education sciences

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Teaching Written Argumentation to High School Students Using Peer Feedback Methods—Case Studies on the Effectiveness of Digital Learning Units in Teacher Professionalization

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Abstract: Fostering argumentation competences in geography classrooms is critical from both a language-aware and content-complexity perspective. Peer feedback can be a successful method for geography teachers to successfully promote written argumentation skills in the (political geography) classroom. The peer feedback method has many empirically verified advantages in educational research and is also successfully used in bilingual education. To ensure that future teachers have verified methods at their fingertips, geography education is in demand by dealing professionally with OERs. The paper examines the extent to which a group of student teachers (n = 16) can be professionalized through an OER unit in how they use peer feedback methods to foster (written) argumentation competence in their future pupils. The research question of the paper is to what extent and in which areas does the OER unit improve the teaching competencies of student teachers in the area of promoting the argumentation competencies of their future students with peer feedback methods? This study provides highly relevant impulses for the future implementation of language-aware professionalization of geography teachers using digital learning units.

Keywords: social sciences; geography; argumentation; peer feedback; language awareness; OER; digital media; professionalization

Citation: Morawski, M.; Budke, A. Teaching Written Argumentation to High School Students Using Peer Feedback Methods—Case Studies on the Effectiveness of Digital Learning Units in Teacher Professionalization. *Educ. Sci.* **2023**, *13*, 268. https://doi.org/10.3390/educsci13030268

Academic Editor: Youmin Xi

Received: 12 December 2022
Revised: 8 February 2023
Accepted: 23 February 2023
Published: 2 March 2023

1. Teaching Didactic Skills to Promote Students' Argumentation Competences in the Context of Higher Education Teaching

Geography can be seen as a subject of the future as it addresses the massive challenges of the 21st century such as the climate crisis, sustainable resource use, urban development or migration. In connection with the teaching of these topics in class, it is of great importance that the students acquire argumentation skills in order to be able to form their own opinion on the topics, to support it with correct evidence and to be able to argue convincingly. These competences creates the basis for them to participate as responsible citizens in democratic societies in the decision-making process to solve the problems of the future.

In order to promote students' argumentation competences in geography lessons, future teachers should be taught suitable didactic methods during their teacher training. In this context, the focus of this article is on the method of peer feedback, which has been shown in previous studies to be particularly relevant for promoting the competences to assess argumentation and to improve one's own argumentation [1–5].

The research project highlighted in this article is anchored in the "Digeo" project (https://www.ilias.uni-koeln.de/ilias/goto_uk_cat_3758292.html (accessed on 2 December 2022). The joint project "DiGeo" is dedicated to the development and application-related research of a digital subject concept for building up competence in the responsible use of digital geomedia in geography teacher training. In the course of the 36-month joint project at the universities of Duisburg-Essen, Frankfurt a. M. and Cologne, exemplary

digital learning formats were developed and tested as open educational resources (OER). The University of Cologne took on the part of dealing with the need to professionalize student teachers in the area of language-aware teaching and specifically the promotion of argumentation skills in students.

Our article examines the extent to which a group of student teachers (n = 16) can be professionalized through an OER unit in how they use peer feedback methods to foster (written) argumentation competence in their future pupils. The research question of the article is:

To what extent and in which areas does the OER unit improve the teaching competencies of student teachers in the area of promoting the argumentation competencies of their future students with peer feedback methods?

First, this article presents basic theoretical assumptions in the field of argumentation research (in geography education) and education and language research on peer feedback, which were the basis for the competency model created to assess the impact of the OER unit. Then, the development steps to the competence model are made clear, which is to be regarded as the basis of the methodical survey. Then, the article describes the structure of the OER. Based on the competency model, empirical procedures and the results are described. These are discussed and placed in a larger framework in terms of an outlook for geography didactics and teacher education.

2. Teaching Argumentation with Peer Feedback

2.1. Argumentation as Part of the Language Aware (Geography) Education

To ensure that linguistic heterogeneity in classrooms does not have an institutionally discriminatory effect on students, teaching must be language aware. Especially in geography lessons, this means that student teachers need to learn how to support their future pupils linguistically in such a way that they acquire (subject) language skills—such as argumentation—to be able to participate in social discourses. Furthermore, it is about the pupils' ability to better understand societal problems and to formulate and develop solutions (see e.g., [6–8]). Being able to act competently in (subject-specific) language is an important step towards equal maturity in society. Especially the educational developments in the context of the corona pandemic show that students who speak languages other than the institutional target language at home and/or have learned it as a second language and/or come from socially disadvantaged families are now likely to have a greater need for (technical) language support due to the lack of face-to-face instruction. Pupils from these milieus already show crucial deficits after summer vacation without face-to-face instruction once they start school (see also [9,10]). Future teachers need to be aware of that issue and they need to be competent in the teaching methods to deal with this situation.

Legislating curricula and reforms share a fundamental belief in the beneficial and anticipated effects of argumentation (e.g., [11–13]). Educational research places the following findings as the expected positive benefits of argumentation in the classroom. Argumentation is considered to be a way of constructing specific knowledge and refers to individuals' epistemological beliefs [14–16]. Argumentation is related to informal reasoning mechanisms that become activated only through the practice of argument [17,18]. Argumentation is connected to critical thinking [19] and people learn better when they argue [20,21]. A number of German Ph.D. theses have shown students' argumentation skills are crucial for understanding spatial conflicts [22], problem solving [23] and complex systems [24] and that they have an important impact on civic and sustainable education [25]. An overview regarding all benefits of argumentation can be found in [26].

2.2. Argumentation Theory Used for the Competency Model for Evaluating Student Teachers' Performance on Lesson Planning for Promoting Argumentation Competence with Peer Feedback

In the following paragraph, the fundamental theory that has been used to construct the instruction parts of the OER unit on teaching argumentation with peer feedback methods for the student teachers is illustrated, as well as the competency model.

It makes sense to start by saying that argumentation—as understood here—refers to the process of presenting, supporting and evaluating claims in order to persuade or convince others. There are different approaches to understanding argumentation [27]. The Toulmin model [28] consists of three main parts: the claim, the grounds and the warrant. The claim is the statement or position that is being argued for, the grounds are the evidence or reasons that are used to support the claim, and the warrant is the principle or assumption that connects the grounds to the claim.

Education policy-wise argumentation is legitimized on a number of levels. In US settings, according to the American National Science Education standards, argumentation is among the main requirements of scientific inquiry for Grades 5 to 12 [11]. In the European Parliament's recommendation of key competences for lifelong learning [13], argumentation skills are included in three of the eight key competences presented in the reference framework. In German national standards for geography education, argumentation is highlighted as a central element of the competence areas for communication and evaluation [12]. All legislating curricula and reforms share a fundamental belief in the beneficial effects of argumentation.

These effects result from several perspectives, such as the assumed relationship between argumentation practice and conceptual change, because through argumentation meanings are negotiated, solutions are coconstructed and the epistemic status of concepts is changed [4].

Because meanings are negotiated, solutions are coconstructed and the epistemic standing of concepts are altered through argumentation, these consequences are the outcome of various viewpoints, such as the assumption that argumentation practice leads to conceptual change [1]. As a result, argumentation is viewed as a method of creating specific knowledge [1–4] and it pertains to people's epistemological ideas [14–16]. Argumentation is connected to informal reasoning processes that can only be engaged by engaging in argument [17,18]. People learn better when they debate (Kuhn, 2005), and argumentation is tied to critical thinking [4,20,21].

According to a number of German Ph.D. theses, students' reasoning abilities are essential for understanding spatial conflicts in geography, for problem solving and for understanding complex systems, as well as for civic education and learning about sustainable development [25]. All curricula-building processes and reforms have also involved extensive competence discourse, yet these discourses lack (interdisciplinary) distinctive definitions and understandings of what argumentative competence and its constituent skills actually are [29].

This conversation has often focused on what students should be able to perform after a specific grade rather than what should be taught to them in terms of content. The broad consensus is that the purpose of argumentation is to convince a partner in an encounter to agree with the expressed position by supporting or refuting a critical thesis [30,31]. How argumentation competence can actually be developed and assessed is crucial to our work on argumentation as a geographical literacy strategy, and it includes peer feedback as a means of constructive criticism to improve students' written argumentation skills.

Argumentation as a form, a method and a goal are the three basic definitions of what argumentation is and how it may be evaluated, according to [29]. According to the definition of an argument's structure or form, an argument is a unit of reasoning in which one or more propositions, or the premises, are joined to support a different statement, or the conclusion. Here, Toulmin's role of warrant has been honored, and it only becomes explicit when the producer needs to make warrants clear or when the argument is being contested [29]. It is important to pay close attention to the dialogical features of the argument, including the application of reasoning in a context, when defining an argument or argumentation as a technique or strategy [32].

Argumentation as a process involves and takes into account the full person as well as his or her context, i.e., taking into account the specific conditions in which the argument is used [33]. It has been confirmed that Kuhn's description of the four main argument skills—

argument construction, justification, counterargument construction and refutation—applies to both interpersonal and intrapersonal contexts (e.g., [34–39]). These results support the hypothesis that all argumentation, even that stated in writing, is dialogical [40].

Therefore, argumentative writing is specifically understood in this context as a social, affective and cognitive process of problem solving that depends on and is influenced by factors such as task context, audience, structural and content prior knowledge, topic, writing goal and motivation [41–43]. The grading of structural completeness is the most popular method used to examine the interdisciplinary quality of argumentation, such as in structural competency models [44]. Toulmin's argumentation model [28] distinguishes between evidence, justifications and conclusions and is applied here as a framework.

There is therefore a general consent to understand argumentation as a means to solve problems by confirming or disproving a critical thesis in order to, by logical reasoning, obtain the partner of interaction to approve the represented position [11,29,31,45]. Garcia-Mila and Gilabert [29] came to the conclusion that from an educational point of view, argumentative competence can be classified into three main meta-knowing competence dimensions, mainly inspired by Kuhn [46–48]. These dimensions are the metacognitive assessment mode, to which the criteria of structure, conceptual quality and epistemic quality are applied; the meta-strategic mode, composed of the presence or type of a specific argument element and the preference or avoidance of specific discourse strategies-genres; and the epistemological mode, expressed through two main types of criteria, those related to the nature of the argument and those related to the fulfillment of an additional goal, such as collaborative learning or problem solving. Kuhn's' description of the main argument skills—that is, argument construction, justification, counterargument construction and refutation—has been confirmed in both interpersonal (e.g., [37,39,46,49]) and intrapersonal contexts (e.g., [34–36]).

These findings add strength to the assumption that all argumentation is dialogical [40] including the one expressed here in written form. In that case, the form consists of the (imaginary) appearance of an interlocutor who represents the opposite position. Specifically, argumentative writing is therefore understood here as an epistemic and strategic process of problem solving, which depends on and is influenced by social, affective and cognitive factors, such as the context of tasks, recipients, the structural and content prior-knowledge, the topic, the intention of writing and motivation [41–43].

The quality of argumentation is interdisciplinary and is most commonly analyzed using the grade of structural completeness, e.g., by structural competence models [44] (overview in terms of systematic meta-analysis in: [50]). Toulmin's model [28] for argumentation differentiates between data, warrants and conclusion and is used as a framework, including here. However, the quality of these elements can only be assessed by the different, subject-specific background of the subjects. Consequently, subject-specific criteria also have to be considered. For a qualitative approach and analysis of argumentation, we therefore need to take a closer look at the subject-specifics of argumentation, such as content, questions, issues, evidence and criteria of quality and how they appear in the subject of geography.

