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**ABSTRACT**

Tasks are essential in fostering students' learning processes, and thinking skills are considered to be of central importance to learning. In order to analyse how tasks promote the development of thinking skills in school geography, we need an instrument that looks beyond a simple distinction between lower and higher order thinking. It should be able to identify types of tasks based on distinctive elements on the way to acquiring powerful knowledge or knowledge of high epistemic quality. In this paper, we describe the development of an instrument based on the adaptation of existing categorisations and the use of Bernstein's recognition and realisation rules. The instrument distinguishes five levels of thinking: lower order thinking, use of thinking strategies, parts of higher order thinking, higher order thinking, and reflection. The instrument was employed to analyse tasks in geography textbooks used in the Netherlands and the German State North Rhine-Westphalia, with researchers and teacher educators in both states considering its efficacy both plausible and practicable. The results show that the instrument is sufficiently sensitive to identify differences in types of tasks and the extent to which access to powerful knowledge is fostered.

## Introduction

This paper is part of a comparative research project into geography teachers' use of higher order thinking tasks in two different curriculum contexts: the German state of North Rhine-Westphalia (NRW) and the Netherlands (NL). According to Seel (2012), "higher-order learning requires the active and intentional manipulation of knowledge and is by definition a conscious act involving critical and creative reflection" (p. 1798). Higher order thinking tasks contribute effectively to these learning processes, as they challenge learners to use complex, newly presented information and integrate it into existing knowledge structures, which should lead to a more

conceptual understanding and give learners more control of their learning process (Bijsterbosch, 2018). Higher order thinking tasks enable students to be critical of information and to participate in decision-making (Roberts, 2013). Therefore, they are key to the development of "powerful knowledge" (Maude & Caldis, 2019), i.e. high epistemic quality (Hudson, 2018).

Previous research has shown significant differences between Germany and the Netherlands in the share of higher order thinking tasks provided in textbooks for upper secondary geography education (Krause, Béneker, Van Tartwijk, Uhlenwinkel, & Bolhuis, 2017). However, the division of tasks promoting either lower or higher order thinking needs to be further explored, insofar as it does not recognise the variation in cognitive processes at these broadly defined levels.

This paper describes the development of a sensitive but still practical instrument to determine the cognitive processes geography tasks aim at, and the results of an analysis of Dutch and North Rhine-Westphalian textbook tasks using this instrument. This analysis throws new light on how textbook tasks foster the development of higher order thinking and powerful knowledge.

## Categorisations identifying higher order thinking tasks

Tasks (including questions, activities and assignments) are vital in geography lessons as they initiate and regulate learning processes, involve students with the subject content, and can be used for formative and summative assessment (Bijsterbosch, Van der Schee, & Kuiper, 2017; Jo & Bednarz, 2009; Kleinknecht, 2010). A distinction frequently made when categorising geography and other learning tasks, is how the kind of thinking they foster are positioned on the continuum of lower to higher order thinking (Lane & Bourke, 2016). As Bijsterbosch (2018) has pointed out, the extremes of this continuum may be reflected in other terms, such as "meaningful" versus "rote learning" (Anderson et al., 2001) or "deep" versus "surface learning" (Harlen & James, 1997).

However, lower and higher order thinking are not always defined in the same way. Whereas some regard all forms of thinking which transcend the mere recall of knowledge as higher order thinking (Anderson et al., 2001; Bijsterbosch, 2018; Maude & Caldis, 2019), others define it more specifically as involving analysis, evaluation and creation (Jo & Bednarz, 2009). Taxonomies which have been used to categorise geography tasks (Bijsterbosch, 2018; Jo & Bednarz, 2009; German Geographical Society, 2012), can be related to the revised taxonomy of Bloom (Anderson et al., 2001). They all deliver meaningful results. However, we see that most of the tasks categorised by these taxonomies belong to the lower and middle categories (Bijsterbosch, 2018, p. 42; Budke, 2011, p. 257; Jo & Bednarz, 2009, p. 9). As the path towards higher order thinking consists of many steps, more detailed information about the cognitive processes fostered by the tasks is needed, especially for these categories, into which most of the tasks occur.

## Higher order thinking and powerful knowledge in geography education

In the most recent academic debate in geography education, higher order thinking tasks have been considered to be important in the development of what is referred to as "powerful knowledge" (Maude & Caldis, 2019), due to the learning processes they

foster. The concept of powerful knowledge was coined by Michael Young (2009) within the context of the Anglo-Saxon geography curriculum debate (Lambert, 2014), before it found its way into geography education in other countries (Béneker, 2018).

