

Towards Spatial Reflexivity: Knowledge and Perspectives on (the Teaching of) Competences to use Geomedia Maturely

Helena Atteneder¹, Inga Gryl² and Thomas Jekel²

¹University of Tübingen, Germany

²University of Duisburg-Essen, Germany

Abstract

Reflection and reflexivity are key concepts in geomedia education. Reflexive geomedia competences (such as reflection on basic technical concepts and spatial constructions, reflexivity in appropriation of space and towards one's own learning processes, as well as general reflexive competences) enable learners to gain deeper insights into geographical issues and more mature participation in everyday spatial decision making. The pedagogical target of teaching reflection and reflexivity requires teachers who have the professional training to do so. However, little research has been done on university lecturers' knowledge of and perspectives on spatial reflexivity. This contribution therefore develops a competence model of spatial reflexivity, and empirically explores teachers' starting points for teaching reflexivity. It does so by analysing 17 in-depth qualitative interviews with German university teachers and teacher trainers.

Keywords:

reflection, reflexivity, reflexive geomedia competences, teacher training, competence model

1 Introduction

Digital geomedia (such as web map applications, route planners, location-based services, or social media with spatial reference) represent a new dimension in the lay processing, analysis and presentation of geoinformation. For example, there are new possibilities for the active, user-centred production of geomedia content, interactive forms of visualization and representation of geodata, the dissemination of individual location-based knowledge in online communities, or bottom-up platforms for citizens' initiatives. Education with the aim of fostering maturity should ideally refer to these changed conditions and enable young people to reflect on both the interest-driven geomedia production of others and their own use of geomedia technologies. 'Maturity' (*Mündigkeit*) is understood here, following Kant and Adorno (2015), as the ability to face digital culture in a self-determined and critically reflexive way. This poses challenges for teacher training – namely to develop teachers' own competences for the responsible use of digital geomedia, as well as their professional knowledge for teaching these

competences in the classroom. Teaching should enable all (i.e. school pupils and student teachers) to act consciously, actively and creatively in a geomeia society. In the remainder of this paper, for clarity, we use ‘student’ to refer to trainee teachers, and ‘pupils’ to refer to young people in primary or secondary education.

Accordingly, the demand to foster reflection and reflexivity in teaching and learning is particularly represented in the didactics of Geography, of primary school education, and of media education. There are different ideas about how to conceptualize reflection and reflexivity. For this paper, we draw on the earlier work of Gryl (2012) and define reflection as an externalized process that describes the questioning of a particular issue or object. Reflexivity, on the other hand, questions one's own thinking and actions in this context. Both aspects are part of reflexive geomeia competences, which we refer to here as the competences to use geomeia maturely. It has been argued that the competences to use geomeia maturely are always integrated into general, non-geomeia-related processes of reflection and reflexivity. Specific competencies to use geomeia maturely are thus in a reciprocal interrelationship with maturity-oriented competences beyond geomeia. We understand that the ability to think about the non-objective nature of maps and to understand how as individuals we are affected by geomeia content are rooted in everyday practices and concerns (for example: spatial data mining, locational privacy, spatial accuracy, changes in individual spatial perception through the use of navigation systems). Accordingly, the competences to use geomeia maturely are always embedded in everyday processes and are strongly interrelated with more general factors of maturity-oriented competences beyond geomeia.

In the context of these debates, different competence models have been discussed (see e.g. Schulze, Gryl & Kanwischer 2015; Jekel, Gryl & Schulze 2015). At the same time, learning environments to support reflexion and reflexivity have been developed for primary and secondary schools, as well as for teacher training as secondary school teachers. However, there are neither learning environments designed for trainee primaryschool teachers, nor sufficient empirical evidence on the impact of such learning environments. While the learning environments mentioned above are aimed at teacher training or designed for use in the classroom, relatively little is known about the extent to which the concepts of reflection or reflexivity are applied in higher education in Geography or Geography-related primary teacher training. This paper therefore poses the following central research questions:

- To what extent and under what conditions do university teachers of Geography¹ require and foster various competences to use geomeia maturely (= in a reflective + reflexive manner)² in university teaching?
- What concepts of reflection and reflexivity do teachers in higher education follow in fostering competences to use geomeia maturely?
- How are teacher trainers’ own competences to use geomeia maturely, or more generally their maturity-oriented competences beyond geomeia, mutually related to:

¹ Included here are related fields, e.g. the geographical perspective in the field of primary school teacher training

² The phrases ‘competences to use geomeia maturely’ and ‘maturity-oriented geomeia competences’ are used synonymously.

- (a) the concepts of reflection and reflexivity they follow in higher education?
- (b) the extent and conditions under which university teachers (of Geography and related fields) require and foster various competences to use geomedia maturely?

Answering these questions is part of the joint DiGeo³ project of the universities of Frankfurt, Cologne and Duisburg-Essen. The overall aim of the project is to develop a digital subject-oriented concept that will foster informed geo-media education about and with geo-media technologies (Schulze et al. 2020). In the context of the project, maturity-oriented geomedia competences can be divided into three dimensions: 1) reflection/reflexivity, 2) argumentation/communication, and 3) participation/production. Each of the three locations involved in the project focused on one of these dimensions. The authors of this paper focused on reflection/reflexivity.

To gain deeper insight, university teachers, managers of study programmes and other leading teaching actors were asked in systematizing expert interviews about the technical, organizational and curricular framework conditions of teaching with regard to reflection and reflexivity.