2.3. Argumentation in Geography Education

In geography education, argumentation is especially relevant since students are often confronted with issues that are relevant to their daily life, e.g., questions of consumerism, sustainability or urban planning. Opinion making and participation in social processes of negotiation within socio-scientific issues (also see [51,52]), e.g., the usage and distribution of resources and spaces, are primary goals of geography education. Furthermore, it is a widely held view that intellectual skills can only be identified and/or nurtured in contexts in which students are engaged in the acquisition of rich and authentic subject matter, which geography offers plenty of [12,53,54].

Argumentations in geography are commonly open-ended with multiple solutions and norms in addition to facts. If students argue, for instance, about a central urban planning

issue or sustainability, they can also refer to norms as well as scientific hard facts. In the context of the subject and according to different criteria, argumentation can therefore be identified as qualitatively high or not. These criteria are the consideration of spatial perspectives, a multiperspective analysis of different actors and time frames and a complex justification based on different geographically approved media, which basically refers to sources that are credible and trustworthy [50] (p. 275). Socioscientific argumentation can therefore be seen as differing from scientific argumentation since scientific argumentation is "the connection between claims and data through justifications, or the evaluation of knowledge claims in light of evidence, either empirical or theoretical" [34] (p. 10f) while socioscientific argumentation depends not only on knowledge of science but also on the application of moral and ethical values and personal identity (i.e., [55–58]). In order to develop qualitatively high argumentation products, students need to acquire skills that enable them to evaluate argumentations in different contexts. Furthermore, they need transferable knowledge concerning the general structure and form of arguments, subject-specific knowledge and awareness of the subject-specific criteria of argumentation. Eventually, they need knowledge of the required means of subject-specific language in order to formulate qualitatively appropriate argumentation in the subject. This kind of technical language and technical content criteria of good argumentation can, according to our thesis, be excellently practiced with peer feedback methods among students. It is important at this point to make the reference to the competency model "Promoting argumentation with peer feedback" (s. Table 1). The theoretical foundations here were used to classify the threshold values and competence areas of the model, such as in the area of the addressee orientation of argumentation or the classification of quality criteria of good argumentation in terms of content.

Table 1. Areas of the competency model "Promoting argumentation competence with peer feedback methods".

Knowledge Type	Areas of Knowledge (Competency Area)	Exemplary Expectation Horizon: Student Teachers Know about the Following Potentials, Pros and Cons of the Method Peer Feedback
I General didactic knowledge about the use of the method	1. Determination of learning objectives by the student teachers for pupils in the geography classroom using peer feedback	• pupils get to know advantages/disadvantages of the method • pupils learn to read and register the details of a (geographical) text (be it their own text or that of their partners) (subject competence, reading competence, communication competence) • pupils experience sustainable acquisition of further technical language skills (textual competence, communication competence) through deeper engagement with the text through the feedback task • pupils learn how to formulate constructive feedback appropriately and how to communicate it profitably in the long term (communication competence) • pupils learn methods and procedures for peer feedback and can use it successfully in a variety of ways • pupils can use different media (e.g., Word) appropriately in order to formulate profitable feedback in a way that is suitable for the target group • pupils learn how to respond to feedback (e.g., communication skills)
	2. Knowledge about the feedback sheet for implementation of the method peer feedback	Student teachers know (that): • the structure and content of the peer feedback sheet and can determine its didactic usefulness • media should be used judiciously and profitably (e.g., Word) • the meaningful combination of oral and written feedback should also be presented and explained orally in an addressee-oriented manner • addressee-oriented constructive criticism should be combined with concrete suggestions for improvement • the criteria of the feedback sheet for argumentation should be observed/learned • feedback (constructive criticism as well as praise) is concretely justified • students refer to the most relevant points of their feedback (reduction)

Table 1. *Cont.*

Knowledge Type	Areas of Knowledge (Competency Area)	Exemplary Expectation Horizon: Student Teachers Know about the Following Potentials, Pros and Cons of the Method Peer Feedback
II Practical transfer knowledge (Implementation of the method)	3. Planning: Preparation and Diagnosis	Student teachers can: • prepare the use of the feedback sheet in a meaningful way in class (e.g., formulate relevant tasks, have students write appropriate argumentative texts) • use the peer feedback sheet in a meaningful way in class (e.g., form appropriate groups, adapt the sheet to the learning group, moderate the process) • meaningfully organize the debriefing of the peer feedback phase (e.g., discuss the criteria for the assessment of argumentative texts, reflect on the method)
	4. Planning: Implementation & Transfer	Student teachers mention that: • the criteria of good feedback should be discussed in the geography classroom • the feedback form must be discussed step by step, questions must be possible and students must be able to give examples • pupils must have learned how to write a good argumentation text (model text) and must be provided with support materials (scaffolding) if necessary • the use of media and platforms must have been explained transparently (e.g., google docs, QWIQR) • time phasing must be appropriate and transparent

2.4. Benefits of Peer Feedback

Feedback, in the context of argumentation, refers to the process of evaluating, commenting on and making suggestions to improve an argument. Feedback can be used to identify weaknesses in an argument, such as missing or inadequate evidence, and can also be used to identify strengths in an argument, such as clear and logical reasoning.

Feedback helps to identify if the warrant is logical and if the evidence used as grounds is relevant and sufficient to support the claim. For example, consider the following feedback statement: "The evidence you've provided to support your claim is not strong enough. You need to find more credible sources and include more data to strengthen your argument." This feedback statement addresses the warrant, or the principle of evidence that is used to connect the grounds to the claim and it suggests finding more relevant and credible sources to support the argument.

In the OER training unit, we used peer feedback to professionalize student teachers in this method so that they can competently support their future students in the area of argumentation. Peer feedback is a method that allows students to mutually review their language product on the basis of a feedback sheet or guideline and give feedback to improve their product in a best-case scenario. In empirical teaching research, peer feedback in this context can be referred to as cooperative writing to promote textual competences [59].

The peer feedback method presented here in the OER has collaborative elements since collaborative learning can be viewed as the process of engaging in a mutual discussion or as the shared engagement of people in an effort to solve a problem—in this case, creating a better, more criteria-approved argumentative text.

International research into science education considers the intensity and complexity of negotiations of students in the interaction as crucial factors, which influence the quality of mutual students' feedback and collaboration regarding the improvement in argumentation or argumentative texts ([1] (p. 30f.), [2] (p. 245f.). Berlan and Hammer [60] highlighted that students refer to their argumentation in different ways to achieve certain functions and goals in order, for instance, to win a discussion, exchange ideas or be able to act in a flood of "fake news". Evagorou and Osborne [55] (p. 21f.), who analyzed collaborative

methods for argumentation within socioscientific issues, mentioned similar results. The more intensely a team was focused on the issue of the debate, the higher quality the mutual feedback tended to be in terms of oral and written argumentation. The students' ways of contextualization and the intensity of interaction are crucial and was an essential element of the construction of this case study.

The effects of peer feedback in geography are still unknown in research. However, the (positive) effects of peer feedback in educational contexts of teaching language and writing are well analyzed. An important result is that peer feedback as a student-centered method is already efficiently implemented in content and language integrated learning (CLIL) settings [61,62]. In a symbiosis of content and language learning, peer feedback is used to improve more complex textual skills, such as argumentation [62,63] (p. 7). Research into language teaching found a number of positive effects of peer feedback, for instance, when considering influencing factors such as adequateness (for a deeper review: [64]). Moreover, Diab and Zhao [65–67] identified a couple of advantages that peer feedback has over other types feedback forms. For instance, such feedback is especially helpful for students who struggle with teacher/expert feedback or self-learning. Diab [65] further detected that peer feedback is relevant in order to overcome "common errors" in language, which are therefore difficult for pupils to eliminate. Berggren, Lundstom and Baker [68,69] identified that even feedback givers gain from such feedback because they become more aware of textual components and structure as well as the addressing of a recipient due to the feedback process.

In this regard, Morawski and Budke [5] additionally showed in their analysis what distinguishes successful peer feedback teams from less successful peer feedback teams in a class: The profitable team had a different opinion and had predominantly more speech acts with textual reference and justifications [64–67]. They discussed sources or called source references in need of improvement [55] and always discussed evidence and the execution of their own opinion, i.e., interpretable aspects. They also had fewer contradictions in the teams that were accepted uncorrected. Low-benefiting teams used less individualization, i.e., improvement was mentioned, for example, even if the point was there and were more often of the same opinion. They left more feedback statements in the sheet and text and did not address them. There was also more purely listed criticism instead of appreciative negotiation and joint discussion [5]. These reflection points were also taken into account in the instructional tone through the learning unit here.

3. Methods: Using Peer Feedback to Teach Argumentation in High Schools: Developing an OER Unit and a Competency Model for Student Teachers Training in Geography

By way of introduction, the methodological elements (mixed methods approach, [70]) that played a role in the project are outlined here.

1. On the basis of the experiences of university didactics and the teaching experiences at the schools, the researchers created a course unit to professionalize students of the teaching profession in the area of argumentation competences in political geography, among other things. The students should learn the method peer feedback so that they can use this method later with their students in order to use argumentation competence with their later students.
2. Parallel to the creation of the learning unit, a competency model was developed in the process to operationalize which competencies students need to successfully use from the peer feedback method in the classroom to promote argumentation competencies.
3. A pre- and post-test was created to measure learning gains and changes in students' self-assessment and self-reflection related to their use and engagement with the OER unit. This measured exactly these aspects through open and scaled questions and answer schemes. This will be explained in more detail later.
4. The answers were analyzed quantitatively if nominally scaled or ordinally scaled. The open-ended questions were evaluated by using a content-summarizing content

analysis according to [71,72]. For this purpose, different raters related the students' answers to the competency model. Through operationalized scoring in the model, the students were able to be assigned points as an evaluation by consciously assigning statements to the model. This made it possible to give statements about the students' self-assessment, reflection and formulated skills (statements about methodological didactic content) both before treatment through the OER unit and afterwards. The individual steps are explained in more detail below.

3.1. Development of a Digital Learning Unit (OER) to Support the Didactic Skills of Student Teachers to Promote the Students' Competences to Argue with Peer Feedback

The OER approach here follows the (competence-oriented) expert approach (e.g., [73] (p. 61), [74] (p. 61)). This approach considers teachers as experts who are particularly successful if they possess high competencies in different areas of competence—in this case, a more professional view on the possibilities to teach argumentation with peer feedback methods. The basic assumption here is that the (successful) work of teachers is based on the knowledge and skills that are gained in theoretical and practical phases of training and then further developed through professional experience. That expertise approach has been applied to the teacher professionalization (cf. et al. [75–77]). This application has generated much resonance in research on the teacher so that there is also talk of the "expert paradigm" in teachers, and teaching research is spoken of. The paradigm of the teacher as an expert is being replaced in classroom research by the so-called "personality approach" and the "process-product paradigm" and from the "process-product paradigm" [75–78]. In our example, we focused on students of geography, i.e., on the training phase.

The OER unit was conducted in a seminar for bachelor student teachers for the teaching profession at high schools at the Institute of Geography at the University of Cologne in Germany. The seminar was entitled "Digital Geomedia and Argumentation". It is important to note that these students usually have little to no practical school experience at this stage of their studies because they have not yet had to complete any mandatory internships or practical semesters. This makes it all the more interesting to survey the extent to which students consider themselves competent to implement certain methods in practice.

