational dialogue among friends*" (Schwarze & Lape, 2012, p. 3f.). In this definition, essential characteristics and preliminaries for fostering critical thinking can be found. First, it has to be `open´ rational dialogue, which means that not only students should be open to new experiences or worldviews, but also the teacher. He or she is not a sage without fail, even if recognized as a brilliant expert in a specific domain. The teacher needs a modest attitude like that one of caring older brother or sister: Of course, some years of experience and learning in advance, but still fallible, still searching for accurate answers to questions, still in awe of the great unknown and mysteries of life. Students can learn a lot from teachers, but in `open´ dialogues teachers also become students of their students, for example when they present innovative and challenging perspectives or conclusions on an issue. `Open´ means that the outcome of the dialogue is not defined by the teacher, but by arguments. To be `open´ also requires the consideration of exotic, strange, outdated or even stirring viewpoints. It also means to struggle for the right words, explanations and actions, to misdo in this struggle or to explore deviant positions, which might bring the speaker in trouble (e.g. by challenging the arguments of other students or the teacher). `Open rational dialogue´ needs challenging viewpoints, making errors and learning from them. `Among friends´[10], to

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[10]   Friends can be a driving force for critical thinking. However, sometimes they share a similar worldview and style of thinking or they do not want to burden friendship with bald and contradicting facts. Then, open

say what somebody truly believes is not a problem, even if a position may sound quirky, irritating, offensive or is badly expressed. It does not matter: Friends are most of the time tolerant and appreciative. In front of friends to make a fool of oneself can even be funny. Friends deal with that. Fellow students and teachers might not. In the worst case, they impose sanctions on `the fool´. Students fear these possible bad outcomes. Carrier-wise, it is better to be focused on good marks, graduation and `useful´ social networks. That means: Be a good boy or a good girl. Do not make or say something wrong or stupid.

It is up to the teachers, to create an atmosphere where students do not have to fear the consequences of bad marks and spoiled reputations when they say something odd or false. Critical thinking needs a climate where arguments are not taken (that) personally and everybody is invited to make mistakes. How can this be achieved?[11] First of all, teachers do not have to become `friends´ with students, but they should explain to them, what kind of mode is needed for `open rational dialogue´. Teachers can tell them to refrain from strategical behavior and ease their worries. They can assure, that students don't have to fear negative consequences. Invite them to make mistakes or take on challenging perspectives. Develop and establish a policy for open rational dialogue together with the students. Show them that you are fallible too. Encounter your students at eye level, as a caring older brother or sister. Try to give them self-esteem through compliments, humor and appreciation. These are not only principles to build a setting atone to critical thinking in class but also online, when students meet virtually, for example in learning management platforms. Questions should be taken seriously and answered within two working days. Netiquettes and an instructed moderator help to manage discussions in message boards or chats.

Having installed the right climate for `open rational dialogue´, now the afford lies on enabling the requested experience to `trigger´ critical thinking (phase 1). But the thought provoking experiences in the intertwined worlds of reflection and discourse are sometimes not given at hand, especially in educational contexts. Fully elaborated but dull PowerPoint-Presentations recited by soliloquizing experts in grey rooms often spoil the students thinking activities. *Why thinking an issue thoroughly through myself, why thinking about my thinking when an expert tells me all the answers and facts he or she is going to test later in the exam?* This kind of experience may not lead to own cycles of critical thinking. Creating situations that enable wonder, doubt or experiencing boundaries is a difficult task. It all depends on the students' worldviews, their knowledge, attitude and their experiences so far. First, the new experience they are going to face must be in some way relevant for them. Students should recognize their part in the matter and the significance of that experience or issue for them. Furthermore, it must be brought to them in a style which they can build upon. Second, it has to be challenging for them, an invitation to withdraw from the comfort zone of knowing and thinking. This can be achieved for example by an ambiguous and complex problem or dilemma that the students must address. It can be material that leads thinking or feeling (or both) into contradictions, wonder or doubt. It can be a `mediated´ experience (as if), where students are confronted or challenged with perplexing sources, statements or observations, but without

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rational dialogue is stuck. Sometimes it needs an outsider, a fool or even an adversary to challenge professional blinkers.