2 Reflection/Reflexivity as both ‘tool’ and ‘topic’ in Geography teacher education

Reflection in combination with reflexivity is a key concept in the production of insights, and thus in pedagogy and learning psychology (Aebli 1980), but also in subject-related discussions (Brendel 2018). Our compound concept of reflection/reflexivity denotes the ability to question content, attitudes and action in several dimensions, for instance, concerning facts/knowledge as well as concerning ethical standards, combined with the ability to reflect on (and hence change) one’s own practice, opinions, and so on. It is a form of criticality that is referred to in several theoretical, didactical and methodological approaches. In Geography education, the theory of Critical Cartography (Harley 1989) forms a basis for questioning the propositions of geomedia that help to collectively communicate and individually construct always limited attributions of meaning to physical space (Gryl 2009). Approaches such as Spatial Citizenship (Gryl & Jekel 2012) aim to question those spatial geomedia constructions with a stronger emphasis on the societal power relations behind them and/or that are, consequently, (re)produced. Over recent years, several approaches have highlighted and developed different dimensions of, and methods for, reflection and reflexivity concerning geomedia and spatial constructions (see e.g. Lehner & Gryl 2020; Lehner et al. 2019; Schulze et al. 2015; Gryl & Kanwischer 2011). Some of them focus on one aspect; others attempt to

³ The full name of the Project is ‘Generalisierbarkeit und Transferierbarkeit digitaler Fachkonzepte am Beispiel mündiger digitaler Geomediennutzung in der Lehrkräftebildung’ (Generalizability and transferability of digital subject/technical concepts using the example of responsible digital geomedia use in teacher education); more information: <https://digeo-oer.net/doku.php>

sum up several dimensions of reflection/reflexivity. Here, they are all condensed to a common model, named spatial reflexivity.

The ‘spatial reflexivity’ model serves as a comprehensive theoretical background for making maturity-oriented geomedia competences analysable, and for operationalizing different areas of learning and teaching. According to the degree of complexity of the learning content and the corresponding educational perspective or context, reflection and reflexivity can be applied based on this model both in university didactic teaching/learning environments and in school-specific settings.

With reference to Gryl (2012), this model builds on the fundamental distinction between reflection and reflexivity. Reflection describes the basic cognitive processes of questioning an object; reflexivity goes beyond this and analyses one's own perspective, one's own actions and options for action.

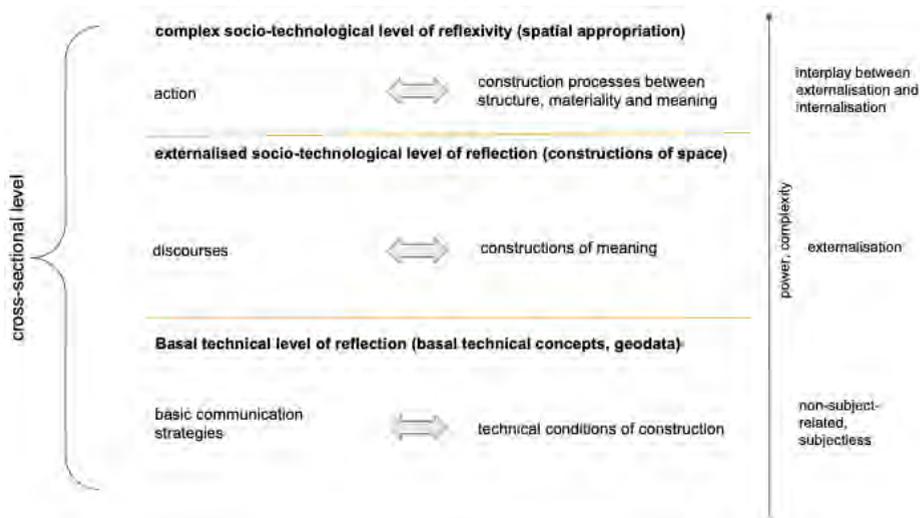


Figure 1: ‘Spatial reflexivity’ competence model

The levels of analysis (Figure 1) range from a basic (technical) level of reflection to a complex socio-technological level of reflexivity (spatial appropriation). The former refers to technical aspects of geomedia and questions fundamental communication strategies with and through geomedia, as well as the technical conditions of construction. The latter refers to action and the construction processes between structure, materiality and meaning. In between, the externalized socio-technological level refers to processes of reflection on spatial constructions that are reflected in both discourses and constructions of meaning. The cross-sectional level describes specific methods, such as deconstruction, that can tie together all three levels, which have varying degrees of complexity. The degree of complexity and, accordingly, the power relations increase from the bottom of the model upwards. Correspondingly, the complexity of reflection/reflexivity also increases towards the top. At the lowest level, reflection is ‘subjectless’ (in the sense of being directed towards a (technical) object), and involves neither reflection/reflexivity pointed at the individual ‘doing’ the reflecting, nor other people, while

the middle level describes reflection only in externalized terms (i.e. in relation to other people). Finally, the third and highest level involves the self, and the interplay of personal relationships and power relations.

This model also allows an analysis of the competences to use geomeia maturely in three areas of learning and teaching (Figure 2).