The OER unit has been developed with material such as texts and support material (scaffolding) such as model texts, animation videos, explanatory videos, visual assignment tasks and different task formats (interactive and multiple choice) and layout suggestions for the lesson drafts (also see: 3.2). Readers will find the OER unit under the following link: (unfortunately, so far it is only in German, and a translation is in the works: https://www.ilias.uni-koeln.de/ilias/goto_uk_lm_3883496.html (accessed on 2 December 2022).

Niewoudt [79] found that academic success is increased when students are provided opportunities for synchronous and asynchronous participation in class. Offir, Lev and Bezalel [80] mentioned that the presence of a teacher–student interaction that accompanies the learning process is very important to all learners despite asynchronous formats. These studies recommend an effective mix of diverse activities. Following these foundations, the OER unit in the project was developed. The two focal points of an upstream self-learning unit and a student-related application task to be presented (teaching project) were crucial. The OER is divided in the following chapters: I Input: Potentials of peer feedback for fostering argumentation skills; II Input: Research on Peer Feedback; III Input: Use of the Peer Feedback method in the classroom; IV Application; V Reflection. Students were guided through different steps and also received the solutions in this format after finishing the interactive tasks. The results of the assignments should be uploaded on the learning platform ILIAS, which is actively used at the University of Cologne. Group assignments on the part of the students could also be conducted through the platform. Through the OER unit, the student teachers are supposed to appropriately reflect on the advantages and disadvantages of the peer feedback method with regard to their teaching project

(s. chapter V). The structure of the OER unit for professionalizing student teachers in teaching argumentation to future pupils with the peer feedback method is decisive here. Basically, the OER unit was designed as a digital self-learning unit, which was introduced by the lecturer and then reflected on in the seminar. There was also the open application task (design of a lesson) which was discussed in the seminar. Specifically, the self-learning unit had two major areas. The first area was the area of "getting to know the method" and the second area was the area of "applying the method".

3.2. Step (Chapters I–II in the Learning Unit): Input: Students Read Empirical Articles on the Importance of Peer Feedback in Promoting Technical Language Requirements (Argumentation) in the Geography Classroom

The aim here was for students to engage with the empirical and theoretical foundations of the successful implementation of peer feedback and argumentation in geography teaching and to discuss these results in interdependent cooperative as well as digital visualization methods (e.g., padlets, concept maps, role plays). The new knowledge should mainly be practiced with interactive formats. For example, one work assignment in the first chapter of the unit was (translation of the task in Figure 1):

Figure 1. Integration of explanatory videos in the unit (screenshot).

"Please watch the explanatory video and the integrated assignments. Summarize briefly which benefits of peer feedback the teacher and the students name and to what extent the students' texts have improved. Then try to structure the potentials mentioned in the video systematically with terms such as (text competence or text quality) in a concept map."

Figure one shows how the sample task is integrated into the user interface of the OER unit. You can see the positioning within the flow of the OER unit on the left. You can see the introduction text and the integration of the video in the learning platform.

3.3. Step (Chapter III in the Learning Unit): Get to Know: Students Learn (New) Strategies for Using Peer Feedback to Promote Argumentation Texts in Geography Lessons

At this point, explanatory and animated videos played a crucial role. One teacher created videos of an exemplary lesson design in which peer feedback was used. The teacher presented an exemplary sequence of four high school lessons for students to

follow in the asynchronous OER unit. The teacher presented a checklist for successful peer feedback use in teaching argumentation. Furthermore, the videos also presented and reflected on the teaching materials used in school, as well as specific media for school use, such as google.docs, Padlet or Qwiqr. During the self-study unit, however, the students' assignments were evaluated automatically throughout.

Furthermore, in the chapter, student teachers learned about the structure of an empirically tested feedback sheet for pupils to promote argumentation skills [5]. Rapanta, Garcia-Mila and Gilabert [29] summarized three main definitions of what argumentation is and how it can be assessed: argument as a form, a strategy and a goal. An argument as a structure or form implies that an argument is a unit of reasoning in which one or more propositions, which are the premises, are combined to support another proposition, which would be the conclusion. Toulmin's function of warrant has been respected here, which becomes explicit only when the argument is challenged or when the producer needs to make the warrants explicit. Defining an argument or argumentation as a procedure or strategy calls for special attention to the dialogical aspects of argument, such as the use of reasoning in a context [32]. Finally, an argument as a process both involves and addresses the whole person and his or her context, that is, taking into consideration the particular circumstances in which the argument is used [33].

An English version was published. In the following, the top categories of the feedback sheet and the most important criteria and the tasks for the pupils integrated are briefly presented (see link: https://www.ilias.uni-koeln.de/ilias/goto_uk_cat_3758292.html, accessed on 8 February 2023). Furthermore, the feedback sheet contains formulation aids (scaffolding) to professionalize the partners' text. The smileys on the right side of the sheet can be used to assess the arguments in light of the topic, materials and grade level.

Category 1: Number of arguments:

The category is about the partner counting the number of arguments by formally checking which speech acts can be counted as arguments at all according to Toulmin [28].

Examples of a task in the feedback sheet: Number of complete arguments formulated by the partner. Complete arguments include an opinion, a proof and a validity relation that logically connects opinion and proof. These are marked in the text and then counted.

Category 2: General structure:

The category is about the partner evaluating text structural and text coherent features of the text. Examples of a task in the feedback sheet: Partner organizes and structures his/her own text. Recognizable and progressively comprehensible sections of meaning that appropriately support the intention of the presentation (introduction, main body, conclusion), e.g., through paragraphs. Partner uses structuring terms in his/her text (e.g., first; second; next; last; first) . . .

Category 3: Arguing about the conflict/problem:

This category is about the partner taking into account the geographical criteria of good argumentation in geography lessons, such as multiperspectivity, spatial and temporal references and addressee reference. Examples of a task in the feedback sheet:

Partner correctly describes the conflict/problem being argued about.

Partner correctly describes the temporal conditions of the conflict. When did the conflict arise and how did it develop in time? e.g., since MM/YYYY, there has been discussion about it; until the year YYYY, we should . . . ; until YYYY, it will be decided whether....

Category 4: Actors:

This category is about the partner appropriately reflecting on the actors in the spatial conflict and evaluating them in the argument. Examples of a task in the feedback sheet:

Partner names the relevant actors for the issue/conflict, e.g., residents, business representatives, environmentalists. Partner correctly states the positions of the actors.

Category 5: Material and material reference:

This category is about the partner appropriately reviewing sources and their linguistic references in the text and reflecting on the evidence for the arguments. Examples of a task in the feedback sheet:

Partner makes a linguistic reference to the source in his or her text. Partner compares materials and links information in a meaningful way.

3.4. Step (Chapter IV): Students Now Apply the (Acquired) Strategies for the Successful Use of Peer Feedback for Teaching Written Argumentation in One's Own Teaching Unit Design

Here, the students received further support materials, such as formulation aids for learning objectives, lesson plans, progress plans, lesson planning and tasks to reflect on linguistic requirements in geography lessons in terms of technical language (Figure 2). One focus of the reflection was on Morawski and Budke's [81] model, which specifies linguistic requirements in geography lessons. Students then presented their lesson designs and were asked here to justifiably classify the language requirements they diagnosed in their lesson plans in the model and to describe them in terms of the difficulties encountered by students.

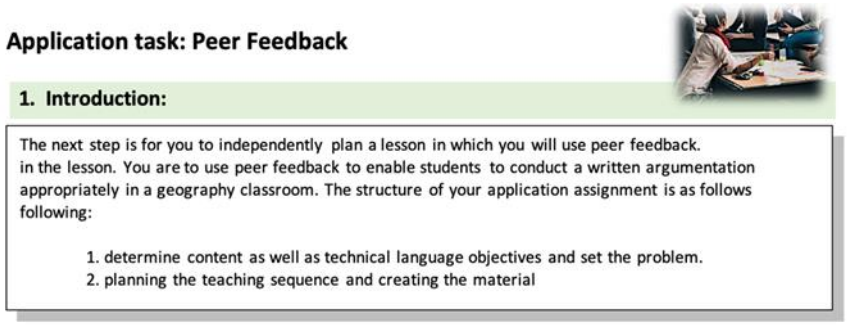

Figure 2. Introduction to the application task (screenshot).

3.5. Step (Chapter V in the Learning Unit): Students Reflect on the Learning Gain through This Learning Unit Using Innovative Methods

Based on a developed feedback sheet, the students were asked to evaluate their fellow students' lesson designs in a reasoned manner during and after the presentations. Finally, the best lesson plan was selected, and the criteria were recorded. In face-to-face sessions, the present teachers and the students discussed the tasks, and good tasks were selected on a reasoned basis using feedback catalogs (see link: https://www.ilias.uni-koeln.de/ilias/goto_uk_cat_3758292.html, accessed on 2 December 2022).

A synchronous zoom session was held to discuss the results, have discussions and reflect on the seminar. As a summary, in the teaching project of the OER unit, the students were asked to finally design a lesson for a ninth-grade class based on the peer feedback method as a culmination of the unit. The student teachers were asked to also design their own peer feedback materials in that project for their future pupils on the basis of the models provided in the OER unit. The students were further asked in that project to create their own learning unit on peer feedback. The problem question of the teaching unit as well as the content topic could be chosen by the students themselves, as well as the grade level of the class they would potentially teach. The only decisive factor was that they decided on a linguistic product/action that they wanted to consciously promote in their students through the peer feedback method. The students were supposed to constructively reflect and evaluate the method and their learning outcomes.

4. Methods: Data Collection and Analysis

Creating a competency model was intended to operationalize changes in students' competencies related to knowledge of the method peer feedback and practical use of the method, as the student teachers' products could be assessed through the model. Through the competency model, the research question "To what extent does the OER unit improve

the teaching competencies of student teachers in the area of promoting the argumentation competencies of their future students with peer feedback methods?" could be expanded into differentiating subquestions that refer to the student teachers' competences in the model including, e.g.,

1. Subject didactic knowledge about the method: to what extent has knowledge of the learning objectives that can be achieved through the use of peer review increased through the use of OER?
2. Concrete preparation and diagnosis: to what extent are students aware of the benefits and uses of the feedback sheet after completing the OER?
3. Implementation: to what extent can students meaningfully embed peer feedback into specific lesson planning after working with the OER?
4. To what extent did the competency model for evaluating the student teachers' performance on lesson planning promote argumentation competence with peer feedback?

The competency models were formulated in a dimensioned and graded form, and the expectations of the competencies of the teachers that provide school activities are that they take on a guiding function for the design of lessons and assume a guiding function for the design of instruction [82] (p. 12). The previously dominant modeling of competencies according to the areas of factual, social, methodological and personal competencies has been replaced by an acquisition of competencies that "starts with the systematic development of 'intelligent knowledge' in a domain". Here, this knowledge refers to the language-aware teaching competence using peer feedback in the domain of promoting argumentation competence [83] (p. 22).