[11] With different strategies and activities, teachers can work on a climate for "open dialogue among friends", but they cannot guarantee it. The same hold true for the process of critical thinking. Teachers can invite to think critically, they can show how it's done, they can provide plenty of opportunities for exercise, but in the end, it is the individual who decides how to think.

having real experience beyond the classroom. Mediated fragments and even fictional fragments of the outer world are brought into the classroom for consideration. Outer realities are simulated which involve taking on different roles and perspectives. Nevertheless, challenging realities beyond the classroom can also be directly brought into educational settings, for example by using authentic sources, witnesses, cases, places, experiments and so on. Although there are so many ways to `trigger´ critical thinking, it is very difficult to find the right, balanced triggers, because students differ rigorously in interpreting an experience. The Jamaican proverb `What is joke to you, is death to me´ articulates the individual perception of experience.

Having found adequate situations and questions that lead to experiences triggering critical thinking, the students then need plenty as well as rich opportunities to explore the experience and its underlying issues from different viewpoints (phase 2, exploration) and develop solutions, judgments, explanations etc. (phase 3, integration). This demands rich and open learning environments and forums that provide the students with different viewpoints and information, leaving space and time for reflection and further dialogue. Different formats of interaction and discussions for example can help to identify different viewpoints, collect and broaden ideas, refute assumptions and so on (Brookfield & Preskill, 2005). Socratic questioning, problematical and dialectical discussions, buzz groups, role plays, debate clubs, devil's advocate strategy, questioning the author – there are so many opportunities to shape critical discussions, although it can be a rather difficult task to bring the critical spirit into discussions. Writing as the hard copy of thinking, on the contrary, can be very useful to sound out and reflect experience, identify and evaluate assumptions, develop an own and balanced view or look for plans of action. There are plenty of methods and strategies available to foster critical thought in written exercises (for detail see Meyers, 1986; Swartz, 2003). To process critical thought and refine points of view, phases of reflection and social interaction must be geared to each other. Various methods and instructional designs like think-pair-share (Petri, 2003) can be useful for this purpose. However, the teacher is not only stipulated as a mere designer of learning environments or media, formats and methods or setting-policies. His or her job as facilitator is also to make activities of critical thinking visible. This means to model critical thinking in multiple ways, for example to introduce helpful concepts and strategies, show good and rather poor arguments or demonstrate flaws in thinking. Furthermore, the teacher must continually evaluate the group process in the "shared world of dialogue" and individual thinking activities in the realm of reflection to come up with the adequate feedback on individual or group-level. Sometimes dialogues falter or turn out to be superficial, because the participants share the same views or lack important knowledge. Then, it is the teacher's role to bring in challenging perspectives and contra-inductions. Sometimes students have problems with understanding and/or applying new thinking concepts or strategies. Then, the teacher must give feedback, model and help to exercise thinking in that style. Other times students may struggle to overcome old views and jettison them, even if their positions were clearly refuted. Depending on the experience, sometimes individuals are rattled, because their worldview is turned upside down and they have not yet found the right approach to deal with the new perspective. Then, the teacher should provide for solid ground and help the student to find ways to cope with that hesitancy by showing empathy, affirmation and coaching. Like seismographs, teachers must record what is going on, prevent from too strong

eruption or instill convulsions if needed. In addition, teachers should cater for a good laugh. Critical thinking is demanding and sometimes burdensome, but a certain sense of lightness and humor can help to overcome severity.