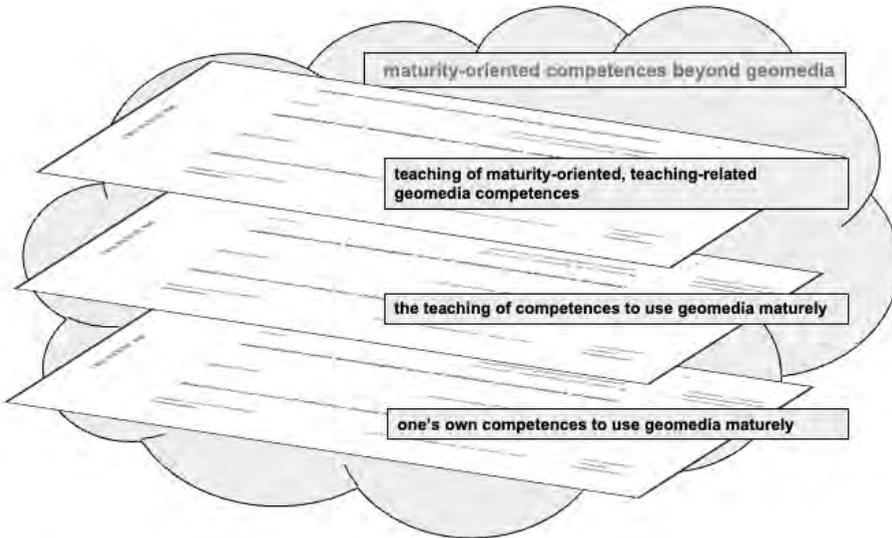


Figure 2: Areas of learning and teaching spatial reflexivity

Depending on the aim and the use of the ‘spatial reflexivity’ model, the focus can be set on

- one’s own competences to use geomeia maturely
- the teaching of competences to use geomeia maturely (e.g. in university teacher education)
- the teaching of maturity-oriented, teaching-related geomeia competences (e.g. teaching the skills of teaching competences to use geomeia maturely)

The areas of learning and teaching spatial reflexivity are embedded in general factors of maturity-oriented competences beyond geomeia and in their mutual conditionality; they lie across all the reflexive competences shown.

3 Methods and Approaches

Within the framework of ‘DiGeo’, the first part of the study analysed relevant curricular documents used by the three universities with regard to already established media-didactic integrations of competences to use geomeia maturely in the teacher training courses for Geography, and for the geographical perspective of primary social and science education.⁴ In

⁴ See project report: Schulze (2021).

brief, the analysis of the curricular documents for all joint project locations and for all study programmes considered shows that these documents provide only a rough framework concerning reflection and reflexivity. Responsibility for their detailed implementation (i.e. implementing reflection/reflexivity) in the teacher-training courses ultimately lies with the lecturer. Although the documents have a structuring function, they promote the greatest possible degree of freedom in teacher-training and in the future teachers' practice.

The second sub-study in the framework of 'DiGeo', the results of which are presented here, is dedicated to interviews with relevant actors (university lecturers, module instructors, etc.) in the field of university Geography teaching. A common, theory-based guideline for the qualitative interviews was created along the DOIT model⁵ (Horz & Schulze-Vorberg 2017). This model considers the areas of didactics, aspects of the organization, the individuals and technology, and the interlinkages of these areas. The selection of the interview partners also followed the DOIT model. Accordingly, interview partners were selected who currently teach or have taught in one or more areas of the model; who had varying degrees of teaching experience; and who covered as wide a content range as possible within the general field of Geography and Geography education (i.e. in relation to their personal research and teaching interests).

A total of 17 faculty members were interviewed at the three German university locations between April and July 2020; the interviews were conducted by Melanie Lauffenburger, Sebastian Seidel and Helena Atteneeder. Due to the Covid-19 pandemic, interviews had to be held online. The interviews were then transcribed as 'a simple scientific transcript' (Fuß, & Karbach 2019) and analysed.

The interview guide was developed against the background of the analysis of the curricular documents and the three competence-dimensions of the DiGeo project (see bullet points in previous section). It comprised a total of six question areas: after opening the interview and explaining the project context (question area A), the interviewees were asked to briefly introduce themselves (question area B) with regard to their areas of activity in research and teaching. In question area C, the role and significance of digital media in general for teaching and learning were discussed. Question areas D, E and F covered argumentation/communication, reflection/reflexivity and participation/design. This paper focuses on the interview results of all 17 interviews concerning the domain reflection /reflexivity.

The range of questions on reflection/reflexivity was geared towards obtaining the greatest possible openness of results (e.g., the initial question asked for the general understanding of the term). Basic questions about the possible advantages and disadvantages of geomedial technologies and their use in higher education were supplemented by questions about the possibilities and limitations of thinking and working reflexively. In this respect, the theoretical model of 'spatial reflexivity' was not directly 'asked for' in the interviews. This has certain advantages in the subsequent qualitative content analysis which was conducted deductively,

⁵ The DOIT model offers a theory-based construct that makes it possible to analyse the use of digital media in higher education teaching in the sub-areas of didactics (D), organization (O), individual (I) and technology (T).

based on the main categories that we deduced from our model. This largely theory-driven approach allows us to identify gaps in the analysed content, which manifest in the form of non-existent cases and correspondingly empty categories. Furthermore, we followed the content-structuring procedure according to Kuckartz (2022), in which both a case orientation and a category orientation remain relevant for the analysis. This allows the identification of the individual perspective at each university location in the columns of the results matrix and to analyse a topic cluster in the rows (Table 1, 2 and 3). Although controversial in qualitative research (for an overview of the controversy, see Kuckartz 2022: 116–18), quantitative frequencies of the analysed material are also described in our results. However, the categorized frequencies are not to be equated with ‘relevance’ and ‘variety’. Rather, in the sense of the combined case *and* category orientation, the focus is on whether a certain category was assigned at all for a certain case, or in how many cases certain categories were applied.