As addressed earlier, a competency model was developed that fanned out individual competency pillars of students to place them in a competency domain to ultimately show how good they are at using peer feedback to promote argumentation in future pupils. Through the competency model, points considering the rating could be assigned to performances along certain levels and areas of competencies. Through this rating, statements could then later be made about the students' level of professionalization before and after the treatment. The competency model was developed, among other things, on the basis of the above-mentioned literature as well as the requirements for teacher training in geography in Germany. Furthermore, some cooperation partners of the Digeo project have gained practical experience in schools on language-aware teaching. The experiences of these teachers in the Digeo project in the use of peer feedback methods were also used to make the competence model valid and to develop it further. This way of bringing in diverse and concrete practical experiences to assess student teacher performance should reduce and address the criticisms of the item-based theory on which the competency model is based here [84,85].

Central in the model is the distinction in the competency model between the general didactic knowledge about the use of the method and the practical transfer knowledge for the implementation of the method in the classroom [86] (p. 15f.); [87] (p. 17f.).

4.1. Data Collection

A one-group pretest–post-test experimental case study design was used to test the influence of the OER unit on students' competences in using peer feedback to teach argumentation to high school pupils in geography (based on methodological work by [88–90]). The influence of the OER unit on the student teachers' competence in teaching peer feedback based on the competency areas in the model and the research question was measured and observed in three ways; more precisely, this refers to the investigation of the change in the student teacher's scoring in the pre- and post-test based on the competency model before and after the OER unit.

The questions were basically based on the key competencies of the competency model (see Table 1) but were specified for the test in the area of concrete teaching scenarios as well as extended by questions for self-assessment regarding one's own competence in using the method. The said test can be found at the above link (see link: https://www.

ilias.uni-koeln.de/ilias/goto_uk_cat_3758292.html, accessed on 8 February 2023). The test included questions about the self-assessment of their own competence in the use of the method, knowledge about the method itself and transfer knowledge about the use of the method, e.g., regarding the age appropriateness and the structural procedure of the use of the method in class. Furthermore, the diagnostic skills of the student teachers were asked, i.e., how they would assess pupils' abilities and how they would deal with heterogeneity in the method procedure when executed in class.

The questions on the test were intended to make the competency domains of the model operable so that conclusions could be drawn about competency enhancements based on the answers (Table 2). Examples of the questions in the pre- and post-test are shown in Table 2.

Table 2. Operationalization of the test questions.

Questions in the Test	According to Competency Area (Competency Model; See Table 1)
Which learning objectives would you formulate in a didactic commentary on a teaching unit with peer feedback and which areas of competence/skills can be promoted in the pupils with this method?	1. Determination of learning objectives by the student teachers for pupils in the geography classroom using peer feedback
What advantages and disadvantages do you see in the peer feedback method?	1. Determination of learning objectives by the student teachers for pupils in the geography classroom using peer feedback
For which grade/age group do you think the feedback sheet and method presented in the unit is suitable?	3. Planning: Preparation and Diagnosis
When in the course of a teaching sequence/series would you use the peer feedback method?	3. Planning: Preparation and Diagnosis
What factors do you think play a central role in successful peer feedback among pupils? What do students need to consider for successful feedback? What needs to be taught to pupils in order for them to give feedback successfully?	3. Planning: Preparation and Diagnosis 4. Planning: Implementation/Transfer
What concrete practical preparations do you need to make in planning before using the peer feedback method in the classroom?	3. Planning: Preparation and Diagnosis 4. Planning: Implementation/Transfer
What steps should you follow to introduce/explain the peer feedback method in the classroom?	3. Planning: Preparation and Diagnosis 4. Planning: Implementation/Transfer

In case of uncertainty, the students should also indicate what would be helpful to them, if anything, or where they themselves see concrete deficits in their teaching competences. This identification of deficits should be explained with reasons. Beyond the student feedback, these questions were intended to provide further impulses for the future professionalization of student teachers in the field in order to use the method even more effectively in the future. In addition, a master's student dealt in her master's thesis with the appropriate involvement of student feedback on the conducted OER unit.

The questions were answered anonymously and online before and after the OER unit. The self-assessment questions were made validatable with Likert scales. The questions were to be answered by students basically as if they were writing a test. So, the students were asked to write down everything they knew about the topic and how they (would) deal with the topic of argumentation and the method of peer feedback in a very practical way in class.

The tasks/questions in the test had to be answered in writing, so there was some textual data base on them. On the one hand, the texts were subjected to a qualitative content structuring content analysis in order to categorize and filter the students' problems

and deficits [71,72]. Second and most importantly, the texts and the students' statements contained therein were analyzed and evaluated and could be assessed by a rater of the test. This rater, who could build on a broad experience in using the method in practice and in training teachers in higher education, evaluated the students' statements in the test by giving the answers a rating in the competency model before and after the unit. This approach of bundling and superimposing competencies on the part of the raters to rate student statements was intended to reduce the violation of specific objectivity (in the understanding of item–response theory) to some extent [84,85]. The interrater reliability was therefore determined by comparing the congruency with the category assignments for all transcripts by the raters. The statements were then connected by an analysis strategy summarization by two researchers [71,72]. Thus, the ratings before the OER unit could then be related to and compared with the ratings after the OER unit. The teaching material developed by the student teachers was presented in the final session after the OER unit and was discussed and uploaded on the OER platform so that there was permanent access.

4.2. Qualitative Approach of Evaluating Students' Answers in the (Pre- and Post-) Test

The following two examples illustrate how the students' answers were evaluated in relation to the pre- and post-tests. First, the anonymized responses in the pretest were evaluated along the competency model (Table 1: Areas of knowledge, etc.). After the students completed the OER unit, the pretest responses were scored. After the post-test, the scores were compared. This example refers to a student's answer to the following question on the pre- and post-test:

In your opinion, to what extent are there possible disadvantages of the peer feedback method? (1. Determination of learning objectives by the student teachers for pupils in the geography classroom using peer feedback)

> *Pretest: RA21: "The method can be time-consuming, depending on the length of the text, and should therefore be used with caution. One-sided feedback can also block the method. When dividing the students into groups/partners independently, it can/will happen that they are divided according to sympathy, which can significantly limit the method."*
>
> *Posttest: RA21: "The method is time-consuming, as you not only have to create texts and have them revised several times. Here it is also necessary to be flexible to a possible lack of time. For the teacher there is a high preparation effort. In addition to the information material, a questionnaire should be created, the digital platform must be set up, as well as the expected results. If the performance level or the thought processes of the pairs are too similar, it can come to the fact that no appropriate feedback comes about, so that here on suitable differentiation must be paid attention to. Likewise, attention should be paid to the fact that problems can occur if the criteria of the feedback sheet are not understood. If the materials do not correspond to the level of the students, it can happen that no feedback is given."*

What the examples show us is that the student had a much more complex idea of what needs to be included in the planning of the teaching sequence in the post-test after the OER unit. He separates, for example, support material from the inclusion of digital media. Obviously, he obtained more points in the area of reflecting on the planning and preparation. More points could also be awarded in the scoring for the more concrete implementation because he pointed out much more concretely the difficulties in grouping students that results from different abilities. He thus addressed differentiation and heterogeneity more specifically. Further, in the post-test, he addressed the difficulties students may have with pupils. More points could also be awarded in the scoring for the more concrete implementation, because he pointed out much more concretely the difficulties in grouping students that result from different abilities. He thus addressed differentiation and heterogeneity more specifically. Further, in the post-test, he addressed the difficulties that students can have when the criteria of good reasoning are not transparent enough or

these are not addressed well enough. However, the basic data here were collected through the results of the pretest and post-test.

5. Findings

The results section first describes the overarching changes in scoring among students between the pretest and post-test. Then, individual categories from the competency model are examined in more detail. The results are divided into the area of evaluation of the treatment, i.e., to what extent did the student teachers improve or deteriorate in which competence areas after the OER unit related to the rating in the competence model.

Improvement in Scoring According to the Pre- and Post-Test

Let us start with the results regarding the evaluation of the treatment. Figure one shows the anonymized codes of the student teachers under the bars. The bars show the scores in the pre- and post-test. The top bar area shows the difference between the pre- and post-test.

It can be seen that all student teachers except one improved in the rating (Figure 3). However, the degree of improvement varied. Not all students improved equally well and there were already differences in the scoring in the pretest, from no prior knowledge to little prior knowledge. The maximum score to be achieved was 50 points.

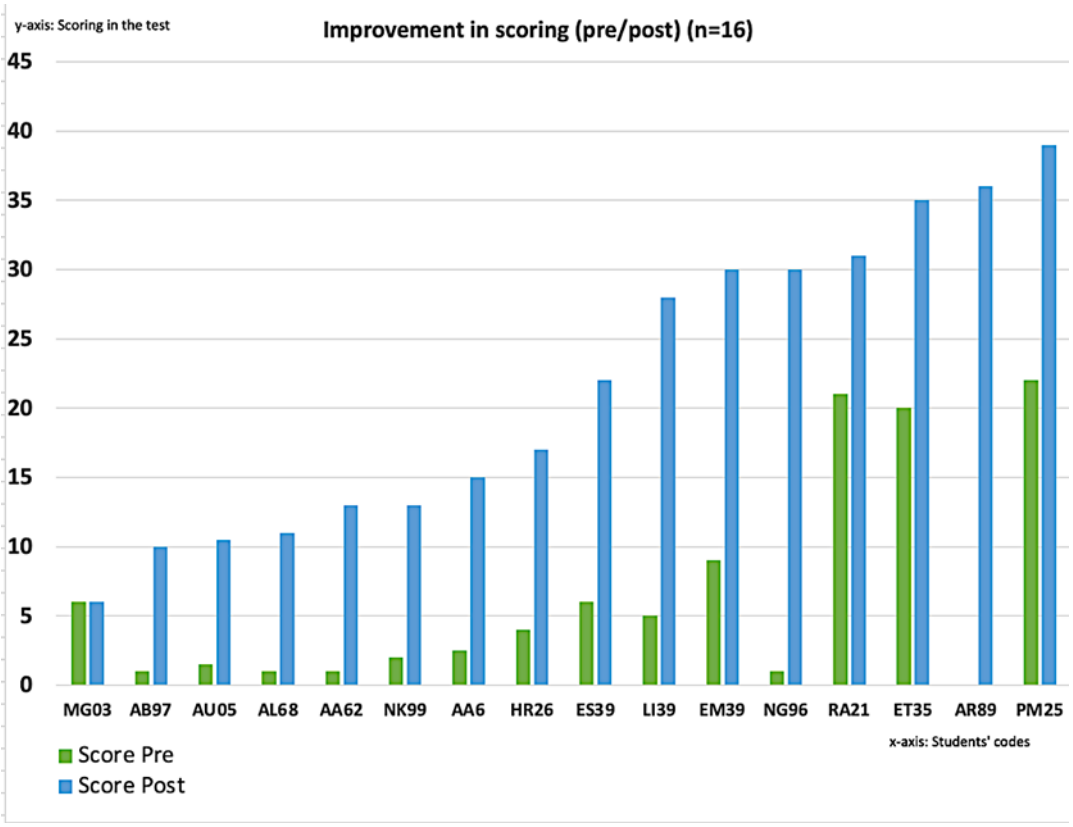

Figure 3. Improvement in general scoring pre/post (own design).

Figure 4 shows the competency areas of the competency model in which most students improved on the post-test.