The phases of exploration and integration end when a certain degree of saturation and elaboration of clear ideas, perspectives, approaches or solutions is achieved. When entering the phase of resolution, the students get the opportunity to test their insights and new ways of thinking. In traditional educational contexts, let's say in big classrooms and slots of 90 minutes, it can be difficult to directly test or apply solutions or to defend a concept or position. Formal educational contexts often cannot compare with those experiences `real life´ has to offer. This is one of the main reasons why the phase of resolution is often neglected and hardly accomplished in formal educational settings (Garrison & Anderson, 2003, p. 62). Nevertheless, even in restrictive environments teachers can find ways to create experiences that allow authentic `trial and error´ and feedback from the real world. If thinking and acting cannot be applied or tested under `real´ conditions, vicarious actions can be helpful: Roleplays, thinking experiments, simulations or games provide good opportunities for engaging assessment and response (Jahn, 2012). For example: Working with case studies, teachers can show how `real´ persons in `real´ settings thought and acted and how it turned out in comparison. But not all testing and applying is restricted to simulation and quasi-experiences. Response to new ways of thinking can also be gained from actions in the "real world", for example when students leave the classroom and conduct research in the field (Kergel & Heidkamp, 2015), work in projects (Kaliva, 2016) or render a service for society (Jahn, Mayrberger, Meyer & Stitz, 2012). Sophisticated forms like research-based-learning, problem-based learning or service learning demand for special educational settings and designs, which differ from `traditional´-lectures drastically. However, with these rather challenging formats, full and intense cycles of critical thinking can be initiated and traversed. In these settings, students can undergo meaningful and sustainable experiences that have the power to broaden their perspective, break up misconceptions and even change their worldview (Hamilton, 2016). These approaches itself don't guarantee sure-fire success in fostering critical thinking. A lot depends on how the experience is designed, structured, moderated and accompanied by the teacher. Action and experience from the shared world must be followed by reflection and discourse to make it meaningful and broaden it, for example. New cycles of critical thinking must be initiated and guided. The teacher as a designer of experience and facilitator of thinking always has to think critically about the process on an individual and group level. In which phase is the group/the individual now? How can I make their thinking visible? Is the experience conducive for critical thinking? What must be done to deepen reflection or dialogue? What are the assumptions of the students? How can I help them to think differently and challenge their assumptions? Questions like these must be addressed continually during all phases of the process and teachers must come up with adequate strategies and actions. Depending on the chosen format, the context, the intended learning outcomes, the group of students, the teachers as a person and the current process, answers can vary considerably. Whatever a good answer may be, it should be built on rich evidence gained from the hints and traces where students thinking becomes tangible: For example, discussions, written reflections, observations or products of the course can reveal where the students are at. The assessment of the critical thinking process is crucial for creating effective learning arrangements.

7.4   Critical Thinking and Digital Media in Higher Education

7.4.1   Thinking Critically about Media

Why should we think critically about media? Digitalization seems to make our lives so comfortable. We won't get lost anymore thanks to Google Maps, we are able to find nearly every unthinkable piece of information online in databases or communicate anywhere anytime with others thanks to WhatsApp, Skype and Facebook. Digital media expands our ability to perceive, think, make decisions or shape our world to an extent that would be impossible without media. "The medium is the massage" – so Marshall McLuhan (2005).[12] He was one of the first scientists who asked the question about the impact of mass media on society and criticized its lulling effect. Media comforts and touches us, it enlarges our world, our abilities and forms us. McLuhan defines media as an extension of the human body. In his theory search engines are for instance an extension of peoples' brains. The consequence is the amenity of having a library, a map or a virtual diary in our pockets. On the other hand, inertia, sluggishness and superficial knowledge might be an effect. (Digital) Media seems to numb or weaken certain human capacities and skills. In a way, we become dependent on the comforts and services digital technology is providing.

