Critical Thinking in Teacher Education Matters to Face Ecological Crises

Susanne Rafolt & Suzanne Kapelari

Abstract

Young people obtain information primarily from social media. In the context of ecological crises, however, public discourse on social media is highly emotional and polarised, and misinformation is often difficult to identify. CT is essential to deal with this type of discourse and misinformation. It is therefore particularly important for (prospective) teachers to understand critical thinking as part of their training, so that they can promote critical thinking in their students. This article introduces the Synergy Model of Critical Thinking as an offer for higher education and school teachers alike to explain critical thinking as well as to reflect on their own and others perceptions of critical thinking. The Model shows that critical thinking results when knowledge, skills, dispositions and norms, values and emotions interplay when dealing with a subject or an object to take a position and this process is controlled by intellectual standards and self-regulation.

Introduction

In many countries, critical thinking (CT) is considered a core aspect of democracy and an education ideal (ten Dam/Volman 2004; Facione 1990; Jiménez-Aleixandre/Puig 2022; Polizzi, 2020). Dealing with urgent social development issues in the areas of health, nature, and ecology requires CT, a basic scientific education, and an understanding of the nature of science (Ernst/Monroe 2004; Hofreiter et al. 2007; Mogensen 1997; Puig et al. 2021; Yacoubian 2015). Moreover, promoting CT is fundamental to counteract the spread of fake news and conspiracy theories in the context of socially highly relevant issues, such as ecological crises, and to ensure evidence-based decision-making (Feuerstein 1999; Jahn/Kenner 2018; Jiménez-Aleixandre/Puig 2012; LeCompte et al. 2017; Machete/Turpin 2020; Puig et al. 2021). It is therefore a declared educational goal of

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formal educational institutions, such as schools and universities, that learners actively experience CT in order to be able to apply it autonomously in different contexts (Jahn/Kenner 2018; Puig et al. 2019; Rafolt et al. 2019). It is particularly important to integrate CT in teacher education, since teachers are encouraged to promote CT in students by acting as role models, supporting their students in CT practice and giving feedback on their CT development (Ab Kadir 2017; Facione 1990; Lorencová et al. 2019). For this, teachers need a clear idea of CT. However, CT is difficult to grasp and existing explanations are either too brief or too expansive to help lay people, such as teachers and students, to develop a holistic understanding of CT (Hatcher 2000; Larsson 2017; Schmaltz et al. 2017). This paper presents a theory-based Synergy Model of Critical Thinking (SMCT) to explain CT. Moreover, the SMCT can be used as a framework to reflect and discuss information, attitudes and ideas within a given context as well as individual perspectives on CT. This paper discusses how the SMCT can support teachers and learners in dealing with CT as a basis for classifying information in the context of ecological crises.

The Synergy Model of Critical Thinking (SMCT)

The discourse about what CT means and what characterises critical thinkers has been going on for centuries. The scientific discourse of the last 30 to 40 years, especially in the fields of psychology and philosophy, shows that CT is understood as a complex interplay of a large number of skills and dispositions that contribute to getting a well-founded picture of a situation, but also to reflect on and question one's own position (Rafolt et al. 2019). The Synergy Model of Critical Thinking (SMCT) reflects this decades-long discourse (Rafolt 2021). It is based on the synopsis of academic literature on CT, published in English since 1980, particularly in the fields of philosophy and psychology (e.g., Ennis 2018; Facione 1990; Halpern 2014; Kuhn 1999; Lipman 1988; Paul/Elder 2014). Literature in the field of education was studied as well (e.g., Bailin et al. 1999), however, literature that reflects the concepts of criticality or critical pedagogy (cf., e.g., Davies 2015) was not included. The literature was studied from a science education perspective (Rafolt 2021) and relates to scientific principles, such as rationalism and scientific reasoning. However, it also includes personal (subjective) characteristics that critical thinkers are aware of. The SMCT (Fig. 1) visualises ideal-typical CT as a complex interplay of interconnected elements, which cannot be clearly distinguished from one another and do not necessarily build on one another: intellectual standards; knowledge and experience; dispositions, motivation and attitudes; norms, values and emotions; skills; and self-regulation.