4 Results

Analogous to the ‘spatial reflexivity’ model, the results for the following areas are described: ‘own competences to use geomeia maturely’, ‘teaching of competences to use geomeia maturely’ and ‘teaching of maturity-oriented, geomeia competences’. First, important quantitative key figures are given for each area. The aim here is not to equate frequency with importance, but to show which levels were addressed by which cases at which university locations. This is followed by a detailed description of the content of the qualitative results. Further, for each of the three areas, the embeddedness in maturity-oriented competences beyond geomeia is described (meta-level).

4.1 Own competences to use geomeia maturely

The area ‘own competences to use geomeia maturely’ was coded a total of 59 times in the interview material. It is remarkable that this area of competence was not mentioned in *all* interviews.

Table 1: Own competences to use geomeia maturely

		FFM_01	FFM_02	FFM_03	FFM_04	FFM_05	FFM_06	KOE_01	KOE_02	KOE_03	KOE_04	KOE_05	DUE_01	DUE_02	DUE_03	DUE_04	DUE_05	DUE_06	Total
meta-level		2	2	1	1	2	1	0	4	0	0	0	2	0	0	5	0	0	20
cross-sectional level		0	1	0	0	0	0	0	0	0	0	2	0	0	0	2	0	1	6
complex socio-technological level - reflexivity																			
	construction level	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	3
	action	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	2
externalized socio-technological level (reflection)																			
	construction of meaning	1	0	2	2	0	0	0	0	1	0	2	1	2	0	0	0	0	11
	discourse	1	1	0	1	1	0	0	1	1	1	0	1	0	0	1	1	2	12
reflection on basal (-technical) level																			
	technical construction	0	1	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	4
	basal communication strategies	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
TOTAL		4	5	3	4	3	2	0	6	5	1	4	6	4	0	8	1	3	59
N = documents		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	17

In interviews KOE_01 and DUE_03, for example, it was not mentioned at all. It is also noticeable that reflection on a basal technical level, as a basic communication strategy, was only mentioned once. In contrast, the meta-level of one's own maturity-oriented competences beyond geomeia was mentioned frequently, especially in interviews KOE_02 and DUE_04. The description of the content should bring more clarity here.

From the material, two basic poles can be identified in the understanding of the term reflection/reflexivity: a more individual-centred understanding, and a social understanding based on interaction. However, there are some gradations in between.

Interviewee DUE_06, for example, describes reflexivity as follows: *'[...] thinking about one's own actions, one's own knowledge. In fact, where does my knowledge come from? How do I get it? Why do I actually think that, and what was the process I had to go through to get there, to gain that knowledge? Or else, to negotiate the knowledge'* (DUE_06, item 34). For other respondents, reflection/reflexivity is equated with 'thinking' (FFM_05, item 126) or an externalized, more technical understanding: *'Critical reflection, yes, this unpleasant can of worms is usually opened by copyright and data protection difficulties'* (KOE_02, item 53). The understanding of interviewee KOE_02 can be further described as process-oriented and based on minimal social exchange: *'something with video perhaps, or in forums or in groups to discuss things or to reflect on how it went? How did the process go? How satisfied we were with something'* (KOE_02, item 51).

In addition to an individual-centred, cognitive component, an action and process perspective is repeatedly brought into focus. Maturity-oriented competences beyond geomeia would not only be determined by questioning certain ways of thinking and acting, but would also be conceptualized as practice, as action - as 'doing reflexivity', so to speak - or even as a certain habitus or disposition: *'Either you are self-reflexive, or you aren't, and if someone is self-reflexive, then they are not only reflexive in one area, but are probably reflexive in many areas of life, and thus they have a 'reflexive habitus''* (FFM_02, item 147). Furthermore, maturity-oriented competences beyond geomeia are described as a process that is largely dependent on the social interaction of the actors participating in a particular teaching setting. The fact that the process itself is not always easy and is sometimes perceived as laborious is mentioned again and again. Interviewee DUE_04 puts it in a nutshell when she says: *'Yes, it's more the recurring [nature of it], that's the strenuous part. Questioning my own actions and the actions of people around me. The given circumstances, and then also how the whole thing then influences everybody. [...] And that, that is an ongoing process, because I change, people around me change, and the circumstances in which we operate change. That means I have to do that continuously. [...] it's exhausting and that's why you sometimes have to distance yourself from it. So you can also reflect yourself to death. [...] That's why reflexivity is an exciting field and a field of tension'* (DUE_04, item 38).