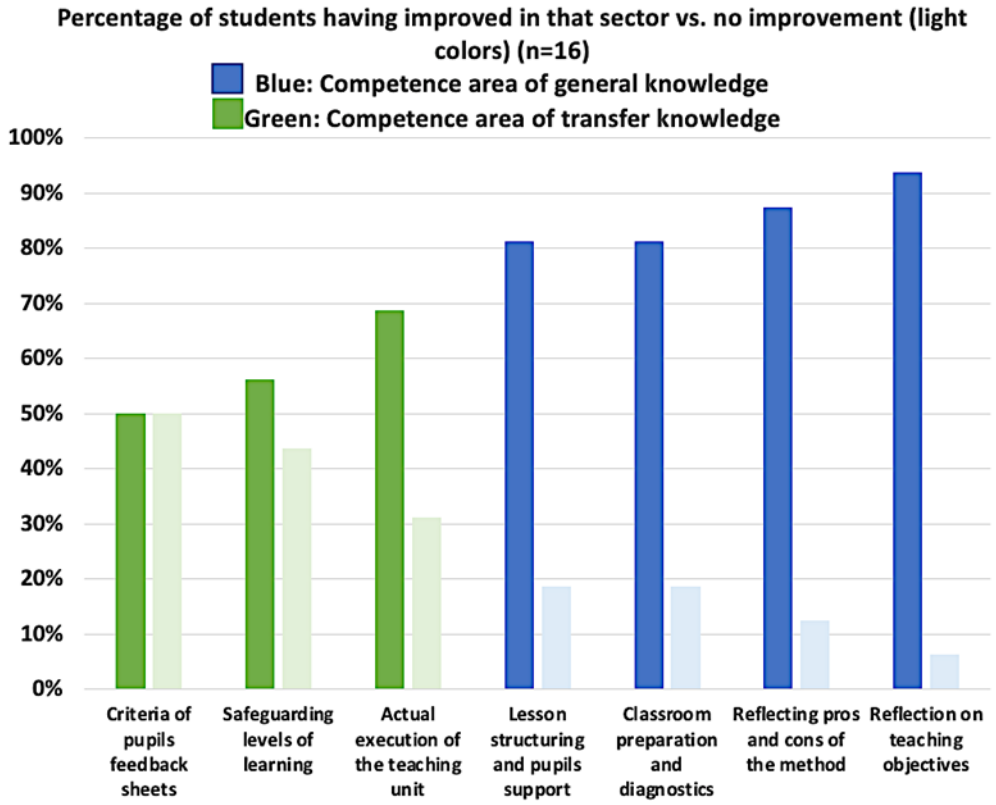

Figure 4. Improvement according to competence areas (own design).

It is noticeable that through the OER, most students could now more accurately represent and explain the competencies of the students that can be promoted through peer review and the learning objectives in the area of lesson planning. Further, most student teachers improved in reflecting on the advantages and disadvantages of the method. After the treatment, they were able to describe more precisely how they would deal with difficulties in the learning group, for example in the composition of the feedback pairs or how they can provide linguistic support. The next areas in which most student teachers improved were diagnosis, class preparation, sequence planning and student addressing in terms of reasonable explanations for instance. The following two examples illustrate student competence growth related to lesson planning and diagnosis (competency areas 3–4). These are statements from the post-test. In the pretest, they were both unable to name any answer to the following question. Now they both go into different areas such as language support and preparation as well as differentiation.

Preparation (diagnosis): What concrete practical preparations would you make in planning before using the method in class?

> *HR 26: "Students must first be comfortable with the lesson topic and writing an argumentative text so that they can confidently apply the criteria of the evaluation sheet. I would practice writing and then evaluating the argumentation often beforehand. Sample texts should make it easier to correct."*

> *AR89: "Give pros and cons, justify comments and make remarks in the text and in the feedback sheet, reduce students' inhibitions (they should be honest and also criticize), communicate with each other. Students might not take this task of giving feedback seriously enough or they might not dare to criticize. But it could also be that some students do not know how to deal with criticism, especially if it does not come from the teacher, but from someone who has not yet understood the topic. First, students need to be taught the basics before they have time to write the texts. In addition, the criteria of writing should be known."*

This means that students could express a more precise understanding of how to meaningfully arrange lessons on argumentation and peer feedback in their own teaching. The results that referred to the students' self-assessment showed that three quarters of the students assessed themselves more competent regarding the use of the method. The results from Figure 2 suggest that the improvement in self-assessment is more targeted at theoretical general knowledge. Figures 5 and 6 again illustrate the changes in scoring in the general knowledge of the method and in the area of transfer knowledge. Again, general knowledge here refers to the extent to which the students could theoretically justify the use of the method and to which they could reflect on the use with regard to theoretical advantages and disadvantages of the method. Transfer knowledge here again specifically meant answers in the test that referred to what thoughts the student teachers formulated with regard to reflecting on the use of the method in the classroom, such as how elaborated their planning thoughts related to the practical use were and which criteria they referred to from the OER unit. It is interesting to note that while more students improved in the area of general theoretical knowledge of the method, significantly more students could demonstrate any knowledge at all in the area of transfer knowledge. More than half of the students could not say anything in the pretest in the area of prior knowledge about the implementation of the method, which was not surprising if they did not know the method before. Nevertheless, the result showed that 13 students out of 16 (81%) had more transfer knowledge as a result of working through the OER unit. With regard to the general knowledge of learning objectives and competencies among the students, students in the pretest were already able to build on prior knowledge. Nevertheless, the results varied in their efficiency from a few students who did not benefit at all to the majority who made significant leaps in the competence rating

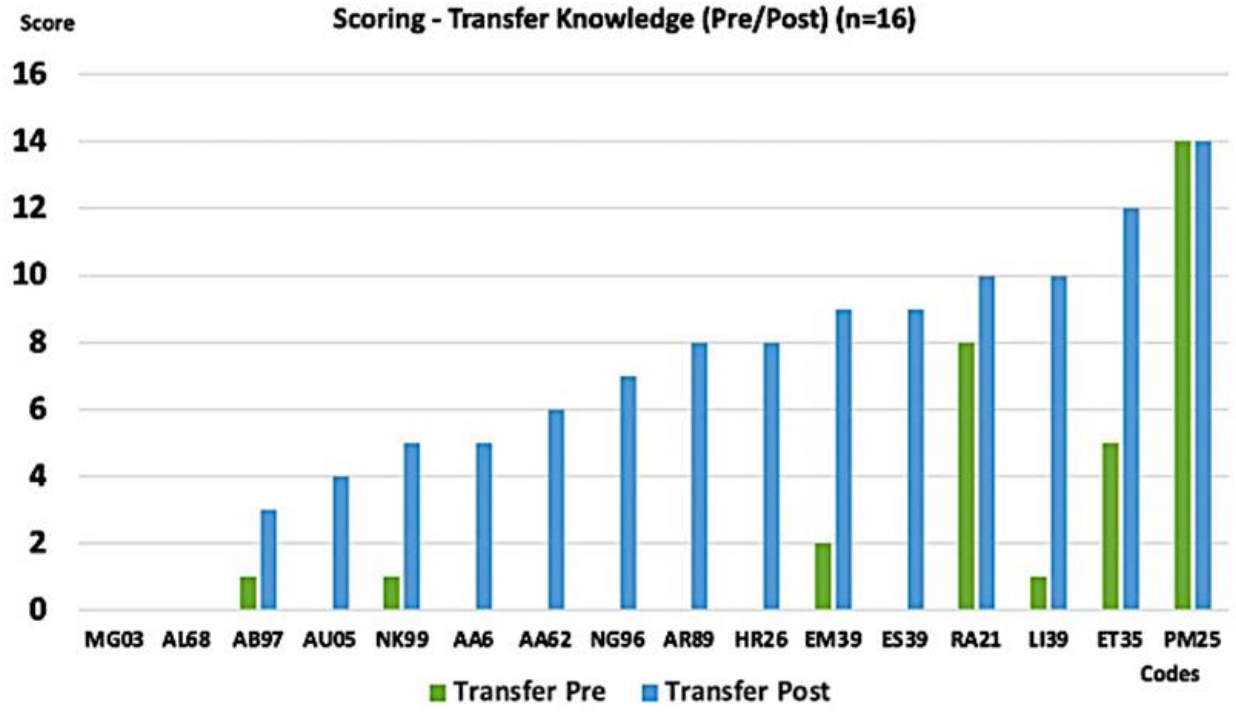

Figure 5. Change in scoring of general knowledge by students (own design).

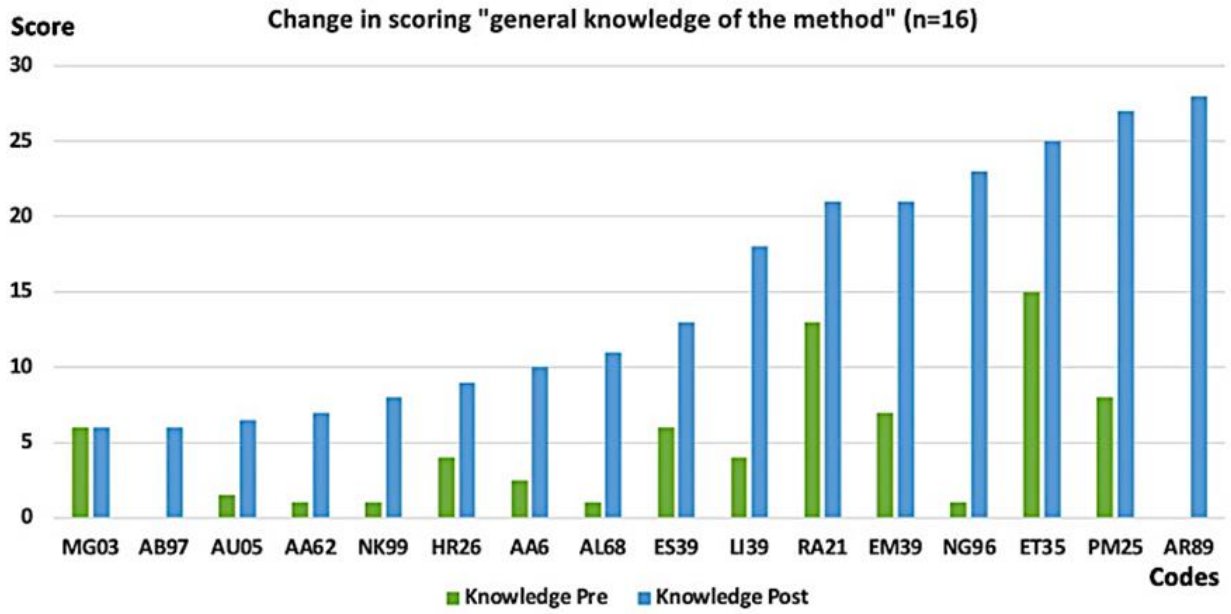

Figure 6. Change in scoring in transfer knowledge by students (own design).

Students MG03 and AL68 were unable to respond to these questions properly. Therefore, no data existed here. The following excerpts from the students' responses intended to show two things that should make the results from Figures 5 and 6 even more transparent by explaining the rating more clearly: First, in the case of student AL68, he could give clearly elaborated answers on general knowledge. The answers differed in depth and accuracy if one differentiated between transfer and general knowledge. Question: what learning objectives would you formulate in a didactic commentary on a teaching unit with peer feedback? (General knowledge).

> *AL 68: "Students can improve the following competencies via the method: Word processing skills, factual skills, assessment skills, writing skills. Students will also improve their reasoning skills by having to justify why they can use certain evidence and also write appropriately for the audience."*

Second, the difference in scoring in transfer knowledge (competency area 3 + 4) was evident in the statement between AL68 and ET35. AL68 mentioned in principle only two superficial points about the preparation and diagnosis of the method whereas ET35 showed a much more complex understanding of the method (competency area 3 + 4). Accordingly, AL68 received no points in this area in terms of transfer knowledge, whereas ET35 gained more points in the scoring. Question: what do you need to teach the students in order for them to use the method successfully? (Transfer knowledge).