Besides McLuhan, pedagogues, teachers or parents have often been skeptical when it came to media usage. Since mass media was established in the 18-19th century, first books, then movies and later TV, video games or the internet have been criticized. Especially in the early 20th century, critics believed that people needed to be guarded and kept away from written adventures or fantastic worlds in texts or on screens (Süss, Lampert & Wijnen, 2013). Even today, parents and teachers are worried about the consequences of being faced with violence, pornography or radicalism in (digital) media. Authors like Ball describe young people as "slaves of uninterrupted availability" (Ball, 2014, p. 66) – he and Markowetz (2015), for instance, criticize the dependency on mobile devices and the need for checking messages or being available. Furthermore, Manfred Spitzer, a much-noticed German neuroscientist, published books with titles like "Digital dementia" (2012) or "Cybersickness" (2015), focusing on the noxious effects – for example bluntness or the lack of concentration – that digital media can cause.

We don't want to deny these effects. Nevertheless, we want to reconsider that a total refuse of digital media is not an option in our opinion. In Germany, the media affinity and media usage of university students is high (Zawacki-Richter, Hohlfeld & Müskens, 2014). Not only private communication and fun activities but also schools, universities, employers or authorities request (more or less) experienced computer skills. Students need to do research for their assignment by checking online databases, written tests become e-exams in a learning management system, more and more job offers ask for programming skills and applications or forms that have to be filled out online. Adolescents organize themselves with apps, communicate via social media with friends and family all over the world and thanks to mobile internet and smartphones they are continuously online. Teachers must deal with learners that want and have to use digital media. Moreover, the NMC Horizon Report estimates that

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[12]   The book title `The media is the massage´ was actually a mistake of the typesetter, who had confused `e´ and `a´ at a new edition of `The media is the message´. When he saw the pressure flags, he was thrilled. The new title pointed out exactly what McLuhan wanted to say (Leusch, 2011).

students do not possess high competences of digital literacy. In fact, they list digital literacy as a "significant challenge" in higher education which still has to be solved (Johnson, Adams, Cummins, Estrada, Freeman & Hall, 2016, p. 24f.). Therefore, the question is how we get students to think critically *about* media and how to *use* digital media to accompany the processes of critical thinking. Both aspects – to analyze and criticize media and its handling (for example knowing how to write a blog post) – are basically central aspects of media literacy (Baacke, 1997) and shall be discussed.

Digital literacy in general and critical thinking about media specifically are significant for almost every discipline in higher education – even if they're not embedded in many curriculums (Rott, 2014). As social media or web applications are part of the students' lifeworld, it is easy to get young people interested in the subject. However, not only the NMC Horizon Report 2016 but also our experience shows that students primarily use digital media and communication tools like Facebook, Instagram and Snapchat, web tools like Dropbox or Google, shop online or watch a movie via Netflix. However, "digital literacy is not a checklist of specific technical skills, but rather the development of critical thinking and reflection in carious social and cultural contexts" (Johnson et al., 2016, p. 24). What's Facebook doing with our data and with us, how come an iPhone is so expensive but workers in China are demonstrating for better working conditions and pay rises, what will happen, if – as the industry 4.0 propagates – all our domestic appliances get internet connections? Students, of course may have heard or thought about several of these questions before. Nevertheless, in our classes generally the minority of the participants reflected profoundly about questions like these. If improving digital literacy is a challenge higher education wants to accept, teachers must trigger issues on how the virtual world influenced our digital routine.

As already mentioned, connecting factors to critical thinking about digital media could be part of almost every study program: Cyber mobbing might be an interesting topic not just for law but also for pedagogy students. Soon-to-be psychologists or sociologists might like to discuss how online dating platforms like OkCupid and Tinder change the dating process and the expectations people have in future-partners today. Viral marketing and product placement via Instagram are interesting topics in economy or linguistics classes. Artificial intelligence and its ethical aspects – for example when robots are used in health care – should be discussed not only by computer science or medical students but also in philosophy classes. These examples demonstrate that critical thinking about digital media is often a cross-cutting issue.