This tension between self-reflexivity and reflection/reflexivity by others also becomes clear in the following quotation: *'even when I talk about students' ideas, I am also actually talking about my reflexivity on my teaching, because as soon as I ask what they actually think, I have to say, does my teaching fit in or do I have to adapt it? [...At] the same time, didactic reconstruction is, in my opinion, a huge process of reflexivity if you take it seriously. Because I have to ask myself, what is important? Socially, normatively, what makes sense, also what perhaps works well cognitively'* (DUE_01, item 86). Following this understanding, reflection and reflexivity is always a social process, which may start on an individual level with 'pen and paper', but it subsequently always reproduces (itself) and changes in the interplay between one's own and others' ideas and practices. The promotion of one's

own and one's students' or pupils' maturity-oriented competences beyond geomeia would therefore always be linked to a certain context, to a situational and social structure. In stark contrast to this is an understanding that sees reflection and reflexivity as 'consumable': *'there is a passion with these digital media as well, to penetrate the digital media themselves and how they can be used [...]'. I am more one who sits at the receiving end, yes [...] the reflection on that, I then have it delivered to me'* (FFM_06, items 121–31).

Overall, all interviewees agree that maturity-oriented competences beyond geomeia must always be integrated into a lived practice of one's own self-reflexivity and can only be taught if one's own maturity-oriented competences beyond geomeia are of a correspondingly high quality. However, differences arise in the assessment of the need to foster one's own maturity-oriented geomeia competences. Some people who have already explicitly made this area a (partial) focus in research and teaching see no need to increase their competences further. Others see a need to improve their own maturity-oriented geomeia competences, but are unable to integrate this satisfactorily into their daily work due to time constraints and subject-specific priorities. *'I think [...] I also have to teach reflexivity. But how can I teach reflexivity? If I just have people write, nothing useful will come out of it, but I have to learn reflexivity [myself] first. I need time for that'* (FFM_01, item 181).

4.2 Teaching of competences to use geomeia maturely

The general area of teaching of competences to use geomeia maturely was coded most frequently in our analysis (243 coded segments). Within this area, there are two major focal points in our results: one around the meta-level of teaching maturity-oriented competences beyond geomeia, with 95 coded segments, and one in the area of technical construction at the basal-technical level of reflection.

Table 2: Teaching of competences to use geomeia maturely

	FFM_01	FFM_02	FFM_03	FFM_04	FFM_05	FFM_06	KOE_01	KOE_02	KOE_03	KOE_04	KOE_05	DUE_01	DUE_02	DUE_03	DUE_04	DUE_05	DUE_06	Total	
meta-level	7	3	7	6	3	6	8	6	1	6	6	10	5	2	11	3	5	95	
cross-sectional level	0	0	0	0	0	1	1	0	0	0	2	5	1	0	0	0	0	10	
complex socio-technological level - reflexivity	construction level	1	0	1	1	2	3	0	1	1	0	3	0	0	0	0	0	13	
	action	1	1	0	0	0	0	1	1	2	0	3	2	0	1	5	0	3	20
externalized socio-technological level (reflection)	construction of meaning	1	1	3	3	0	1	3	3	1	2	4	2	0	3	2	1	2	32
	discourse	0	2	1	0	1	1	0	1	0	3	1	1	2	2	3	1	0	19
reflection on basal (-technical) level	technical construction	4	0	2	1	3	0	2	3	0	4	5	2	0	7	2	3	2	40
	basal communication strategies	1	0	0	0	3	1	1	1	0	0	1	1	0	3	0	1	1	14
TOTAL	15	7	14	11	12	13	16	16	5	15	22	26	8	18	23	9	13	243	
N = documents	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	17	

The particular role of maturity-oriented competences beyond geomeia in relation to the other sub-areas studied in the project (participation and argumentation) is addressed at the meta-level. Maturity-oriented competences beyond geomeia taught to both students and pupils

would always be related to participation and argumentation, in the sense that both should be subjected to the process of reflection/reflexivity. For example, who can participate or not in something might be questioned. Another example relates to reflection on argumentation. Arguments put forward are always normative and goal-oriented. Prospective teachers should be made aware of this. In connection with this, the fostering of reflexivity on one's own scope of action as a teacher is also mentioned: *'How much autonomy and how many decision-making possibilities they actually have as teachers [is not clear to them]. Most see themselves as somehow ticking off everything that is in the textbook, that is in the curriculum. So, yes, they are somehow not aware of their own creative space, and that they basically don't want to take advantage of it'* (KOE_01, item 43).

Also discussed at the meta-level was the interplay between one's own attitude (in relation to the teaching of relevant competences) and the attitude of the pupils or students. These differ greatly in terms of which professional goals the pupils/students are striving for. In general, great heterogeneity within pupil/student groups is perceived as a problem. This applies to the teaching of technical competences, of subject-related competences, and of maturity-oriented competences beyond geomedial. In the teaching of maturity-oriented competences beyond geomedial, the time factor is also repeatedly perceived as limiting. The focus is often on teaching subject content, and fostering maturity-oriented competences beyond geomedial is not integrated due to 'time constraints'. This problem could be exacerbated by technical difficulties, which would not only be time-consuming, but would also make it impossible to have a common basis of understanding to initiate reflection/reflexivity at the technical level. Interviewee DUE4 describes the problem as follows: *'Well, I sometimes ask myself, do the students understand when I tell them to use a different browser? Do they know what that means? So I don't know if they all know. I really don't know'* (DUE_04, item 16). At the same time, the interviewees do not agree on whether the teaching of technical competences should play a greater role in studies or be marginalized even more. The position taken in each case was justified by the interviewees in relation to their own particular focus in teaching. The university teachers we interviewed, who themselves teach technology-oriented courses and seminars, argue that the promotion of technical competences should be much more in focus; people who pursue other priorities in teaching (such as subject-oriented courses) say that the teaching of technical competences is of secondary importance because requirements change much too quickly, and learning technical skills should therefore be shifted to self-study.