Young and Muller (2010) introduced the notion of powerful knowledge into a new curriculum framework, positioned in opposition to both a curriculum led by traditional knowledge (a so called Future 1 scenario), in which knowledge is seen as absolute and given, and a curriculum led by generic skills (Future 2 scenario), in which knowledge is subordinate and arbitrary. A powerful knowledge-based curriculum understands knowledge to be reliable and based on proof, but also recognises that knowledge is constructed, which allows for the possibility of change and the existence of multiple perspectives (Young, 2014). To realise powerful knowledge in what is called a Future 3 scenario, teachers should engage students with subject-specific knowledge that is on one hand concrete and real and on the other hand counter-intuitive, abstract, theoretical and transcends the limits of their own experience in order to let them think in new and critical ways (Huckle, 2019; Lambert, Béneker, & Bladh, 2021; Maude, 2020). In this context, there are three important aspects to consider with respect to higher order thinking in geography education.

Although there is agreement on the essence of powerful knowledge, there is not a clear-cut definition of it which is operationalisable. Discussion arises about the powerfulness (does it lie in the nature of the knowledge or the potential for learners), the lack of agreement on geographical key concepts, the danger that a well-defined definition might be interpreted as a rigid framework, the question to what extent basic facts and concepts form the base for powerful knowledge, and, finally, the relation between powerful and everyday knowledge (Maude, 2018). In this paper, we regard powerful knowledge as the amalgamation of five aspects of knowledge (Béneker, 2018), e.g. factual or concrete knowledge (geographical facts and basic concepts), conceptual and theoretical knowledge (key concepts of geography), systematic knowledge (application of conceptual knowledge to concrete phenomena), knowledge and language of societal debates (enabling participation in these debates and envisioning future perspectives) and knowledge of knowledge (its origins and limitations). As Young and Muller (2016) emphasised, powerful knowledge comprises both, knowledge and skills, as these are interwoven when it comes to teaching practice.

Second, the development of powerful knowledge is seen as a process in which students increasingly engage with the abstract nature of knowledge and its complexity (Maude, 2020). This process is called epistemic ascent (Winch, 2013), where powerful knowledge is regarded as being of "high epistemic quality", which refers to an approach that knowledge can be fallible, and that stimulates critical and creative reasoning (Hudson, 2018; Winch, 2013). Such knowledge assists students to develop their "epistemic self" (Vernon, 2020).

Third, as Roberts (2014) pointed out, knowledge only becomes powerful through adequate teaching. This means that teachers must support the student learning process for all of the five aspects of knowledge indicated above to ensure powerful knowledge is developed. Previous research has shown that learning tasks are a crucial instrument for teachers to foster student learning and are at the centre of their lessons (Krause et al., 2017). A question to be answered is, how and what type of tasks

can refine the internal schema of knowledge of students and advance the development of powerful knowledge, e.g. high epistemic quality.

## The way to higher order thinking: recognition and realisation rules

As the notion of powerful knowledge relies partly on Basil Bernstein's work (Young, 2014), we now turn briefly to Bernstein's ideas about learning. Bernstein (2000, p. 11) regards learning as a kind of initiation path, but emphasises that the degree to which students gain access to knowledge differs between curriculum contexts in different countries as well as between types of schools within a country. This is due to two basic principles – "classification" and "framing" – which can vary in strength (Bernstein, 1975), and which have been used frequently in empirical research (see Bernstein, 2000).

*Classification* concerns who decides on the content that is to be transferred within the educational context (the *what*) and which meanings are relevant. This relates to declarative as well as procedural knowledge, e.g. knowledge of "what" (facts and concepts) and knowledge "how" to do something (Anderson et al., 2001). Classification functions through *recognition rules*, which regulate the level of complexity and abstraction. As more substantive and organising concepts are considered, more potential interactions between these concepts arise. Combined with the increase in abstraction, a "potential discursive gap" occurs (Bernstein, 2000, p. 30). This means that there is more than only one answer to a problem, and that there are various ways of ordering solutions to a problem. Classification regulates the details within the overall knowledge that students must gain and apply to, for example, the climate system. The discursive gap becomes observable when students are able to discuss various scenarios about climate change and the possible solutions. This knowledge is usually specified in curriculum documents. The stronger the classification, the higher the demands for complexity of the knowledge structure.