7.4.3   *How to Foster Critical Thinking using Digital Media*

Digital media cannot only be the subject of a course, which intends to foster critical thinking. Digital media or learning management platforms itself can support the CT process – apart from the field of study. Since the 1990s the key technologies for digital learning environments have enhanced, from multimedia and computed based trainings to web based trainings and virtual classrooms. Since 2000 to 2005, web 2.0 tools and collaborative learning became central. Nowadays mobile learning on smartphones or tablets and MOOCs are common and discussed in university teaching (Röthler & Schön, 2017). How can digital media explicitly support the process of critical thinking and why should teachers consider implementing it in their classes? Authors and university teachers like Jahn (2012), Saadé, Morin and Thomas (2012), Brandon (2013) or Gharib, Zolfaghari, Mojtahedzadeh, Mohammadi and Gharib (2016) have implemented digital media successfully in different environments and disciplines like

economic education, computing courses or medical sciences. Saadé et al. (2012) resume, for example, that for "today's students, an interactive environment is very important for their learning. It seems that today's websites such as those of social media that are highly interconnected and interactive are the primary educational behavior agents to our university students" (ibid., 2012, p. 9). Gharib et al. accentuate that "critical thinking skills of virtual learners will depend upon their ability to work independently and deal with educational materials with minimal intervention of the instructor" (ibid., 2012, p. 277). Effective digital tools that support the CT process are according to Jahn (2012, pp. 178ff.)

- Logic software that helps learners to develop arguments based on logical criteria.
- Videos that evoke critical thinking.
- Web-based-trainings and simulations to expand critical thinking e.g. in an online story-setting.
- Discussion boards where students can debate asynchronously online.
- Virtual classroom where learners "meet" live online and communicate directly via (video) chat.
- Weblogs and e-portfolios where students write a (private) research/reflection diary, collect and share interesting links or websites.
- Web-quests where learners find independently online information to a "real" issue or topic.

Jahn (2012) summarizes recent research results on these web tools. They can be helpful to improve different aspects of critical thinking, for example to sharpen thoughts through writing and documenting ideas in a blog. Nevertheless, a teacher as an instructor and role model is required when critical thinking is directed (Jahn, 2012, p. 191). Tools follow the didactical design and so, when it comes up to conceive an educational concept, teachers have to analyze carefully based on their framework conditions which technologies can further be used to achieve their learning outcomes.
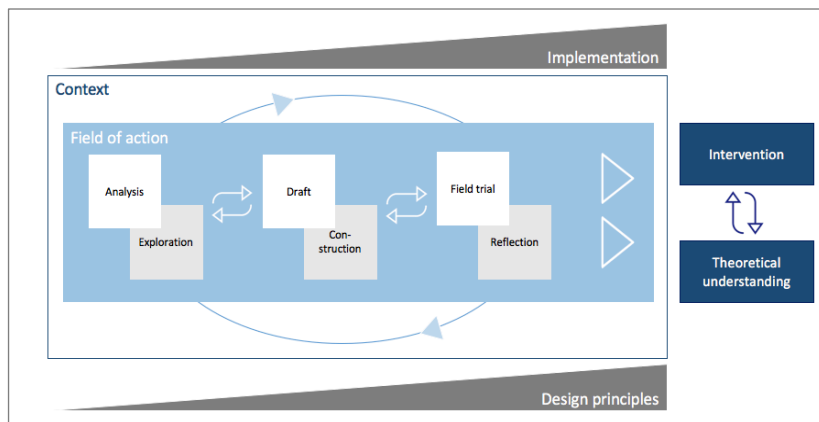

Figure 7.2: DBR cycle (own graphic referring to McKenney & Reeves, 2012; Reinmann, 2014).