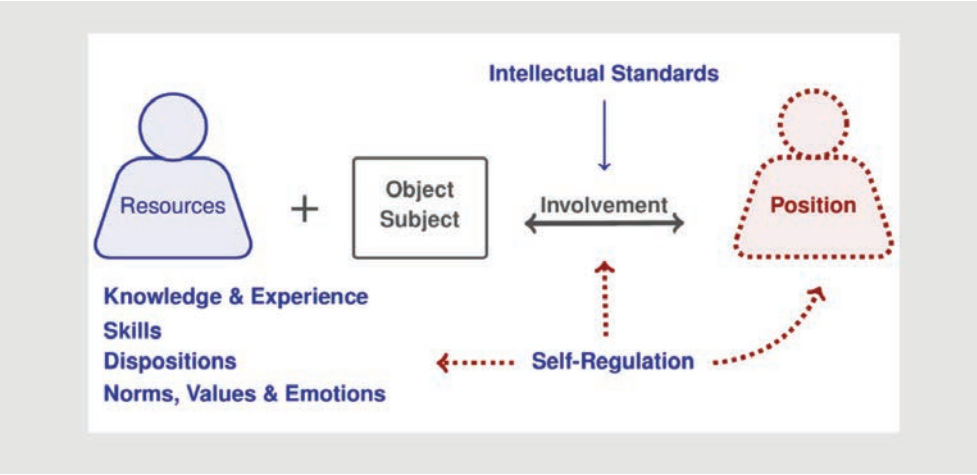

Fig. 1: The Synergy Model of Critical Thinking (Rafolt 2021, p. 80)

The SMCT shows that critical thinkers engage with an object or subject, such as a problem or an assertion. This results in an individual, changeable, and possibly only temporary *positioning* (e.g., a standpoint, a decision, actions). Critical thinkers rely on *knowledge and experience* (Ennis 2018). They develop and use relevant *skills*, for example, by/when researching (synthesis), defining (determination), arguing (discussion), judging (evaluation), and drawing conclusions (interpretation) (Facione 1990; Halpern 2014; Paul/Elder 2014). CT *dispositions* ensure that critical thinkers are motivated and live a certain attitude. For example, they strive for knowledge, rationality, expertise and truth and are open, courageous, creative, curious, responsible, self-confident, modest, and frustration-tolerant (Bailin et al. 1999; Ennis 2018; Halpern 2014; Kuhn 1999; Paul/Elder 2014). Critical thinkers also are aware of their own and others *values and emotions* and deal with individual and societal norms. Moreover, they understand the values of CT, which are reflected in CT dispositions, intellectual standards and self-regulation (see below), and that CT is a value in itself (Bailin et al. 1999). It is important to understand that CT is goal-oriented and criteria-based. Intellectual standards (correctness, clarity and precision, relevance and significance, autonomy, fairness and neutrality, logic and rationality, and breadth and depth) (Paul/Elder 2014) and self-regulation (e.g., Facione 1990; Kuhn 1999; Lipman 1988) guide the involvement with an object or subject and affect all other elements, including the position that is taken. In the course of self-regulation, critical thinkers engage in empathy, perspective taking and self-reflection, recognise mistakes and shortcomings, and adapt their thought patterns, attitudes, and actions.

The SMCT as a framework to discuss media-effective ecological crises

Hereinafter, the elements *norms, values and emotions*, *dispositions, knowledge,* and *self-regulation* (in the context of knowledge as well as dispositions) are discussed as examples to show what (future) teachers and students should pay attention to when promoting CT while engaging with media content on ecological crises.