*Framing* is concerned with who decides about the manner of transmission (the *how*). It structures communication through realisation rules. According to Bernstein (2000, p. 17), these rules determine "how we put meaning together and how we make them public". At the individual level of the learner the realisation rules decide whether their answers can be considered a "legitimate text". The requirements regarding possible answers arise in parallel to the hierarchy of the knowledge structure, which means more abstract and complex meaning structures, in other words "texts", have to be constructed (Bernstein, 2000, p. 162). These texts must fulfil certain criteria and standards that are set by the curriculum context. One example is the type of answers that are expected in high-stake exams, such as an essay or a short and concise answer, or the requirements for a paper or a study. The stronger the framing, the higher the demands on the expected manner of communication in relation to the knowledge structure.

Bernstein (2000) emphasises the importance of realisation rules to achieve higher order thinking and also stresses the effects of disadvantage for some learners, such as students from lower socioeconomic groups, because of their lack of language
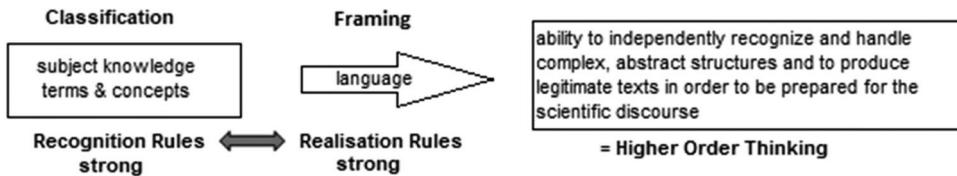
**Figure 1.** Bernstein's notion of classification and framing in relation to thinking skills and tasks – classification (recognition rules) and framing (realisation rules) always work together but can vary in strength (Source: authors).

development: "If they do not possess the *realisation rule*, they cannot speak the expected legitimate text" (pp. 17–18, italic in original).

According to Bernstein (2000), in educational practice, the concepts of classification and framing – of recognition and realisation rules – always work together and cannot be separated. In his view, learning can be seen as entailing the development of two parallel paths: the learner progresses from concrete knowledge and simple procedures to more abstract and divergent knowledge, and from simple answers to the production of highly complex text structures. At the end of this progression from novice to expert practice, higher order thinking occurs (Figure 1). Both the ability to handle increasing complexity and the multiperspectivity of knowledge, and the development of the use of subject-specific language can be understood as an epistemic ascent, while the type of knowledge taught can be characterised by epistemic quality (Hudson, 2018; Winch, 2013).

Nevertheless, two other important aspects should also be considered. As Béneker and Van der Vaart (2020) have stressed, explanatory power does not lie in abstract concepts themselves or concrete facts but in the combination of both, which allows the detection of sense-making connections. Moreover, the journey towards powerful knowledge and the development of an epistemic self is not considered to take a linear path but instead a spiral, constantly moving between the very concrete and the very abstract (Vernon, 2020).

### Distinctions in cognitive processes leading to higher order thinking

The development of a deeper understanding of the subject area is, according to Firth (2017), an important aim of learning at school. As stated by Ritchhart, Church, and Morrison (2011, pp. 10–11), to attain such deeper understanding, "one has to engage in authentic intellectual activity [ … ] to build disciplinary understanding". However, as Winch (2013) acknowledged, this does not mean that students will contribute in a genuine way to knowledge production, rather that it is a way of developing inferential thinking, dealing with complex structures and reaching an evaluation based on argumentation within a given framework. Based on literature about the categorisation of tasks and powerful knowledge we distinguished the following four elements that explain the continuum between lower and higher order thinking:

1. The provision of *new* contexts (King, Goodson, & Rohani, 1998). "'New' here means applications that the student has not thought of before, not necessarily something universally new" (Brookhart, 2010, p. 5). It is here that the explanatory power of concepts in relation to geographical facts starts to

emerge (Béneker & Van der Vaart, 2020) and, relational thinking often is linked to higher order thinking (Hooghuis, Van der Schee, Van der Velde, Imants, & Volman, 2014). In Bernstein's terms, an increasing classification leads to more demanding recognition and realisation rules focussing on correct connections.

2. The complexity of the contexts (e.g. resources) and the use of criteria and standards (King et al., 1998). The information being processed comprises "larger contexts" (Anderson et al., 2001, p. 80), which demand the "breaking [of] material into its constituent parts and determining how the parts are related to one another and to an overall structure" (p. 79). Information is valued and reorganised, and answers are underpinned by criteria-based argumentation (Anderson et al., 2001, pp. 83–87). An increase in abstraction leads to alternative possibilities and interpretations (Bernstein, 2000).

3. Representation and the reorganisation of resources and use of criteria and standards must be applied independently. Anderson et al. (2001) acknowledged that writing, when it exceeds the representation of memorised knowledge, requires the student "to assemble previously taught material into an organised presentation" (p. 85) that has to "meet specified standards of scholarship" (p. 88). A strong classification demands a high level of recognition, and a strong framing in the highest stage of secondary education emphasises realisation rules by demanding legitimate texts in propaedeutic terms, such as "scholarly" essays.