Another point discussed in the interviews was the question of what methods could be used to teach maturity-oriented competences beyond geomedial at all. One position refers to the measurability of maturity-oriented competences beyond geomedial. The interviewee does not want to foster maturity-oriented competences beyond geomedial in his own teaching as long as these competences cannot be measured validly: *'It is not the case [... that one] would not also try to make reflexivity measurable. [...] They actually try [...] to get to grips with it somehow. Otherwise, [...] as long as you can't measure it, I'll remain self-critical for the time being'* (DUE_02, item 68). Other participants in our study integrated various methods for the targeted fostering of maturity-oriented competences beyond geomedial into their lesson planning. For example, observation sheets or working with portfolios (as two possibilities among many) to establish self-reflexivity loops as a habit are mentioned here. Another strategy is to stimulate reflection/reflexivity processes in students by making them do something themselves: *'Doing something yourself also creates a different view in the students. If they are more and more consumers, then there is not such a self-*

reflexive form as if they are also producers – of a map, for example’ (DUE_04, item 11). In addition to the targeted encouragement of self-reflexivity, critical exchanges in a group are seen as an important area of competence for the development of maturity-oriented competences beyond geomedial. This area is more difficult to promote and is strongly dependent on group dynamics and the general atmosphere on the course, ‘because they then perceive this as lacking solidarity, and you have to try to create an atmosphere in which it is still possible to express this criticism. [...] With the hope that this criticism will then also be taken up in the following seminar sessions and lead to an improvement in one’s own work [...]. And what I recognize is that sometimes it works, sometimes it doesn’t’ (FFM_06, items 347–52).

Another problem posed by fostering maturity-oriented competences beyond geomedial emerges in the question of the assessment/non-assessment of portfolio work: *‘[T]he question is, can I demand reflection, reflexivity, if it is not assessed? On the other hand, can I demand it if it is assessed? Because that is quite a dilemma. Am I allowed to assess reflection/reflexivity, or how do I encourage reflection/reflexivity if it’s not assessed and if the students don’t see the short-term economic benefit in it for themselves’ (DUE_01, item 34). As a solution, this respondent suggests explaining the benefits of self-reflexivity: ‘[I]t’s very important to me that the students also have spaces where they are not constantly assessed, but where they can actually reflect. But the question is, when will they recognize the benefit of these spaces if they don’t directly receive a reward, in the sense of, okay, you’ve now gained another 10% for your examination performance’ (DUE_01, item 36). Beyond pointing out the benefits of being self-reflexive, we want to stress the importance of distinguishing here between general assessment (i.e. a general assessment of whether some form of reflection and reflexivity has taken place) and specific grading. In a teaching setting (whether in a university or at a school), it can be determined whether reflection and/or reflexivity has taken place, but an assessment and evaluation of this in the form of ‘right/wrong’ or via a grading system is not feasible.*

The teaching of competences to use geomedial maturely is often related to the teaching of reflection in relation to the possibilities and limits of certain digital geomedial. In other words, according to the question of which geomedial can be used for what purposes. *The opportunities are clearly the illustration of geographical facts, for example. So if I can use Google Earth [...] or Google Street View to look directly into a favela in São Paulo, for example, and see the situation on the ground, or if I can use Google Maps to look at satellite images of the tropical rainforest [...] and see the changes in rainforest deforestation over time, then of course these are great tools for illustrating something. [Teachers] have to understand these media themselves, how they work, the technical knowledge, but of course they also have to be able to reflect on what is shown in digital geomedial. [...] So this critical reflection on digital geomedial must also be taught in teacher training. Only then can it be passed on to the pupils’ (FFM_01, item 37).*

In the teaching of competences to use geomedial maturely, students should be made to question not only the content of digital geomedial, but also their own patterns of action. However, one interviewee raises the point that university students’ competences to use geomedial maturely often do not go beyond a technical level: *‘So we also try to bring in this critical view again and again. But [...] at the end of a project report [...], you notice that it’s often written down [...] only briefly, on half a page. ‘I had a lot of problems with data collection’ or something like that’ (FFM_03, item 73).*

4.3 Teaching of maturity-oriented, teaching-related geomeia competences

The area ‘teaching of maturity-oriented, teaching-related geomeia competences’ was coded the least frequently in the entire set of interviews, with a total of 41 mentions. Regarding the frequencies with which certain issues were mentioned within this specific area, the meta-level attracted the most comments. In addition, technical areas were also addressed very frequently. In terms of content, two large thematic blocks emerged: (a) the thematization of the technical feasibility in schools; (b) large social topics, such as the great responsibility of teachers.