> *AL 68: „Students must be honest and trained in this method".*
>
> *ET35: "The students are given another text and have to evaluate it according to the evaluation criteria/sheet. Afterwards, there is an exchange between the students to talk about it, if something was unclear, etc. The students are asked to evaluate the text. In plenary, common mistakes, ambiguities, etc. are discussed and improvements are noted. Students should also know the pros and cons of the method, be able to justify comments and make annotations in the text and feedback sheet. Inhibitions of the students should be reduced (they should be honest and also criticize) and communicate with each other and also allow questions. Feedback should be appreciative."*

6. Limitations, Discussion and Implications

In the following, we include the results in the discussion on the extent to which insights into the research question "To what extent and in which areas does the OER unit improve

the teaching competencies of student teachers in the area of promoting the argumentation competencies of their future students with peer feedback methods?" could be provided.

The results should be understood here as the results of a first study in a pre–post design to examine the increase in competence through an OER unit concerning teaching argumentation with peer feedback methods. The aim, therefore, was to find out exploratively how an OER unit can be used successfully in order to create first approaches in the still quite unexplored field of asynchronous in-service training formats in (geography) teacher professionalization on the topic of promoting pupils' argumentation competencies through interdependent peer feedback methods. Through the results, impulses for change and further progress in the OER unit will be discussed, and insights regarding the effectiveness of the unit on students' perceptions of competence will be developed. More general conclusions such as the positive effect on the use of OERs in higher education or the design of OERs for higher education are also discussed in the field of geography.

In general, it can be stated that the OER unit led to an increase primarily in knowledge areas that generally address the advantages and disadvantages of the method peer review as well as the learning objectives associated with the use of the method, albeit with varying intensity, among the test group.

In summary, hence, the results showed that all but one student improved in scoring on the post-test compared to the pretest (Figure 3). In practical implementations such as the concrete structuring of worksheets and lesson plans, they still showed deficits in the post-test (Figure 4).

Nevertheless, it is important to emphasize that almost all students improved through the OER unit in terms of their assessed competencies and the assessed statements in the test. This shows that the unit showed some promising and efficient approaches that concretely reflected the benefits of the OER units. The settings here allowed self-directed learning, in which the student teachers were supposed to be in focus. Furthermore, the students' different learning styles and learning preferences were taken into account. This professionalizing teaching unit could therefore further benefit from high flexibility due to the independence of the time and place individual design and scheduling possibilities [79,91]. The question arises as to why fewer students made serious improvements in transfer knowledge compared to general knowledge about the method (Figure 4). The results showed that at this stage of training, basic skills in lesson planning seem to be partly missing, e.g., related to the differentiation of learning objectives or the practical monitoring and safeguarding of lessons. Once again, it should be mentioned at this point that the group of students studied are still quite at the beginning of their education (bachelor's degree) and they do not learn more practical skills in concrete terms until they obtain their master's degree. So, it is about embedding further possibilities of the OER in the university teaching to eliminate possible weaknesses of this. The OER and further work with this should discuss, among other things, the concrete practically oriented lesson planning of the students even more, because based on the results here, you can obviously only partially convey transfer knowledge with such a learning unit. This OER should be used when basic skills for lesson planning are available—in our case, while obtaining one's master's. For subsequent studies, it might make more sense—especially for students in the master's program—to conduct the post-test after the final seminar session and after the discussion of the presented teaching units. In this way, acquired competencies can still be included in the survey through the reflection on the material. This type of structuring would also be a suggestion for the design of another seminar in this area. This may also explain why students scored higher in terms of general method knowledge.

This study further showed, nevertheless, the positive effects of the treatment through the OER unit. It was striking, however, that not all students benefited equally from the unit in scoring and that the students improved differently in different areas. At this point it should be reflected that the OER unit was mainly conceptualized as a self-learning unit, which accordingly could not offer the interactivity of a face-to-face seminar [79] (p. 17f.), [91] (p. 10f.), [92] (p. 11), [93] (p. 20f.). The question arises to

what extent criteria such as individuality or the quality of (automatic) feedback could be even more increased in further seminars (Scanlon, E. 2010, p. 10f.). For example, a diagnostic questionnaire could be inserted in front of the OER unit, and the students could work on certain focal points of the unit in a differentiated manner depending on their own identified deficits or interests [79] (p. 17f.), [91] (p. 10f.). The iterative cycles of testing and refining in an approach such as ours produced new knowledge within the still rather deficiently researched field of asynchronous teacher training in the area of student argumentation development, which is applicable for future projects in OER contexts [92,93].

It is undoubtedly critical and limiting to note here that this study did not include a control group and therefore it cannot be said beyond doubt whether the concrete increase in scoring between the pretest and post-test can be attributed exclusively to the learning unit. However, the students' answers certainly suggest that this might be a reasonable explanation as they sometimes directly referred to and quoted the learning unit in the answers of the test, and they would have had no other contact with the peer review method during their studies. Further studies in the field of this OER research should in any case investigate the effectiveness of the OER unit also related to other groups of students in the training and control groups to compensate for the aforementioned methodological deficits and to achieve more concrete indications of the effectiveness of specific areas of treatment (the OER unit).

Another way to look at the poorer results in transfer knowledge is that these may have also had to do with the curricular design of the teacher study programs in Germany in general, and that basic legitimizing documents such as core curricula and educational standards or theoretical advantages and disadvantages of methods are talked about relatively quickly in seminars or lectures but the practical exercise only come up later. It is worth mentioning here that teacher education has two phases in Germany—the first phase teaches theoretical foundations related to geography and geography didactics content, theories and concepts, and a second phase teaches practical teaching in schools.

To ensure the quality of geography education defined in the way of language-aware teaching, a contribution is to be made in the course of teacher training. In this sense, the study brought the following: a model was developed to diagnose the competencies that students should have when using the peer feedback method to promote argumentation skills in future students (Table 1). In the area of professionalizing language-aware teaching related to pupils' argumentation competencies, scholars would have to discuss and further develop the competence model presented here (Table 1) in the context of formative assessments. The model can be used in future workshops for the in-service training of teachers and students alike by using the model and testing procedures to measure the effectiveness of training, similar to the case study here. After the initial testing phase in the study area presented here, changes could be made in the structuring of the competency areas. For example, the precise separation between practical and theoretical knowledge and the subdivision into preparation and diagnosis as well as competencies for transfer and implementation has emerged as a meaningful split in the model. The final result was published in this article (Table 1). Not only was the competency model successful in operationalizing the students' responses in their processing of the OER unit, the model furthermore remotely exemplified how linguistic actions and methods of language-aware geography teaching can be systematized and queried by using the example of peer review. It would also be effective to divide the students' results into levels in order to be able to assess more concrete support measures after the course of the OER units. It would also be conceivable to conduct group interviews with students of different levels as a supplement to the feedback sessions in order to be able to draw further conclusions about problems regarding implementation in the discussions developed there. These interviews could lead to even more individualized attention to student teachers' deficits and areas of interest. Thinking further, this could lead to offering/developing modular OERs that offer units for specific subinterests of language-aware geography instruction.

The creation and verification of the model here should be noted as one of the crucial important findings of this study. In the sense of the reflections of item–response theory (e.g., [81,82,93]), this kind of conceptualization and operationalization can also be transferred to further linguistic actions of geography teaching to even measure the statistical properties of questions and test items independently of the test takers' abilities [92,93]. The feedback sheet proved to be effective, as most critical feedback comments on the partner's argumentation were recorded in the sheet. The results indicated that arguments were mainly improved rather than discovering new ones. For future research, it could be beneficial to include a central task to encourage students to seek out additional arguments besides their partner's. Additionally, the use of multiple media was significant, as feedback comments that led to improvements in the text were not present in all media, leading to exclusive insights from the students.

Ultimately, the findings from the case study also go beyond the use of purely these OER and should be discussed in discourses in the wider OER community. It has been shown that it is precisely the intensive and personal reflection in the presence of the application task of OER that is meaningful. This means that, as initially suspected, meaningful flipped classroom instruction is efficient. The expertise of the teacher has also been shown in this case study in that the elaborated results can be classified. The potential of OERs in terms of individually generated feedback, which approaches the feedback quality of human teachers, needs to be further investigated, especially when it comes not only to purely standardized multiple-choice answers but also to open, more individual answers. In addition, student feedback should be repeatedly solicited in feedback loops to improve existing OERs. With regard to inclusive education, the extent to which subtitles are available for explanatory videos, for example, and which colors and font sizes and fonts are used should be reflected for accessibility.

7. Conclusions and Outlook

A great strength of the tested OER unit is that the idea of promoting argumentation skills through peer feedback can be applied to other subjects. Argumentation also plays an important role in other subjects such as politics, economics, biology or mathematics. The structure of the learning unit could also be tried out in other subjects since it also relies on general input phases that do not only address subject-specific didactics precisely because there is the elegant possibility of adapting the application tasks to the subject in a meaningful way. Likewise, the competency model can be applied in other subjects.

A possibility for collecting further critical data in that matter, which was also planned as part of the project, would be to use the digital units with master's students after their internships and practical semesters and see to what extent this has an impact on the scoring results in transfer knowledge. Furthermore, the project partners discussed to what extent it might make sense to follow up with the OER unit presented and evaluated here on the instruction of the peer feedback method with a practical intervention phase in the school. The student teachers would thus prepare themselves with the OER unit, synchronously test their teaching sequence for promoting students' argumentation skills with peer feedback in the school during the practical semester and then again work through another OER unit to reflect on their experiences in the school. On the basis of the OER unit, a digital portfolio could be created so to speak, which guides the students to reflect on their methods used in the practical phases to promote argumentation. This would again be followed by a synchronous period with the instructor to sort through the practicum experiences. Such an approach would probably not only increase the transfer knowledge, but the OER unit would create a transparently uniform and verifiable tool for monitoring and evaluating language-conscious professionalization, which can be continuously developed further in the network of project partners and can be applied widely.

Teaching in the university education and training of teachers in the corona pandemic has increasingly shown that synchronous and asynchronous formats can mesh quite effectively. The question arises as to what extent instructors can take up methods identified as

effective in order to integrate the benefits of asynchronous OER formats into the increasingly re-emerging face-to-face teaching as well in order to make the actual face-to-face time in a seminar even more profitable for students. Our experience in embedding OER in higher education teaching shows the effectiveness of well-timed asynchronous and synchronous flipped classroom arrangements. This study showed that preparation, i.e., theoretical input prior to a plenary discussion task, can be successfully embedded in a withholding phase. This case study further illuminates that the way, especially in the professionalization of teachers for digital and individualized levels of training, is being paved more and more in order to be able to use the direct contacts of interaction even more effectively and interest driven. Such a more effective flipped classroom design with OER formats can mean that students can talk in a very concrete way with the lecturer during the face-to-face time about their personal experiences and knowledge enhancements through the OER units. The synchronous interaction with the lecturer can then set the necessary impulses to dock further professionalization steps in the student. Not only does this provide the opportunity for even more individualized learning for student teachers, which could be tailored more to their inclinations, abilities and attitudes, it then also benefits the pupils in the end. Preparing one or more generations for the challenges of linguistic heterogeneity in classrooms and making language-aware teaching the norm is such an engaging task that successful conceptualizations of effective OER units in the field should be a crucial tool of future teacher education (in geography).