4. Metacognition, which can be defined as knowledge about cognition itself and the control, monitoring and regulation of cognitive processes (Anderson et al., 2001, p. 43), is of great importance for successful learning (Roberts, 2003) especially with respect to higher order thinking, as the more complex contexts and the demands of recognition and realisation rules call for an increasing application of self-regulation strategies (Brookhart, 2010; Ritchhart et al., 2011). Metacognition, contributes to knowledge of knowledge, an important part of powerful knowledge (Béneker, 2018).

## Research question

In the absence of an instrument to categorise geography tasks in terms of higher order thinking and powerful knowledge, the research literature was examined, and four cognitive process elements were identified. In order to determine whether the resultant instrument was capable of delivering meaningful results, we applied it to textbook tasks from the Netherlands and North Rhine-Westphalia (Germany). Our research question was

How can the thinking skills required by geography textbook tasks be categorised in order to provide insight into their contribution to the acquisition of powerful knowledge?

## Methodology

A more extended description of the design of the instrument, deviations from Bloom's revised taxonomy, and how the quality criteria in terms of consistency, practicality and effectivity (see Plomp & Nieveen, 2013) were considered, can be found in

| | | CATEGORY OF TASKS |
|---|---|---|
| REALISATION RULES | RECOGNITION RULES | GATHERING (READ, LOOK, ETC.) OR NAMING INFORMATION (NUMBER OR TITLE OF RESOURCE, ETC.) WITHOUT ANY FURTHER TASK |
| | LOWER ORDER THINKING | RECOGNIZING (LEARNT KNOWLEDGE) |
| | | REPRODUCING (LEARNT KNOWLEDGE) |
| | | PERFORMING (SIMPLE PROCEDURES) |
| | USE OF THINKING STRATEGIES | TRANSFORMING (E.G. VERBAL INTO NON-VERBAL), EXTRACTING OR COMPLETING INFORMATION (IN SCHEMAS) |
| | | EXEMPLIFYING |
| | | COMPARING OR CLASSIFYING |
| | | GIVING THE MAIN POINTS OR SUMMARIZING |
| | | FINDING, NAMING OR EXPLAINING PATTERNS AND CORRELATIONS |
| | | CONSTRUCTING HYPOTHESES OR FORMULATING ENQUIRY QUESTIONS |
| | PARTS OF HIGHER ORDER THINKING | DISCRIMINATION OF (IR-)RELEVANT INFORMATION IN LARGER CONTEXTS |
| | | GENERATING A COMPLEX, COHERENT, RELATIONAL STRUCTURE |
| | | IDENTFYING INTENTIONS, VALUES AND BIASES IN INFORMATION |
| | | CHECKING CORRECTNESS AND CONSISTENCY OF INFORMATION |
| | | NAMING POSSIBLE SOLUTIONS TO A PROBLEM BASED ON CRITERIA |
| | HIGHER ORDER THINKING | ANALYSE: BREAKING COMPLEX MATERIALS INTO ITS CONSTITUENT PARTS, IDENTIFYING INTENTIONS AND BIASES, GENERATING A LOGICAL STRUCTURE TO PRESENT THE RESULT IN E.G. AN ESSAY |
| | | EVALUATE: JUDGING A PHENOMENON AFTER ANALYSIS BASED ON CRITERIA PRESENTED IN E.G. AN ESSAY OR BY USING A COMPLETE ARGUMENTATION |
| | | CREATE: DEVELOPING A SOLUTION TO A PROBLEM IN A STRUCTURED WAY AFTER ANALYSIS BY USING CRITERIA AND PRESENTING IT IN E.G. A POSTER, MAP OR ESSAY |
| | | REFLECTING ON THE CONTENT, THE PROCESS OR ONESELF |
| | | PRESENTING RESULTS |
| | | NO ANSWERING MODEL AVAILABLE |

**Figure 2.** Geography Task Categorisation Framework – the arrows indicate the increase of importance of recognition and realisation rules (Source: authors).

the online repository. Below, we will shortly describe instrument and then show how it was applied in Dutch and North Rhine-Westphalian textbooks.