Norms, values and emotions

Teachers need to explain that critical thinkers research, organise, question, and discuss norms, values, and emotions. Students do not only need to understand the meaning of these norms, values, and emotions but also how they interact in science and in society (Lipman 1988; Paul/Elder 2014). Especially with regard to ecological crises, emotions play an important role (Hufnagel 2022; Neckel/Hasenfratz 2021). Görg (2011) states,

> "the gap between the societal capacity to transform the natural environment and the lack of capacity to control our impact on that environment – and the repercussions of that lack for societies – is one of the major contradictions of contemporary societies" (p. 43).

This tension between helplessness and dependence as well as the will and power to shape and use nature is one reason why ecological crises can trigger strong emotions (cf. Neckel/Hasenfratz 2021). The way in which traditional or popular media and social media present sustainability and environmental protection issues reflects the polarisation of society on ecological crises. Mass media use "apocalyptic language" und refer to "threats to human wellbeing" posed by ecological crises (Case et al. 2015, p. 397). This shows that alarm calls from the scientific community are taken seriously and communicated by the mass media. In order to develop CT, teachers could ask their students to discuss the effects of this apocalyptic language on people's behavior and how strong emotions might impact peoples' positioning in the context of ecological crises. For instance, they could discuss whether using such language could also lead people to turn away from the challenges associated with ecological crises. Moreover, teachers should support students to reflect on how values and emotions might influence their own position and that of others (Paul/Elder 2014). For example, when students learn about the importance of nutrition in the context of ecological crises and explore why insects do not play a greater role as food sources, they could discuss why the idea of eating insects triggers disgust in some people, even though they rationally understand that doing so would be healthy and conserve resources (cf. Kornher et al. 2019). Furthermo-

re, students could discuss how norms regulate social coexistence (e.g., animal rights) and the scientific genesis of knowledge (e.g., traceability; see *Nature of Science*, e.g., Lederman/Lederman 2019). For example, they could explore local, regional, and global norms that are intended to regulate climate-friendly and climate-damaging behaviour, discuss on what values these norms are based and reflect on what emotions these norms might evoke in different people.

Dispositions and self-regulation

Teachers and learners should understand that they cannot examine complex issues in the context of ecological crises with a quick Internet search. Instead, they need to experience that CT is not easy and requires a deep commitment to develop a well-founded position. This can be exhausting or frustrating. Ideal-typical critical thinkers seek to think and act in a truth- and goal-oriented way; they strive persistently for information that is differentiated, well-founded, rational as well as reason-based; and they want to gain expertise to offer a knowledge-based solution to a given problem (Paul/Elder 2014; Facione 1990; Halpern 2014). When students negotiate media content on ecological crises, they should be made "aware that media texts embody certain political and ideological positions and have political effects" (Kellner 1995, as cited in Carvalho 2007, p. 240). When students analyse social media content, they could discuss what attitudes the person who wrote the post might hold or what interests he or she might pursue. However, it can be difficult to fathom attitudes or interests of individuals who spread information on social media, especially if they remain anonymous. In general, developing CT dispositions and analysing possible dispositions of others are big tasks for both students and teachers. We therefore believe that one goal should be to sensitize students to ask themselves consistently what motivation and attitude they have towards a subject or an object and to what extent this influences how they deal with the topic (see self-regulation). Likewise, students should be instructed to deal seriously with others and in doing so, change their perspectives and show empathy. In order to promote perspective taking and empathy, students could discuss how people differ in their attitudes towards ecological crises, such as climate change, as identified by Kuthe and colleagues (2019). For example, while the *Paralyzed* do not act in a climate-friendly manner because they feel very uneasy and helpless, the Uninvolved do so because of a lack of interest and/or ignorance (Kuthe et al. 2019, pp. 176-177). Students could reflect on whether they find themselves or people with whom they interact (or whose claims they are analysing) in one of these groups and discuss group dynamics, possible underlying values, and motivational aspects and how these can affect individual perceptions.