Table 3: Teaching of maturity-oriented, teaching-related geomeia competences

		FFM_01	FFM_02	FFM_03	FFM_04	FFM_05	FFM_06	KOE_01	KOE_02	KOE_03	KOE_04	KOE_05	DUE_01	DUE_02	DUE_03	DUE_04	DUE_05	DUE_06	Total
meta-level		2	0	0	2	0	0	4	1	0	1	3	1	2	1	2	1	0	20
cross-sectional level		0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
complex socio-technological level - reflexivity																			
	construction level	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	action	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
externalized socio-technological level (reflection)																			
	construction of meaning	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	3
	discourse	0	0	1	0	0	0	2	1	0	0	0	1	0	1	1	0	0	7
reflection on basal (-technical) level																			
	technical construction	1	0	0	0	0	0	1	0	0	1	0	1	0	2	0	0	0	6
	basal communication strategies	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	3
TOTAL		4	0	1	2	0	0	9	2	0	2	3	6	4	4	3	1	0	41
N = documents		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	17

Our respondents see great difficulties in the technical feasibility and practical relevance of didactic concepts that employ the use of geomeia in school lessons. Processes of reflection/reflexivity on the benefits and areas of application of digital geomeia would cease without adequate technical equipment in schools: *‘We do a lot in our studies, teach our students a lot [...] (laughter). But what they can then implement when teaching at schools with super-bad or non-existent Wi-Fi is another question. That is what we get reflected back to us from our students’* (FFM_01, items 37–39). Respondent DUE_04 also addresses the problem of technical implementation: *‘Whether or how the transfer succeeds, [...] whether the prospective teachers then use it in the classroom ... Yes, well, I don't just wonder about geomeia. I wonder that about many things, whether [our students and then, subsequently, the school pupils] really do things the way we envision them. Some of the schools are a bit of a lottery. The schools that are really badly equipped are so badly equipped that digitally you can do naff-all there ‘* (DUE_04, item 16). On the other hand, some interviewees emphasize the advantages of digital geomeia in overcoming precisely these problems. They mention, for example, an intuitive use of geomeia applications suitable for the general public, or a generally greater flexibility that would result from digital geomeia. We also consider that teachers’ ability to identify the technical options available to design/access/alter geomeia is itself a maturity-orientated competence in the use of geomeia, a competence that can be reflected upon and made visible through these same practices. At the same time, power relations can be made visible and reflected upon through availability/unavailability/accessibility of technology.

In general, the transfer of concepts and content taught at university to professional practice as teachers is addressed. The corresponding simplification, i.e. the ‘downscaling’ and the development of a feeling for what is achievable with the respective school level, is central here: *‘Of course, I would not make a one-to-one transfer of mathematical models [...] but I have to look at how strongly I can reconstruct the whole thing didactically, so that I can still convey the essentials of it. [...] For projection, for example, I don't use mathematical models, but rather simple experiments. Look, wrap the globe in paper [...]. You'll notice that it wrinkles, it folds ...’* (DUE_01, item 30).

In addition to the thematization of teaching, or of the teaching of how to teach, on a purely content-related level (preparation, adaptation, application and diversification of the learning materials), or the exploration of technical possibilities, weightier socio-political issues of responsibility, inequality etc. play a considerably more important role for our interviewees: *‘Our student teachers ultimately shape future teachers, who then shape the next generations. On this level, I think we have to make them aware of the responsibility they have and the responsibility we have as lecturers. And at this level, I think things have to be addressed even more intensively’* (KOE_04, item 57). Respondent DUE_01 also emphasizes the great potential of teachers to effect transformation: *‘I find the potential of teachers to shape and thus to participate very high. And that's why they should be given a lot of information on [...] their integration into society, their integration into the lives of the pupils, and also the significance of their own actions for the future of the pupils’* (DUE_01, item 82).

Great potential for social change is also attributed to Geography lessons at the content level: *‘What should cities look like? How should they be designed? The issue of gentrification. Are these processes that one should welcome, or which one should actually fight against? Sustainable urban development, climate change and so on. So what actually is one's own narrower position on this, because I think it is very important that teachers are aware of what their own opinion actually is. Otherwise this implicit, unconscious influence on the pupils will be much greater, because they don't have this reflection process at all. So they don't even know, ‘ah yes ok, I have such and such an attitude to the topic, so perhaps I have to be a bit careful how I present this in school now, so that there is the possibility for the pupils to develop their own opinion’* (KOE_01, item 35).

Another topic triggered by the Covid-19 pandemic is responsibility with regard to (social) inequalities within a school class or learning group: *‘I think that we are actually coming to the keyword of ‘maturity’. I think it is very important for education to take these risks [note: the risks from excessive online teaching in the pandemic] that I have just mentioned [...] and to deal with them. That means not only to include the social distancing that is connected with it, but also the distancing between the pupils and the learning material and the learning contents that is implied by this kind of teaching or instruction. That is, that one also continues to critically observe [these forms of distancing] and to teach how to handle them correctly’* (FFM_04, items 53–55). The interviewee goes on to say that heterogeneities and inequalities among pupils were further increased by the pandemic – through unequal access to equipment such as laptops, due to a lack of socio-economic support, but also through inequalities of a cognitive nature, or the lack of support within the family network.

5 Discussion

It is clear from our interview material that the area ‘teaching of competences to use geomedial maturely’ was the most frequently addressed. Without equating frequency with ‘importance’,

this focus is probably due to the role and corresponding responsibility of our interview partners as university lecturers. Furthermore, the willingness to use geomeia and to reflect on their implications on a technical, socio-technological, complex or cross-sectional level is strongly linked to general digitization-related competences.

The conceptual understanding of reflection/reflexivity shown in the interviews largely covers all areas of the dimension as we define it, but not to the same extent for all individuals. Reflection at the basal technical level is consistently seen by all respondents as the questioning of an object area (e.g. the technical functioning of a specific tool), and as a process of examining the potential possibilities of use in the classroom. On the level of constructions of meaning and discursive negotiation possibilities of and with geomeia technologies, reflection is equated with potential inclusion and exclusion processes. Here, breaking down the concept results in a strong reference to the concept of participation as fundamental empowerment. Reflexivity (on a complex socio-technological level) is often verbalized in terms of the responsibility of future teachers to question their own role (in the form of a certain position of power) and their own actions.