We first applied the boundaries in cognitive processes described above (marking the path towards higher order thinking and the development of powerful knowledge) to the 19 cognitive processes of revised taxonomy of Bloom. In order to achieve more congruency we then aligned these categories with the taxonomy of Marzano and Kendall (2008), who criticised Bloom's revised taxonomy and whose categorisation is considered to rely on current insights of cognitive science (Helmke, 2010, p. 38). This led, after several trials and expert appraisal, to the following instrument, which we named Geography Task Classification (GTC) Framework (Figure 2).

The level of *Lower Order Thinking (LOT)* comprises thinking skills which deal with the memorisation of acquired knowledge. LOT tasks mainly concern concrete geographical knowledge or conceptual and theoretical knowledge, leading to the acquisition of a vocabulary of the subject (Lambert, 2011).

The level of *Use of Thinking Strategies (UTS)* can be separated, on the one hand, from LOT in the use of new, authentic contexts in which learnt knowledge has to be used, and on the other hand, from *Parts of Higher Order Thinking* in its more simple structures, in which thinking strategies must be applied. We explicitly chose not to

use the label "understanding", because it is likely to be interpreted as "reproduction", in the sense of describing in one's own words (Geerts & Van Kralingen, 2011, p. 163; Roberts, 2003, p. 113). At this level, we find types of tasks which stimulate inferential thinking (Hudson, 2018; Winch, 2013). In summary, the cognitive processes at the level of UTS contribute to an understanding of the grammar of geography (Lambert, 2011) and students develop systematic knowledge (Béneker & Van der Vaart, 2020).

*Parts of Higher Order Thinking (PHOT)* consists of the separate cognitive processes related to the categories of analysis, evaluation and creation in Bloom's revised taxonomy. The recognition rules to which they apply are indeed more complex and the materials more multifaceted. However, the separate cognitive processes do not necessarily lead to the production of legitimate texts in forms such as essays. With PHOT tasks students develop an understanding that there are several ways of ordering, other interpretations and various solutions, which contributes to the knowledge required to engage in societal debates (Lambert, 2014).

*Higher Order Thinking (HOT)* can be distinguished from *PHOT* by the form of representation, for which are clear specifications to be met, such as writing a paper that adheres to standards of scholarship (Anderson et al., 2001, p. 87). Student answers must be based on criteria that have to be applied autonomously and which fulfil standards of representation. In geography education, the criteria are defined by the concepts of the subject and by the way the information has to be processed. Here, students acquire and practise the language that will allow them to participate in societal debates (Lambert, 2014).

We also included another level in our instrument, "*Reflecting on the content, the process or oneself*", as metacognition, next to checking the correctness, consistency and bias of information, especially in relation to content, is crucial for the development of knowledge of knowledge (Béneker, 2018).

Returning to the top of the table, a category was added because there were subtasks that only demanded, for example, the reading of a text, without any further specification. Furthermore, at the end a category "*presenting results*" was inserted, because some textbook tasks only prompted students to let students present their results. The type of thinking and legitimate text required is defined by the task which lies at the base for the presentation.

The Geography Task Classification Framework was used to analyse textbook tasks on the topic of Geographies of Agriculture and Food, which was chosen for reasons of comparability (Zemanek & Nerbig, 2012). It occurs in both curricula for upper secondary school at the highest level: as *Agricultural structures in different climate and vegetation zones* in North Rhine-Westphalia (NRW), and as the *Global Food Issue* in the Netherlands (NL). Three textbooks used in 2019 in each state were examined. 798 tasks (430 NRW, 368 NL) were categorised using the GTC Framework, with respect to the cognitive process they foster (see online repository for examples). The following aspects were applied:

- Every sub-task was counted as a separate task.
- To consider reproduction, the continuous text in the textbook was deemed to be the body of knowledge for the student.

- The tasks were categorised based on the answers in the teachers' guides as the performance expected of the student becomes visible with respect to recognition as well as realisation rules.

After categorisation, the frequencies were analysed using descriptive statistics with Excel and SPSS for correlations between the two contexts as well as between the textbooks (one sample T-test, one-way ANOVA [Post Hoc Dunnet T3], bi-variate correlation [Spearman's Rho], Kruskal–Wallis). For each textbook, a representative sample of at least 10% of the tasks was categorised by a second expert. The Cohen's Kappa of 0.71 shows that the interrater reliability was sufficient. The results of the categorisation of the textbook tasks were discussed by an expert review panel with subject pedagogy expertise from both NRW and NL.

## Results and discussion

The analysis of the tasks on the topic of Geographies of Food and Agriculture in six (three Dutch and three North Rhine-Westphalian) textbooks led to the following results (Table 1).