Knowledge and self-regulation

Social media, including Twitter, Instagram, Facebook, and YouTube, are the primary source of information for people, especially for young people (Fergie et al. 2015; Lederman/Lederman 2016). Therefore, students need to understand that current media development requires them more than ever to think critically (Jahn/Kenner 2018; Machete/Turpin 2020; Polizzi 2020; Puig et al. 2021). In this process, teachers are responsible to support students by selecting suitable sources and subject content, moderating discussions, evaluating student statements and actions, and giving feedback (Lorencová et al. 2019). However, students should not be given the impression that they should distrust all media. Both traditional media and social media provide platforms for all citizens, including scientists and activists, to reach a large audience and share knowledge and opinions with others (Carvalho 2007; Chapman/Greenhow 2019; Höttecke/Allchin 2020; Pearce et al. 2015; Polizzi 2020). However, students should negotiate how social media reinforce political polarisation (Höttecke/Allchin 2020; Jahn/Kenner 2018; Yarchi et al. 2021) and help misinformation and conspiracy theories to reach a wide audience (Jahn/Kenner 2018; Puig et al. 2021; Sharon/Baram-Tsabari 2020). Moreover, students could discuss possible intentions and goals of different media. Respectable media and journalists use and communicate evidence-based information. They do not obtain information from any scientist or give equal space to all opinions or explanations, regardless of whether this information or these opinions and explanations are justified or not, but they reflect the scientific consensus (cf. Nichols 2017). Students need to understand that there is no authority or generally accepted quality assurance process that could act as a gatekeeper to false or misleading information which is disseminated in social media (Höttecke/Allchin 2020; Polizzi 2020). However, regardless of whether scientists use social media to spread information or reputable media to explain the scientific consensus, simplifications are usually required to make the causes of certain phenomena, possible consequences, and recommendations for action accessible to citizens (Carvalho 2007). Students should reflect on how simplifications of complex and unpredictable environmental and health issues (cf. Zeyer 2021) carry the risk of consciously or unconsciously multiplying misunderstandings and misinformation. Students should understand that ideal-typical critical thinkers determine their own level of knowledge and that of people with whom they interact or from whom they obtain information. In doing so, critical thinkers check the origin and significance of the information and are experienced in dealing with sources and argumentation strategies (cf. Jiménez-Aleixandre/Puig 2012). For example, climate change deniers claim that global warming is not real, human behaviour is not responsible for it, the warming is not as bad as portrayed, the vast majority of climate scientists cannot be trusted, and alterations to stop global warming do not work (any longer) (Cook 2020). False claims like these can be disproved by scientific evidence

and scientific consensus (Jiménez-Aleixandre/Puig 2012). Especially in the context of social media, it is important to support students to classify and evaluate discussions, claims and individual experiences or perceptions in the light of the scientific consensus. In order to be able to do all of this, teachers and students must understand the principles of reaching a scientific consensus, which includes academic dissent, and how scientists work (Schmaltz et al. 2017; Yacoubian 2015). Moreover, they need to understand that critical thinkers constantly ask themselves whether they know enough and whether their information is coherent with the scientific consensus, but also that they accept the fact that the level of knowledge might expand or facts might change and reflect on their own shortcomings (see above, self-regulation) (Kuhn 1999; Kuhn/Modrek 2021). Students could explore how scientific journals and other media present information and how techniques of science denial (cf. Cook 2020) are applied on these media. Teachers should explain that they cannot find true factual structures, but examine individual ways of presenting scientific content on complex issues, such as ecological crises, which are based on a consensus of a scientific community. This insight can be confusing or even disturbing. Students should understand that in order to be able to deal with this situation in everyday life, a lay person must be able to rely on certain sources. Otherwise, every piece of information has to be checked. This process requires in-depth knowledge on a variety of topics and highly developed skills. Therefore, educators and learners need to understand that they can only practise CT within certain limits. They should be made aware that they do not have the resources (e.g., time, knowledge, skills, access to data) to cover all topics in depth and breadth, check all the information for correctness, penetrate every phenomenon in its causes and implications or analyse all proposed solutions to their last consequences. Especially in the context of everyday classroom learning and teaching, it seems important to us that teachers and students alike experience to trust certain institutions and their ways of gaining knowledge (cf. Winch 2003). Laypeople do not necessarily need to question and test established knowledge, such as the fact that an increased atmospheric concentration of carbon dioxide leads to a rise in temperatures on earth and acidification of the oceans (cf. Owens et al. 2021). However, teachers should provide students with evidence-based and trustworthy sources of information. On the subject of climate change, for example, they can find several offers that provide relevant information and facts in a clear and concise manner (cf. Climate Change Centre AUSTRIA 2022). Teachers need to explain that discussions in which only little knowledge of the facts is negotiated are irrelevant and counterproductive. Moreover, as discussed above, student should address the role of emotions, values, norms, attitudes and interests. In this context, students need to understand that a person does not achieve this goal simply by expressing his or her opinion. Otherwise they might think that everyone who expresses his or her opinion thinks critically, regardless of the knowledge base on which it is formed. When analysing a social media claim, students could discuss its