In the teaching of competences to use geomeia maturely and the specific development of competences in higher education and subsequently in school education, two basic approaches can be identified: one is implicit support, and the other is explicit training. Explicit training means purposefully addressing the processes of maturity-oriented geomeia competences and highlighting reflection/reflexivity as one such area of competence. In contrast, implicit fostering means questioning a topic or a way of acting without thematizing the processes of reflection/reflexivity themselves. Different tools and methods, for example portfolio work or observation sheets, can be used for both approaches.

Overall, it can be seen that the competences required to teach competences to use geomeia maturely and to teach teaching-related geomeia competences are strongly linked to the extent of one's own competences in using geomeia maturely and of one's own maturity-oriented competences beyond geomeia. Additionally, the characteristics of maturity-oriented geomeia competences at the various levels are co-determined by the specific research interests and thematic focus of the particular university locations in this study. These competences are thus strongly linked to the individuals and their involvement at a micro-level in certain research topics and focuses of work.

Acknowledgements

The project on which this article is based was funded by the Federal Ministry of Education and Research under the grant number 16DHB3003. The authors are responsible for the content of this publication.

The authors thank the anonymous reviewers for their valuable comments and Mary Rigby for her incredible support with language issues.

References

- Adorno, T. W. (2015). *Erziehung zur Mündigkeit. Vorträge und Gespräche mit Hellmut Becker 1959-1969* (25th Edition). Frankfurt: Suhrkamp.
- Aebli, H. (1980). *Denken, das Ordnen des Tuns*. Stuttgart: Klett-Cotta.
- Brendel, Nina. (2018). Reflexives Denken im Globalen Lernen fördern. Eine qualitative Studie zu Weblogs im Geographieunterricht. *Zeitschrift für internationale Bildungsforschung und Entwicklungspädagogik* 41 1, 10-16. URN: urn:nbn:de:0111-pedocs-189523 - DOI:10.25656/01:18952
- Fuß, S., & Karbach, U. (2019). *Grundlagen der Transkription. Eine praktische Einführung*. Opladen: UTB.
- Gryl, I. (2009). *Kartenlesekompetenz. Ein Beitrag zum konstruktivistischen Geographie-unterricht*. Wien: Institut für Geographie und Regionalforschung der Universität.
- Gryl, I. (2012). Reflexive Geomedienkompetenz. Theoretische Fundierung, bildungskonzeptionelle Ansätze und empirische Ergebnisse zur Rolle der Geographielehrenden [PhD Thesis]. Universität Koblenz-Landau.
- Gryl, I., Jekel, T. (2012). Re-centering geoinformation in secondary education: Toward a spatial citizenship approach. *Cartographica* 47, 1, 18-28.
- Gryl, I. & Kanwischer, D. (2011). Geomedien und Kompetenzentwicklung. Ein Modell zur reflexiven Kartenarbeit im Unterricht. *Zeitschrift für Didaktik der Naturwissenschaften (ZfDN)* 17, 177-202.
- Harley, J. B. (1989). Deconstructing the Map. *Cartographica*, 26, 1–20. <https://doi.org/10.3138/e635-7827-1757-9t53>
- Horz, H., & Schulze-Vorberg, L. (2017). Digitalisierung in der Hochschullehre. *Konrad Adenauer Stiftung e. V. (Ed.), Analysen & Argumente: Digitale Gesellschaft*. Ausgabe 283, Nov. 2017 (pp. 1–12). Berlin: Konrad-Adenauer-Stiftung.
- Jekel, T., Gryl, I. & Schulze U. (2015), Education for Spatial Citizenship. In Muniz-Solari, O., Demirci, A. & van der Schee, J., *Geospatial Technologies and Geography Education in a Changing World*. Tokyo: Springer, 35-49.
- Kuckartz, U. (2022). *Qualitative Inhaltsanalyse. Methoden, Praxis, Computerunterstützung (5. Auflage)*. Weinheim: Beltz Juventa.
- Lehner, M., Pokraka, J. & Gryl, I. (2019): From ‘the map’ to an internalized concept. Developing a method of deconstruction as praxis for reflexive cartography. *GI_Forum* 2, 194-205.
- Schulze, U. (2021): *DiGeo-Ergebnisbericht UAP 1.1, Studiengangs- und hochschulspezifische Anforderungen an das digitale Fachkonzept, Analyse curriculare Dokumente*. With the collaboration of H. Atteneder, M. Lauffenburger und S. Wolff-Seidel. Unpublished version, Status of editing 30.04.2021.
- Schulze, U., Gryl, I. & Kanwischer, D. (2015). Spatial Citizenship education and digital geomedias: composing competences for teacher education and training. *Journal of Geography in Higher Education*, 369-385. DOI: 10.1080/03098265.2015.1048506
- Schulze, U., Kanwischer, D., Gryl, I., & Budke, A. (2020). Mündigkeit und digitale Geomedien— Implementation eines digitalen Fachkonzepts in der geographischen Lehrkräftebildung. *AGIT - Journal Für Angewandte Geoinformatik*, 114–123. <https://doi.org/10.14627/537698011>.