For all textbooks, most tasks belonged to the UTS level, followed by tasks at the LOT level. Tasks in the category of "Recognising" only occurred in the Dutch textbooks. At the UTS level, we see concentration in two categories. Firstly, there were a substantial number of tasks aiming at transforming, extracting or completing information. However, while tasks in German textbooks more often required an analysis of the resource as a whole, tasks in the Dutch textbooks frequently required detailed knowledge. Secondly, with respect to the other category of "Finding, naming or explaining patterns and correlations", tasks in the German textbooks mostly required several aspects to be mentioned in answers. The Dutch textbook tasks, however, required quite specific information, which could not always be derived from the resources given, but partly required everyday knowledge, as also occurs in PISA tasks (Uhlenwinkel, 2005). Tasks in this category occurred more often in the Dutch (32.45%) than in the German textbooks (12.35%), and here the difference between both countries was significant ($t$ (85.23) $= -2.01$, $p < 0.05$).

Tasks at the PHOT level were low (under 3.5%) in three of the six textbooks. Only two of the German textbooks offered tasks covering nearly the whole range of this level. A larger number of tasks fell into the category of "Naming possible solutions". With respect to Higher Order Thinking, tasks fitting into the category of "Analyse" were absent from the Dutch textbooks. Tasks in the category of "Create" only occurred in one Dutch textbook, despite the ambition of the field to teach problem-solving, which are considered essential to students' ability to influence the future of spatial structures and processes. The reasons for this lack might be due to the topics studied; for example, the problems might be thought to be too big to be "solved" by students, or by difficulties in constructing adequate tasks in this category. Tasks in the category of "Evaluate" were present in five of the six textbooks, but the variation between them was considerable. Only three textbooks offered metacognitive questions

**Table 1.** Results per textbook of the analysis of tasks on the geographies of agriculture and food, according to cognitive processes and geographical thinking.

| Category of tasks | 1 | 2 | 3 | x̄ NRW | SD | 4 | 5 | 6 | x̄ NL | SD |
|---|---|---|---|---|---|---|---|---|---|---|
| Gathering (read, look …) or naming information (number or title of resource ..) without any further task | 0,97 | 0,57 | 0,00 | **0.51** | 0.49 | 0,00 | 0,00 | 6,67 | **2.22** | 3.85 |
| Recognizing (learnt knowledge) | 0,00 | 0,00 | 0,00 | **0.00** | 0.00 | 5,19 | 1,63 | 0,00 | **2.28** | 2.66 |
| Reproducing (learnt knowledge) | 15,53 | 30,11 | 23,18 | **22.94** | 5.19 | 9,09 | 33,70 | 13,33 | **18.71** | 13.05 |
| Performing (simple procedures) | 1,94 | 1,70 | 2,65 | **2.10** | 0.49 | 5,19 | 1,09 | 3,33 | **3.21** | 2.06 |
| LOWER ORDER THINKING (LOT) | 17,48 | 31,82 | 25,83 | **25.04** | 7.20 | 19,48 | 36,41 | 16,67 | **24.19** | 10.68 |
| Transforming (f. ex. verbal into non-verbal), extracting or completing information (in schemas) | 16,50 | 19,89 | 23,18 | **19.86** | 3.34 | 17,53 | 3,80 | 20,00 | **13.78** | 8.73 |
| Exemplifying | 2,91 | 1,14 | 1,32 | **1.79** | 0.98 | 0,00 | 3,80 | 0,00 | **1,27** | 2.20 |
| Comparing or classifying | 7,77 | 5,11 | 7,28 | **6.72** | 1.41 | 6,49 | 3,80 | 6,67 | **5.65** | 1.60 |
| Giving the main points or summarizing | 6,80 | 3,41 | 2,65 | **4.28** | 2.21 | 5,19 | 1,09 | 0,00 | **2.09** | 2.74 |
| Finding, naming or explaining patterns and correlations | 12,62 | 12,50 | 11,92 | **12.35** | 0.37 | 37,66 | 39,67 | 20,00 | **32.45** | 10.82 |
| Constructing hypotheses or formulating enquiry questions | 0,00 | 0,57 | 5,30 | **1.96** | 2.91 | 6,49 | 2,72 | 13,33 | **7.51** | 5.83 |
| USE OF THINKING STRATEGIES (UTS) | 46,60 | 42,61 | 51,66 | **46.96** | 4.53 | 73,38 | 54,89 | 60,00 | **62.76** | 9.55 |
| Discrimination of (ir-)relevant information in larger contexts | 1,94 | 0,00 | 0,00 | **0.65** | 1.12 | 0,00 | 1,09 | 0,00 | **0.36** | 0.63 |
| Generating a complex, coherent, relational structure | 2,91 | 1,70 | 1,32 | **1.98** | 0.83 | 0,65 | 0,00 | 0,00 | **0.22** | 0.37 |
| Identifying intentions, values and biases in information | 1,94 | 1,70 | 0,66 | **1.44** | 0.68 | 0,00 | 0,00 | 0,00 | **0.00** | 0.00 |
| Checking correctness and consistency of information | 0,00 | 0,00 | 0,66 | **0.22** | 0.38 | 0,00 | 0,00 | 3,33 | **1.11** | 1.92 |
| Naming possible solutions for a problem based on criteria | 1,94 | 0,00 | 2,65 | **1.53** | 1.37 | 1,30 | 1,63 | 6,67 | **3.20** | 3.01 |
| PARTS OF HIGHER ORDER THINKING (PHOT) | 8,74 | 3,41 | 5,30 | **5.81** | 2.70 | 1,95 | 2,72 | 10,00 | **4,89** | 4.44 |
| Analyse: breaking complex materials into its constituent parts, identifying intentions and biases, generating a logical structure to present the result in f. ex. an essay | 4,85 | 6,25 | 2,65 | **4.58** | 1.82 | 0,00 | 0,00 | 0,00 | **0.00** | 0.00 |
| Evaluate: judging a phenomenon after analysis based on criteria presented in f. ex. an essay or by | 16,50 | 6,25 | 2,65 | **8.47** | 7.91 | 2,60 | 1,63 | 0,00 | **1.41** | 1.31 |