Author Contributions: Conceptualization, M.M. and A.B.; methodology, M.M.; software, M.M.; validation, M.M. and A.B.; formal analysis, M.M. and A.B.; investigation, M.M. and A.B.; resources, M.M. and A.B.; data curation, M.M.; writing—original draft preparation, M.M.; writing—review and editing, M.M. and A.B.; visualization, M.M.; supervision, M.M. and A.B.; project administration, Sebastian Wolff-Seidel, A.B.; funding acquisition, A.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the German Federal Ministry of Education and Research (BMBF) as part of the project "Generalisability and transferability of digital subject concepts using the example of responsible digital geomedia use in teacher education" (DiGeo), funding reference 16DHB3003.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board (or Ethics Committee) of University of Wuppertal—Institution of Geography and Primary Education.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: All data can be made available.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Berland, L.; Reiser, B. Classroom communities' adaptations of the practice of scientific argumentation. *Sci. Educ.* **2010**, *95*, 191–216. [CrossRef]
2. Teasly, S.D.; Roschelle, J. Constructing a Joint Problem Space: The Computer as a Tool for Sharing Knowledge. In *Computers as Cognitive Tools*; Lajoie, S.P., Derry, S.J., Eds.; Lawrence Erlbaum Associates, Inc.: Mahwah, NJ, USA, 1993; pp. 229–258.
3. Berggren, J. Learning from giving feedback: A study of secondary-level students. *ELT J.* **2015**, *69*, 58–70. [CrossRef]
4. Lundstrom, K.; Baker, W. To give is better than to receive: The benefits of peer review to the reviewer's own writing. *J. Second. Lang. Writ.* **2009**, *18*, 30–43. [CrossRef]
5. Morawski, M.; Budke, A. How Digital and Oral Peer Feedback Improves High School Students' Written Argumentation-A Case Study Exploring the Effectiveness of Peer Feedback in Geography. *Educ. Sci.* **2019**, *9*, 178. [CrossRef]
6. Budke, A.; Weiss, G. Sprachsensibler Geographieunterricht. In *Sprache als Lernmedium im Fachunterricht. Theorien und Modelle für das Sprachbewusste Lehren und Lernen. Language as Learning Medium in the Subjects*; Michalak, M., Ed.; Schneider Hohengehren: Baltmannsweiler, Germany, 2014; pp. 113–133.
7. Budke, A.; Kuckuck, M.; Morawski, M. Sprachbewusste Kartenarbeit? Beobachtungen zum Karteneinsatz im Geographieunterricht. *GW-Unterricht* **2017**, *48*, 5–15. [CrossRef]

8. Morawski, M.; Budke, A. Förderung von Argumentationskompetenzen Durch das "Peer-Review-Verfahren". In *Argumentieren im Sprachunterricht. Beiträge zur Fremdsprachenvermittlung*; Abdel-Hafiez, M., Ed.; VEP: Landau, Germany, 2018; pp. 75–101.
9. Alexander, K.L.; Entwisle, D.R.; Olson, L.S. Schools, Achievement, and Inequality: A Seasonal Perspective. *Educ. Eval. Policy Anal.* **2001**, *23*, 71–191. [CrossRef]
10. Ditton, H. Qualitätssicherung in Schulen. In *Qualitätssicherung im Bildungssystem—Eine Bilanz. (Beiheft der Zeitschrift für Pädagogik)*; Klieme, E., Tippelt, R., Eds.; Beltz: Weinheim, Germany, 2008; pp. 36–58.
11. National Research Council. *Inquiry and the National Science Education Standards*; National Academy Press: Washington, DC, USA, 2000. Available online: http://www.nap.edu/openbook.php?isbn=0309064767 (accessed on 2 December 2022).
12. Deutsche Gesellschaft für Geographie (DGfG). Bildungsstandards im Fach Geographie für den Mittleren Schulabschluss–mit Aufgabenbeispielen [Educational Standards in the Subject Geography for the Secondary School]. Bonn. 2014. Available online: http://dgfg.geography-in-germany.de/wp-content/uploads/geographie_bildungsstandards.pdf (accessed on 2 December 2022).
13. European Union Recommendation of the European Parliament and of the Council of 18 December. Key Competences for Lifelong Learning. 2006. Available online: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:394:0010:0018:en:PDF (accessed on 2 December 2022).
14. Weinstock, M.P. Psychological research and the epistemological approach to argumentation. *Informal Log.* **2006**, *26*, 103–120. [CrossRef]
15. Weinstock, M.P.; Neuman, Y.; Glassner, A. Identification of informal reasoning fallacies as a function of epistemological level, grade level, and cognitive ability. *J. Educ. Psychol.* **2006**, *98*, 327–341. [CrossRef]
16. Hoogen, A. Didaktische Rekonstruktion des Themas Illegale Migration Argumentationsanalytische Untersuchung von Schüler*Innenvorstellungen im Fach Geographie. Didactical Reconstruction of the Topic "Illegal Migration". Analysis of Argumentation among Pupils' Concepts. Ph.D. Thesis, University of Münster, Münster, Germany, 2016. Available online: https://www.uni-muenster.de/imperia/md/content/geographiedidaktische-forschungen/pdfdok/band_59.pdf (accessed on 2 December 2022).
17. Means, M.L.; Voss, J.F. Who reasons well? Two studies of informal reasoning among children of different grade, ability and knowledge levels. *Cogn. Instr.* **1996**, *14*, 139–178. [CrossRef]
18. Reznitskaya, A.; Anderson, R.; McNurlen, B.; Nguyen-Jahiel, K.; Archoudidou, A.; Kim, S. Influence of oral discussion on written argument. *Discourse Process.* **2001**, *32*, 155–175. [CrossRef]
19. Kuhn, D. *Education for Thinking*; Harvard University Press: Cambridge, MA, USA, 2005.
20. Leitao, S. The potential of argument in knowledge building. *Hum. Dev.* **2000**, *43*, 332–360. [CrossRef]
21. Nussbaum, E.M.; Sinatra, G.M. Argument and conceptual engagement. *Contemp. Educ. Psychol.* **2003**, *28*, 573–595. [CrossRef]
22. Kuckuck, M. Konflikte im Raum—Verständnis von Gesellschaftlichen Diskursen Durch Argumentation im Geographieunterricht [Spatial Conflicts—How Pupils Understand Social Discourses through Argumentation]. In *Geographiedidaktische Forschungen*; Monsenstein und Vannerdat: Münster, Germany, 2014; Volume 54.
23. Dittrich, S. Argumentieren als Methode zur Problemlösung Eine Unterrichtsstudie zur Mündlichen Argumentation-on von Schülerinnen und Schülern in Kooperativen Settings im Geographieunterricht. Solving Problems with Argumentation in the Geography Classroom. Ph.D. Thesis, University of Münster, Münster, Germany, 2017. Available online: https://www.uni-muenster.de/imperia/md/content/geographiedidaktische-forschungen/pdfdok/gdf_65_dittrich.pdf (accessed on 2 December 2022).
24. Müller, B. Komplexe Mensch-Umwelt-Systeme im Geographieunterricht mit Hilfe von Argumentationen er-schließen. Analyzing Complex Human-Environment Systems in Geography Education with Argumentation. Ph.D. Thesis, University of Cologne, Cologne, Germany, 2016. Available online: https://kups.ub.uni-koeln.de/7047/4/Komplexe_Systeme_Geographieunterricht_Beatrice_Mueller.pdf (accessed on 2 December 2022).
25. Leder, J.S. Pedagogic Practice and the Transformative Potential of Education for Sustainable Development. Argumentation on Water Conflicts in Geography Teaching in Pune. India. Ph.D. Thesis, University of Cologne, Cologne, Germany, 2016. Available online: http://kups.ub.uni-koeln.de/7657/ (accessed on 2 December 2022).
26. Budke, A.; Meyer, M. Fachlich Argumentieren Lernen—Die Bedeutung der Argumentation in den Unter-Schiedlichen Schulfächern. In *Fachlich Argumentieren Lernen. Didaktische Forschungen zur Argumentation in den Unterrichtsfächern*; Budke, A., Kuckuck, M., Meyer, M., Schäbitz, F., Schlüter, K., Weiss, G., Eds.; Waxmann: Münster, Germany, 2015; pp. 9–28.
27. Budke, A.; Creyaufmüller, A.; Kuckuck, M.; Meyer, M.; Schlüter, K.; Weiss, G. Argumentationsrezeptions-Kompetenzen im Vergleich der Fächer Geographie, Biologie und Mathematik. In *Fachlich Argumentieren Lernen. Didaktische Forschungen zur Argumentation in den Unterrichtsfächern*; Budke, A., Kuckuck, M., Meyer, M., Schäbitz, F., Schlüter, K., Weiss, G., Eds.; Waxmann: Münster, Germany, 2015; pp. 273–297.
28. Toulmin, S. *The Use of Arguments*; Beltz: Weinheim, Germany, 1996.
29. Rapanta, C.; Garcia-Mila, M.; Gilabert, S. What Is Meant by Argumentative Competence? An Integrative Review of Methods of Analysis and Assessment in Education. *Rev. Educ. Res.* **2013**, *83*, 438–520. [CrossRef]
30. Budke, A. Förderung von Argumentationskompetenzen in Aktuellen Geographieschulbüchern. In *Aufgaben im Schulbuch*; Matthes, E., Heinze, C., Eds.; Verlag Julius Klinkhardt: Bad Heilbrunn, Germany, 2011; pp. 253–263.
31. Kopperschmidt, J. *Argumentationstheorie. Theory of Argumentation*; Junius: Hamburg, Germany, 2000.
32. Walton, D.N. *The New Dialectic: Conversational Contexts of Argument*; University of Toronto Press: Toronto, Canada, 1998. [CrossRef]
33. Perelman, C. *The Realm of Rhetoric*; University of Notre Dame Press: Notre Dame, IN, USA, 1982.