Creating a new concept or a curriculum for university classes has much in common with research. Not research in the sense of foundational research, where outcomes should submit evidence-based, universal statements. We understand research in a pedagogical context as solving a didactical problem in a specific context. This may be, for instance, how to get students of computer science thinking more critically about the risks of digitalization (personal problems like hacking, social problems like the change of the labor market e.g.). Design-based research (DBR) "is a methodology designed by and for educators that seeks to increase the impact, transfer, and translation of education research into improved practice. In addition, it stresses the need for theory building and the development of design principles that guide, inform, and improve both practice and research in educational contexts" (Anderson & Shattuck, 2012, p. 16). Central aspects of DBR are doing research in real education contexts, the focus on the creating and designing process of an intervention and its testing in the field. After several iterations and reworks, the design principles (how to foster critical thinking) for a specific educational context become clearer, the quality of the intervention is optimized and the theoretical understanding has formed (for example: What's the meaning of critical thinking in my field work? How should it be fostered?). DBR interventions use in general, multiple methodologies and do not go strictly by quantitative or qualitative methods (Collins, Joseph & Bielaczyc, 2004; Reeves, 2006; Plomp, 2010; Anderson & Shattuck, 2012; Jahn, 2014). Figure 7.2 demonstrates a typical DBR cycle:

Creating a teaching concept/intervention (not only but especially for critical thinking) has much in common with research: How can I ensure my students reach the learning outcomes? Which methods and topics are useful for discussions? Will my concept also work in another context, for example with students of another faculty or in an interdisciplinary course? The DBR cycle may help in the implementing, testing and improving of a curriculum. In the following, we will quickly demonstrate the most important steps:

I.   Analysis and exploration: Different contexts require a different understanding of critical thinking and it's the teacher's task to work these out. Teachers and students work and learn in a specific context, have individual preconditions and qualifications. Philosophy students may have taken a class about ethics and therefore be familiar with critical thinking. For architecture students, CT might be a new field. Talking to students and colleagues or reading good practice articles or research papers from teachers, can help in finding answers and getting a vague idea about how your CT understanding might be. After this overview analysis, it is time to get more specific and analyze the framework conditions: Who will attend my class (for example masters students in economy), what are my intended learning outcomes, topics, which media and methods can/will I use? How can I trigger the critical thinking process and how far will the class come into the thinking process? It is important to downsize the intended learning outcomes and to have in mind that students usually are novices in the field of critical thinking. If learning outcomes address explicitly critical thinking (for example the differentiation of sufficient and essential conditions in the section of logic), we recommend to communicate these to the students. Teachers need to have in mind that every single framework condition influences the field of action. Not everything can be changed or affected by the teacher (for example the classroom, media equipment).

II.   Draft and construction: Garrison and Andersons' inquiry model (2003, p. 59) helps

to develop an educational design for the critical thinking class, having in mind the specific learning context. The course should start with a warm up to create an open learning atmosphere. After that, a trigger event initiates the critical learning process, the wondering and asking. The following exploration phase conduces the understanding and supports the finding of different explanations, viewpoints or research data. Students get in a circle of reflection, which is characterized by the enrichment of information, reflect by themselves and exchange arguments with the group. Solution approaches and opinion formations are the focus of the integration phase. Students build their own argumentation or find a solution for a certain problem. The resolution phase is for testing out new ideas and to implement the made-up strategies. In table 7.2 we will be more specific not only about helpful educational guidelines but also for the role, digital media may take in the process. To give the students individual feedback on their thinking skills, it is important to develop adequate assessment-tools and fitting exercises. Rubrics, for example, are either a good instrument to demonstrate the critical thinking criteria and performance levels and a good tool to evaluate the critical thinking performance of the individual student (or the group), let's say in online-discussions. If the teacher has a clear concept of critical thinking in mind, it is not difficult to derive descriptive criteria and operationalize concrete performance-levels for assessment tools.[13]