relevance and possible impact. They could reflect on why some contributions are more valuable than others in the discourse on ecological crises and why this judgment has nothing to do with restricting people from expressing their opinions. Teachers should help students to classify criticisms expressed by different scientists in the context of a scientific discourse in terms of their relevance for the formation of a scientific consensus. For example, if a scientist comments on an issue although it is not his or her area of expertise, this contribution is not as relevant as contributions from scientists who have been studying and researching this issue for years. Students should also reflect on why criticisms made by laypeople (e.g. journalists, politicians, experts in other disciplines) do not have the same relevance and scope. Individual citizens, societies and political decision-makers do not always bear the same responsibility (Malmberg/Urbas 2019) and laypeople do not have the same sovereignty of interpretation as, for example, climate scientists (cf. Nichols 2017).

The SMCT as a starting point to reflect on and discuss perceptions of critical thinking

For any support measures to be effective, educators and learners need a context-specific, clear and holistic understanding of CT. In addition, teachers and their students need a shared understanding of CT to observe and articulate learning progress explicitly and use the term CT judiciously. Due to the complex and culturally conditioned nature of the construct CT, however, it can be interpreted differently and sometimes assigned to diametrically opposed thought and decision-making processes (Rafolt et al. 2019; Jahn 2013). When promoting CT, educators and learners should not follow their gut feeling as to what CT means, but resort to well-founded theoretical concepts in order to gain a holistic understanding of CT. The SMCT (Fig. 1) can help to talk to each other about ideas or concepts and to think about their deeper meaning together. The SMCT therefore serves to sharpen one's own ideas of CT and to counteract an undifferentiated understanding. The latter is demonstrated, for example, when rejecting well-founded information just to position oneself against the mainstream opinion, taking a stand against the scientific consensus or simply questioning facts is equated with CT. Such an understanding neglects the complexities of thought involved in CT. When conflicting ideas about CT collide or the goals and usefulness of CT itself are questioned (cf. Hoy 2004), the SMCT can provide a framework for discussing the importance of individual aspects of CT and how they interact with each other. It does not provide a final definition of CT, but it is a way to show what processes CT includes and how challenging it is.

Conclusion

Teachers need support on how to promote their students' CT especially when negotiating ecological crises with their students. The SMCT could be used in teacher education to practice CT in the context of ecological crises, for example, by discussing information provided in different (social) media, including diametrically opposed statements made by individual scientists, fake news and conspiracy theories. Norms, values, and emotions play an important role in negotiating ecological crises (cf. Hufnagel 2022; Neckel/Hasenfratz 2021). However, these aspects are not addressed adequately in most of the existing CT explanations (Lombard et al. 2020; Thayer-Bacon 2000). The SMCT provides a framework for teachers and students to engage with norms, values, and emotions, as well as dispositions, knowledge, skills, and self-regulatory aspects that are essential to CT. In addition, (future) teachers could use the SMCT to reflect on their understanding and perceptions of CT. This is essential for teachers to act as role models, provide their students with feedback and, thus, support their students in developing CT (Ab Kadir 2017; Facione 1990; Lorencová et al. 2019).

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