34. Erduran, S.; Jiménez-Aleixandre, M.P. *Argumentation in Science Education: Perspectives from Classroom-Based Research*; Springer: Dordrecht, The Netherlands, 2008.
35. Garcia-Mila, M.; Gilabert, S.; Erduran, S.; Felton, M. The effect of argumentative task goal on the quality of argumentative discourse. *Sci. Educ.* **2013**, *97*, 497–523. [CrossRef]
36. McNeill, K.L. Teachers' use of curriculum to support students in writing scientific arguments to explain phenomena. *Sci. Educ.* **2008**, *93*, 233–268. [CrossRef]
37. Felton, M.; Kuhn, D. The development of argumentative discourse skills. *Discourse Process.* **2001**, *32*, 135–153. [CrossRef]
38. Kuhn, D. *The Skills of Argument*; Cambridge University Press: Cambridge, UK, 1991. [CrossRef]
39. Kuhn, D.; Shaw, V.; Felton, M. Effects of dyadic interaction on argumentative reasoning. *Cogn. Instr.* **1997**, *15*, 287–315. [CrossRef]
40. Billig, M. *Arguing and Thinking: A Rhetorical Approach to Social Psychology*; Cambridge University Press: Cambridge, UK, 1987.
41. Bachmann, T.; Becker-Mrotzek, M. Schreibaufgaben Situieren und Profilieren. To Profile Writing Tasks. In *Textformen als Lernformen. Text Forms als Learning Forms*; Pohl, T., Steinhoff, T., Eds.; Gilles & Francke: Duisburg, Germany, 2010; pp. 191–210.
42. Feilke. Schreibdidaktische Konzepte. In *Forschungshandbuch Empirische Schreibdidaktik. Handbook on Empirical Teaching Writing Research*; Becker-Mrotzek, M., Grabowski, J., Steinhoff, T., Eds.; Waxmann: Münster, Germany, 2017; pp. 153–173.
43. Hayes, J.; Flower, L. Identifying the Organization of Writing Processes. In *Cognitive Processes in Writing*; Gregg, L., Steinberg, E., Eds.; Erlbaum: Hillsdale, NJ, USA, 1980; pp. 3–30.
44. Dawson, V.; Venville, G. High-school students' informal reasoning and argumentation about biotechnology: An indicator of scientific literacy? *Int. J. Sci. Educ.* **2009**, *31*, 1421–1445. [CrossRef]
45. Kienpointner, M. Argumentationsanalyse. Analysis of Argumentation. In *Innsbrucker Beiträge zur Kulturwissenschaft*; Institut für Sprachwissenschaften der Universität Innsbruck: Innsbruck, Austria, 1983; Volume 56.
46. Kuhn, D. A developmental model of critical thinking. *Educ. Res.* **1999**, *28*, 16–26. [CrossRef]
47. Kuhn, D. Metacognitive development. *Curr. Dir. Psychol. Sci.* **2000**, *9*, 178–181. [CrossRef]
48. Kuhn, D. Teaching and learning science as argument. *Sci. Educ.* **2010**, *94*, 810–824. [CrossRef]
49. Zohar, A.; Nemet, F. Fostering students' knowledge and argumentation skills through dilemmas in human genetics. *J. Res. Sci. Teach.* **2002**, *39*, 35–62. [CrossRef]
50. Zeidler, D.; Sadler, T.; Applebaum, S.; Callahan, B. Advancing reflective judgment through socioscientific issues. *J. Res. Sci. Teach.* **2009**, *46*, 74–101. [CrossRef]
51. Sadler, T.D.; Donnelly, L.A. Socioscientific argumentation: The effects of content knowledge and morality. *Int. J. Sci. Educ.* **2006**, *28*, 1463–1488. [CrossRef]
52. Metz, K. Children's understanding of scientific inquiry: Their conceptualization of uncertainty in investigations of their own design. *Cogn. Instr.* **2004**, *22*, 219–290. [CrossRef]
53. Sandoval, W.A.; Millwood, K. The quality of students' use of evidence in written scientific explanations. *Cogn. Instr.* **2005**, *23*, 23–55. [CrossRef]
54. Evagorou, M.; Osborne, J. Exploring Young Students' Collaborative Argumentation Within a Socioscientific Issue. *J. Res. Sci. Teach.* **2013**, *50*, 209–237. [CrossRef]
55. Evagorou, M. Discussing a Socioscientific Issue in a Primary School Classroom: The Case of Using a Technology-Supported Environment in Formal and Nonformal Settings. In *Socioscientific Issues in the Classroom*; Sadler, T., Ed.; Springer: New York, NY, USA, 2011; pp. 133–160.
56. Evagorou, M.; Jime´nez-Aleixandre, M.; Osborne, J. 'Should We Kill the Grey Squirrels? 'A Study Exploring Students' Justifications and Decision-Making. *Int. J. Sci. Educ.* **2012**, *34*, 401–428. [CrossRef]
57. Oliveira, A.; Akerson, V.; Oldfield, M. Environmental argumentation as sociocultural activity. *J. Res. Sci. Teach.* **2012**, *49*, 869–897. [CrossRef]
58. Lehnen, K. Kooperatives Schreiben. In *Handbook on Empirical Teaching Writing Research*; Becker-Mrotzek, M., Grabowski, J., Steinhoff, T., Eds.; Handbuch empirische Schreibdidaktik; Waxmann: Münster, Germany, 2017; pp. 299–315.
59. Berland, L.K.; Hammer, D. Framing for scientific argumentation. *J. Res. Sci. Teach.* **2012**, *49*, 68–94. [CrossRef]
60. Coyle, D.; Hood, P.; Marsh, D. *CLIL: Content and Language Integrated Learning*; Cambridge University Press: Cambridge, UK, 2010. [CrossRef]
61. Morawski, M.; Budke, A. Learning With and By Language: Bilingual Teaching Strategies for the Monolingual Language-Aware Geography Classroom. *Geogr. Teach.* **2017**, *14*, 48–67. [CrossRef]
62. Breidbach, S.; Viebrock, B. CLIL in Germany—Results from Recent Research in a Contested Field. *Int. CLIL Res. J.* **2012**, *1*, 5–16.
63. Gibbs, G.; Simpson, C. Conditions under which Assessment supports Student Learning. *Learn. Teach. High. Educ.* **2004**, *1*, 3–31.
64. Diab, N.W. Effects of peer-versus self-editing on students' revision of language errors in revised drafts. *System* **2010**, *38*, 85–95. [CrossRef]
65. Zhao, H. Investigating learners' use and understanding of peer and teacher feedback on writing: A comparative study in a Chinese English writing classroom. *Assess. Writ.* **2010**, *1*, 3–17. [CrossRef]
66. S´eror, J. Alternative sources of feedback and second language writing development in university content courses. *Can. J. Appl. Linguist.* **2011**, *14*, 118–143.
67. Kelle, U. Mixed Methods. In *Handbuch Methoden der Empirischen Sozialforschung*; Baur, N., Blasius, J., Eds.; Springer: Wiesbaden, Germany, 2014. [CrossRef]

68. Mayring, P. *Qualitative Inhaltsanalyse. Qualitative Analysis of Content*, 12th ed.; Beltz: Weinheim, Germany, 2015. [CrossRef]
69. Schreier, M. *Qualitative Content Analyis in Practice*; Sage Publications: Los Angeles, CA, USA; London, UK, 2012.
70. Herzmann, P.; König, J. *Lehrerberuf und Lehrerbildung*; Verlag Julius Klinkhardt: Bad Heilbrungg, Germany, 2016. [CrossRef]
71. Terhart, E. Lehrerberuf und Professionalität. Gewandeltes Begriffsverständnis—Neue Herausforderungen. In *Pädagogische Professionalität*; Helsper, W., Tippelt, R., Eds.; Beltz: Weinheim, Germany, 2011; pp. 202–224.
72. Leinhardt, G.; Greeno, J. The cognitive skill of teaching. *J. Educ. Psychol.* **1986**, *78*, 75–95. [CrossRef]
73. Bromme, R.; Rheinberg, F.; Minsel, B.; Weidemann, B. Die Erziehenden und Lehrenden. In *Pädagogische Psychologie*; Krapp, A., Weidemann, B., Eds.; Ein Lehrbuch: Weinheim, Germany, 2006.
74. Bromme, R. Teacher Expertise. In *International Encyclopedia of the Behavioral Sciences: Education*; Smelser, N.J., Baltes, P.B., Weinert, F.E., Eds.; Pergamon: London, UK, 2001; pp. 15459–15465. [CrossRef]
75. Helmke, A. *Unterricht Erfassen, Bewerten, Verbessern*; Kaalmeyer: Seelze, Germany, 2003.
76. Nieuwoudt, J.E. Investigating synchronous and asynchronous class attendance as predictors of academic success in online education. *Australas. J. Educ. Technol.* **2020**, *36*, 15–25. [CrossRef]
77. Offir, B.; Lev, Y.; Bezalel, R. Surface and deep learning processes in distance education: Synchronous versus asynchronous systems. *Comput. Educ.* **2008**, *51*, 1172–1183. [CrossRef]
78. Morawski, M.; Budke, A. Language Awareness in Geography Education—An Analysis of the Potential of Bilingual Geography Education for Teaching Geography to Language Learners. *Eur. J. Geogr.* **2017**, *7*, 61–84.
79. Fögele, J. Entwicklung Basiskonzeptionellen Verständnisses in Geographischen Lehrerfortbildungen. Rekonstruktive Typenbildung | Relationale Prozessanalyse | Responsive Evaluation. 2016. Available online: https://www.uni-muenster.de/imperia/md/content/geographiedidaktische-forschungen/pdfdok/gdf_61_f__gele.pdf (accessed on 2 December 2022).
80. Klieme, E.; Avenarius, H.; Blum, W.; Döbrich, P.; Gruber, H.; Prenzel, M.; Reiss, K.; Riquarts, K.; Rost, J.; Tenorth, H.-E.; et al. (Eds.) *Zur Entwicklung Nationaler Bildungsstandards*; Eine Expertise; BMBF: Bonn, Germany, 2003.
81. Lord, F.M. *Applications of Item Response Theory to Practical Testing Problems*; Erlbaum: Mahwah, NJ, USA, 1980.
82. Rasch, G. *Probabilistic Models for Some Intelligence and Attainment Tests*; MESA: Chicago, IL, USA, 1960.
83. van Holt, N.; Manitius, V. *Transfer Zwischen Lehrer(fort)bildung und Wissenschaft. Reihe: Beiträge zur Schulentwicklung*; WBV: Bielefeld, Germany, 2019.
84. Vigerske, S. *Transfer von Lehrerfortbildungsinhalten in die Praxis. Eine empirische Untersuchung zur Transferqualität und zu Einflussfaktoren*; Springer VS: Wiesbaden, Germany, 2017. [CrossRef]
85. Thyer, B. *Quasi-Experimental Research Designs*; Oxford University Press: Oxford, UK, 2012. [CrossRef]
86. Frey, B. *The SAGE Encyclopedia of Educational Research, Measurement and Evaluation*; SAGE Publications, Inc.: Thousand Oaks, CA, USA, 2018; Volume 1–4. [CrossRef]
87. Rubin, C.; Babbie, S. *Research Methods for Social Work*, 9th ed.; Cengage: Boston, MA, USA, 2017.
88. Arndt, C.; Ladwig, T.; Knutzen, S. Zwischen Neugier und Verunsicherung: Interne Hochschulbefragungen von Studierenden und Lehrenden im virtuellen Sommersemester 2020: Ergebnisse einer qualitativen Inhaltsanalyse. *Tech. Univ. Hambg.* **2020**. [CrossRef]
89. Grimm, S.; Rödel, B. *Open Educational Resources (OER) an Berufsbildenden Schulen in Deutschland Ergebnisse Einer Bundesweiten Onlineumfrage*; Wissenschaftliche Diskussionspapiere: Heft, Germany, 2018.
90. Beutner, M.; Schneider, J.N. Open Educational Resources in der aktuellen Bildungslandschaft: Motivation zur Teilung und Nutzung. *Kölner Zeitschrift für Wirtschaft und Pädagogik* **2015**, *58*, 3–32.
91. Wang, F.; Hannafin, M.J. Design- Based Research and Technology-Enhanced Learning Environments. *Educ. Technol. Res. Dev.* **2005**, *53*, 5–23. [CrossRef]
92. Scanlon, E. Technology enhanced learning in science: Interactions, affordances and design-based research. *J. Interact. Media Educ.* **2010**, *2010*, Art. 8. [CrossRef]
93. Baker, F. *The Basics of Item Response Theory*; Tech. Univ. Hambg.; ERIC Clearinghouse on Assessment and Evaluation, University of Maryland: College Park, MD, USA, 2001.