**Table 1.** Continued.

| Category of tasks | 1 | 2 | 3 | x̄ NRW | SD | 4 | 5 | 6 | x̄ NL | SD |
|---|---|---|---|---|---|---|---|---|---|---|
| using a complete argumentation | | | | | | | | | | |
| Create: developing a solution for a problem in a structured way after analysis by using criteria and presenting it in f. ex. a poster, map or essay | 0,00 | 0,00 | 0,00 | **0.00** | *0.00* | 0,00 | 1,09 | 0,00 | **0.36** | *0.63* |
| HIGHER ORDER THINKING (HOT) | 21,36 | 12,50 | 5,30 | **13.05** | *8.04* | 2,60 | 2,72 | 0,00 | **1.77** | *1.54* |
| Reflecting on the content, the process or oneself | 0,00 | 1,14 | 0,00 | **0.38** | *0.66* | 1,95 | 2,72 | 0,00 | **1.56** | *1.40* |
| Presenting results | 3,88 | 1,70 | 1,32 | **2.30** | *1.38* | 0,65 | 0,54 | 0,00 | **0.40** | *0.35* |
| No answering model available | 0,97 | 6,25 | 10,60 | **5.94** | *4.82* | 0,00 | 0,00 | 6,67 | **2.22** | *3.85* |

(x̄ = mean value per country based on the percentages per book [3 books per country: 1 = Terra, 2 = Mensch und Raum, 3 = Diercke Praxis, 4 = De Geo, 5 = De wereld van, 6 = Buitenland] and SD = standard deviation).

(none of them referred to knowledge of knowledge), while tasks concerning bias in or correctness of information were scarce.

Despite the variance between all six textbooks and between the textbooks of one country, we detected significant differences between the countries. UTS-level tasks were greater in the Dutch books, while the HOT-level tasks were greater in North Rhine-Westphalia. This partly confirms previous results (Krause et al., 2017), but the margins in the current study are smaller.

Taking a closer look at the textbooks of each country (see online repository), we saw that in the Dutch books more tasks at the Lower Order Thinking level related to fewer tasks at the UTS level. For the North Rhine-Westphalian books more tasks at the UTS level were linked to less tasks at the PHOT and/or HOT level. This raises the question of the ideal balance between types of thinking tasks included in a textbook, and how attaining this balance might contribute to epistemic ascent and the acquisition of powerful knowledge. The categorizing of the tasks showed that, in some of the textbooks, the number of LOT tasks accounted for more than 30% of all tasks. However, it is only through higher order thinking tasks that students learn to apply complex ideas on their own, relate them to exemplary materials, structure their ideas, build up their argumentation and, by doing this, produce valid texts. This competence is required within the scientific context (in a potential future career).

Furthermore, we were able to compare our results with a classification done by the authors of one of the Dutch textbooks, De Geo (with the exception of the tasks they classified as "application"). A comparison of the labelling showed a sufficient interrater reliability (Cohen's Kappa of 0.71). Disagreement occurred mainly with the categories of "Finding, naming or explaining patterns and correlations" and "Hypotheses or formulating enquiry questions", where tasks were considered to be in the category of "Analyse" by the textbook authors, which suggests a different interpretation of "analysis".