III.   Field trial and reflection: After completing the draft, it is time for the teacher to test the intervention in the field and to ask him-/herself: How was the atmosphere in the group? Did the trigger event initiate critical thinking? Were the questions interesting and relevant for the students? Could the individuals build up a personal opinion? Was the material useful or too complex? Were discussions or group work constructive and what conclusion did the students come to at the end of the course: What have they learned about the method of critical thinking, the discussed topic? Did they advance in their thinking skills? The assessment of students' products of thinking (for example artefacts like written reflections, presented solutions etc.) give some first hints, if the instruction-design was appropriate. Furthermore, Garrison and Anderson (2003, p. 61) list some descriptors and indicators for teachers to observe, if and how the practical inquiry circle is at work respectively if students engage in critical thinking: For example, in the trigger phase students show puzzlement and try to recognize the problem. The exploration seems to function when students exchange relevant information, divert in viewpoints, suggest, brainstorm or show intuitive leaps. When integrating, the students converge, synthesize their viewpoints and come up with solutions. In resolution, they test, defend or apply the solutions, approaches and so on. These demonstrated actions (face to face or online interaction) can help to find out, if the course design works in general. To appraise the course design, it is helpful to implement a formative evaluation and reflect the presented questions in the middle of the semester, when conceptual changes can still be made. It might

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[13]   A rubric to assess critical thinking in written exercises (according to the authors definition) can be found in Wilbers (2014, p. 77f.).

be helpful to arrange a teaching analysis poll by students (Baldioli & Jahn, 2014) to get a structured and honest feedback from the course participants. The summative course evaluation at the end of the semester should focus on the didactical design's quality and the students' learning success. The teacher must reflect on the material, the trigger, the concept and the execution. Interviews or a feedback round at the end of the seminar will give the teacher furthermore an echo if the learning outcomes were achieved and if students could improve their critical thinking techniques. In addition, questionnaires are helpful to get an (anonymous) overall assessment of the class. Usually by this analysis and the teacher's reflection/conclusion, a new intervention can be designed. So, the DBR cycle starts over – and the concept gets revised in the next semester.

Finally, we want to give some ideas how to design and implement a critical thinking course with digital media (Table 7.2).

7.5   Conclusion

Critical thinking in higher education is not only a postulated task in the Bologna Accord (Kruse, 2010). It is an essential competence for adolescents and soon-to-be academics who live in a more and more complex world where it is not easy to make reasonable decisions easily. University teachers can encourage students to question established arguments, to literally view the world from another perspective and to have the ability to entitle an own option. Critical thinking is not just a subject in philosophy classes but in every study-program. In this essay, we tried to clarify its importance in general and to work out the possible role of digital media in this process: as a topic, students should critically think about and in the way that digital tools can support critical thinking.

Both, in the end, require teachers with not only high skills of digital literacy but also knowledge how to design, implement and evaluate a CT concept. These competences cannot be implied – especially as university teachers in Germany (who define themselves primarily as researchers) do not get a didactical instruction when they start their job. Nevertheless, centers for university didactics that nowadays are more or less established in most of the (German) universities help to bridge a gap and train teachers how to plan and design lectures. Workshops to enhance media competences, how to implement for example e-learning in higher education, are findable. Workshops how to implement critical learning in higher education, on the other hand, are scarce goods. But university teachers need a space, where they can think about, work on and share their approach on fostering critical thinking.

In 2017, the Center for Higher Education at the University of Erlangen-Nuremberg offered a seminar on this topic and the demand was very high – not only from people who teach in social sciences but also in technical, economic or medical sciences. We want to encourage other centers for higher education to implement critical thinking workshops in their program to bring the topic to teachers' attention. In this way, CT gains not only attention, but also research projects on a broad data basis can be realized and advanced.