Criteria were required in all of the answer models for higher order thinking tasks. However, for 15 of the 52 HOT tasks in the German textbooks, the criteria were given in the task, such that the main aim was the derivation of information from the

resources and its structuring in order produce legitimate texts according to the real-isation rules (e.g. essays), which confirms concerns within the German context (Klein, 2010). The most frequently used criteria were linked to "sustainability" and "entitlement" (the set of all commodity bundles a person legally, politically, econom-ically and socially has access to) in judging the preferability of developments in food production and consumption. "Entitlement" (Sen, 1981), however, was not explicitly introduced as a concept in any of the textbooks.

All of the experts in subject pedagogy from both jurisdictions (expert appraisal) considered in the interviews the results to be meaningful, both for their own curricu-lum context and for comparison. The Dutch experts recognised the absence of Higher Order Thinking tasks, in which "you have to undertake a real analysis". The German experts interpreted the results that "it was quite illustrative that not only is competence orientation important, but also geographical concepts are". Finally, the question of the influence and pre-shadowing effects of high stake exams, for both curriculum contexts, was also raised.

## Conclusion

The aim of this research was to develop a practical instrument in order to categorise tasks regarding the kind of thinking they promote in different curriculum contexts. Bernstein's notion of recognition and realisation rules helped us to understand the development of higher order thinking – or epistemic ascent – as a path of increasing dif-ficulty with respect to cognitive processes and demands regarding expected outcomes.

The GTC Framework with its criteria-based levels helped to identify how tasks contribute to the five aspects of powerful knowledge. In doing so, it demonstrates, that the heuristic of powerful knowledge can be applied for analytical purposes. The framework proved to be consistent and applicable in practice, and can be helpful for teachers in selecting tasks fostering higher order thinking in their geography lessons, not only in the Dutch or German context. Furthermore, the framework delivered meaningful and reliable results and was able to reveal the differences between the textbooks and the curriculum contexts. The results emphasised that the UTS level does comprise essential thinking skills, which are key to the development of system-atic knowledge and an important step towards higher order thinking (Béneker & Van der Vaart, 2020; Maude, 2020; Winch, 2013).

We also showed that, in the Dutch context, the interpretation of the categories of "Understanding" and "Analyse", which are used in the revised version of Bloom's tax-onomy, pose problems in practice. These labels are not understood in daily practice in the manner intended and defined by the taxonomy. A reconsideration of "understanding" as the *Use of Thinking Strategies* better reflects the intended meaning in the taxonomy, as the cognitive processes at this level exceed the mere reproduction of information in one's own words, which is a widely used definition of "understanding".

With respect to Higher Order Thinking, the instrument revealed the importance of realisation rules (Bernstein, 2000), which aim at the production of legitimate texts such as essays and other forms required by the scientific discourse at higher educa-tion levels. Textbook tasks in this category were scarce in the Dutch context, which

confirmed previous results (Krause et al., 2017). Furthermore, the analysis showed the importance of the independent use of geography concepts (criteria) in Higher Order Thinking tasks, because otherwise the focus in these tasks would lie too much on the realisation rule. Moreover, the *Parts of Higher Thinking* level allowed us to distinguish a set of tasks that do not focus on the production of legitimate texts as a whole but make use of more complex resources and require the use of criteria, and in this way promote multiperspectival, critical and future-oriented thinking, which are key elements of the knowledge required for societal debates.

As Bernstein frequently mentions, the distribution of knowledge is political and power relations decide about the type of knowledge certain groups get access to (2000, p. 31). In this regard, the analysis of the Dutch textbooks by our instrument revealed that at the highest level of upper secondary education there is a significant shortcoming with respect to realisation rules, which poses the question of epistemic access (Hudson, 2018; Wheelahan, 2010). However, we should understand textbook tasks as reflecting the "intended curriculum" (Van den Akker, 2003) and potential material, which means that teachers decide what types of tasks they use in practice. The latter and the criteria used by teachers to choose tasks for classroom practice, which according to Van den Akker (2003) concerns the "implemented curriculum", require further exploration.

A final point for further consideration concerns the curriculum contexts of the two jurisdictions studied, which not only differed in how the theme of Geographies of Food and Agriculture was interpreted but also in the variation in the levels of tasks. These contexts are determined and re-contextualised, for example, by official institutions, through curriculum documents and other legal regulations, which were not part of the scope this paper. Further research should examine if and how these contextual factors correlate with the tasks found in textbooks and the criteria teachers use when task-setting in the classroom.

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