Stage of Process	Description	Educational Guidelines	Possible usage of digital media	Example
Pre-stage: Atmosphere	Creating an open, relaxed and friendly atmosphere	Before the initiation of the CT process, it is important to start with an icebreaker session. It is important to set an open, discussion-friendly atmosphere in class. Teachers should also describe the needed interactions and the ends of the sessions (learning goals related with critical thinking).	A forum, message board e.g. that allows students to upload some personal facts or artefacts, maybe a photo or a motivational text about why they are interested in CT.	An introduction of participants in the learning management system (LMS) gives students an oversight of the group and the possibility of pre-knowing each other, for example in a forum. A netiquette and "communication guidelines" give advice how to argue or give feedback online and keep the communication flowing in a structured way (for example by quoting statements someone refers to).
Triggering event	Positive or negative trigger that initiates the critical thinking process.	The trigger event causes wonder, misunderstanding, doubts or a liminal experience and has to be chosen carefully from the teacher. It is important that students can build a bridge from the trigger to their own lifeworld. The trigger must be interesting, actual and relevant for the target group. It's challenging to discuss the topic and it is worth to think it critically through. There is no "easy" solution; in the end, there are lots of questions which have to be cleared.	Demonstration of a film, photo, picture, online-article, website, podcast e.g.	Demonstrating a provoking film about factory farming and, on the other hand, photos on Instagram with hashtag #beeflovers.
Exploration	Students find, collect and structure information, research data, statements from different stakeholders e.g. to the topic.	It is important that students find a great variety of different perspectives of interesting, catching sources. Teachers should give learners the space to find, reflect and discuss different theses in the group. Phases of single work are as important to think statements and information through as group work and discussions, where different opinions might be exchanged. Instructors can help the students to invent a position by making their own process of thinking transparent. Loud thinking and arguing, the visualization of thinking patterns and making explicit the steps of argumentation are good practice. The exploration phase usually takes some time. The teacher's task is to make the students thinking observable; how their thinking changes, how their CT process develops. This can be done by the learners, for example, by written reflection reports, loud thinking and in discussions. Teachers can evaluate on this basis the students' CT status.	Finding information: Online-research in scientific databases but also e-newspapers, social media channels, YouTube e.g. Collecting information: Mind maps, link lists and notes in LMS, learning portfolios, wikis e.g. Reflection and discussion: Blogs, discussion forum	Students can find (research) data and information about factory farming online, the current situation of farmers, animal welfare and consumers. On YouTube, they watch another documentation about the subject, also they find some Facebook pages pro/contra vegetarianism. The class collects interesting links in a list they made up in a LMS and every student create one own mind map. In a blog, they document their thoughts about factory farming weekly – and have the possibility to comment on each other's posts.
Integration	Students scrutinize and synthesize on basis of data,	Dealing with contraire arguments from different stakeholders is not easy to withstand for adolescents. Neither is taking position to an elusive issue. Teachers must help students to develop their own points of view and integrate them into thinking and acting in a rational way.	E-Portfolios, blogs e.g.	Writing makes thoughts visible and lines argumentation become clearer. Reflecting the "final" opinion about factory farming or vegetarianism is easier when students

Stage of Process	Description	Educational Guidelines	Possible usage of digital media	Example
	information and different perspectives an opinion about the subject.	Learners should have the opportunity to find and reflect ideas for improving practice. We also recommend to not let the humor in the critical thinking come too short: If the playful in the critical thinking process gets lost, it can lead to stress and bitterness.		can re-read their thoughts on an issue. Peer reviews of blog entries or e-portfolios or the feedback of the teacher help to refine argumentation lines.
Resolution	Students test out new ideas and implement made up strategies.	It is time to implement made up strategies in class beyond university: Which consequences will result from the students' résumé? Conducted situations help learners to apply and reflect their findings through concrete actions both in practice and in the class community teachers should tell students about possible risks that can lead to critical thinking and subsequent action. For example, they can report from own experiences and show how they deal with the issue. Examples from practice also help to show students how to act on the basis of insights.	Creating a podcast, writing a blog, starting a Facebook page, discuss in an online forum e.g.	Maybe after the course students view factory farming in a more critical way, buy meat with organic certification or get informed in vegetarianism. The internet is a great place to stay informed but also to get others informed about the issue. Students can start a podcast about factory farming, join an online forum to participate in more discussions or write a blog and share vegetarian recipes.

Table 7.2:   Implementing a critical thinking course with digital media (own Figure).

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