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Learning the Disciplines Through Linguistic Feedback: Contribution to the Development of a Discipline-Specific, Formative Evaluation of Students' Assignments

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Abstract

Students write to learn. Besides, enculturation to the disciplinary discourse happens during writing. Feedback on the assignments from the students scaffolds students' writing development and learning paths. However, knowledge about the relationship between language, including argumentation in the discipline, on one hand, and the content of the discipline, on the other, is needed. This article is based on a socio-cultural approach to writing in the disciplines, and theory on feedback, and focuses on the relationship between the meso-level of texts (sentences, clauses, word choice) and the content of the discipline. We discuss how insight into the meso-level of texts may be used to improve and to develop feedback and formative evaluation. Cases from an intervention project in a Danish upper secondary school are included, and indicate that teachers and students assign a lower priority to feedback on the meso-level. This article claims that providing feedback on the meso-level strengthens writing development and students' learning processes. To illustrate how this may be accomplished two texts are analyzed: one from a history class and one from a biology class.

Keywords: disciplinary writing, feedback, formative evaluation, the text triangle

1. Introduction

Language and thought are closely connected (Vygotsky, 1962, p. 200-203), and furthermore, are closely connected to learning. Language materializing in writing involves a process of giving concrete form to thoughts, and making them visible to the writer and the reader. The written communication must be understandable to a reader in another time and space than the writer, which calls for decontextualization. This decontextualization makes writing challenging. But in another sense, discipline-specific writing is contextualized, specifically through a disciplinary discourse. The writer obtains access to a disciplinary discourse by writing with a specific purpose, and applying the language and genres specific to the discipline (Krogh & Hobel, 2020; Vygotsky, 1962). In other words, writing is an important teaching and learning tool. In the framework of New Literacy Studies (e.g. Street, 1997), recent Danish research (Krogh, 2015) suggests that writing in the disciplines involves learning the content of the disciplines concurrently. Writing is a meaning-making process situated in a specific context and community, rather than a technical skill that transfers knowledge from the head to the paper/the screen. In short, writing is a situated meaning-making process.

Learning is scaffolded by activities other than writing, such as feedback, and formative evaluation. Research from both cognitive and sociocultural perspectives shows that feedback scaffolds learning as well as writing and writer development (e.g. Black & Wiliam, 1998; Graham et al., 2015; Hattie & Timperley, 2007; Piekut & Hobel, 2016). But the situation is different when it comes to the question of *how* language and discipline-specific knowledge are connected, and *how* the students' work with this connection are supported by feedback. Research on these topics is sparse. This knowledge is needed in classroom practices, where teachers find it difficult to teach writing and discipline-specific content simultaneously. Solid knowledge of both language and the discipline-specific content is necessary. Teachers in subjects that are not language-focused, find this especially challenging.

This article contributes to the development of the theoretical and didactic (Note 1) knowledge of feedback on students' texts that scaffold their writing in the disciplines and learning the disciplines through the same process. We focus on how explanations specific to a discipline are realized at the meso-level in the text, which, roughly speaking, includes word choice, constructing and linking sentences, and developing paragraphs. We describe a

connection between language, knowledge specific to the disciplines, and feedback that scaffolds student writing and learning of the disciplines.

By analyzing two student texts from Danish upper-secondary-school biology and history we discuss our contribution. The texts origins from an intervention project conducted by one of the authors of this article. Texts from two subjects were chosen to demonstrate how the formative feedback is connected to, and dependent on, the discipline's discourse. Just as the subject teachers' lack of knowledge of language and writing, we, as researchers in the field of writing, lack knowledge of the discipline-specific content and discourse. Thus, our analysis was carried out in dialogue with teachers who know and participate in the actual disciplinary discourse.

2. Existing Research on Feedback and Writing

In this section we present existing research on the impact of feedback in general and on feedback on writing and student texts. Next, we present studies of the connection between writing and learning in the natural sciences and history, as our examples of student texts and feedback activities are drawn from these disciplines. This exposition shows uncertainty and a lack of awareness of feedback at the meso-level of the text.

Feedback scaffolds and supports learning (Black & Wiliam, 1998; Hattie & Timperley, 2007; Shute, 2008), regardless of whether it is provided by a teacher (e.g. Blåsjö & Josephson, 2018; Dysthe, 2011; Wingate, 2010) or by a peer (e.g. Adams, 2011; Crossman & Kite, 2012). According to Hattie and Timperley (2007), feedback that enhances learning works at four levels: task, process, self-regulation, and self. Feedback on the self-level addresses the recipient rather than learning, and research on feedback at this level reveals ambiguity regarding its effect on learning, therefore, we omit the self-level from this article. Feedback on the task level addresses an assignment or activity, and feedback on the process level addresses the work process. Hattie and Timperley (2007) describe the self-regulation level mainly in terms of personal elements such as motivation and engagement. Monitoring learning is also mentioned, but only briefly. To stress the learning aspect together with the personal elements, we call this level "self-regulation and meta-reflection" (Christensen, 2014; Christensen & Hobel, 2020). Feedback on this level scaffolds the questions of how you *engage* in the learning process and *what* you are learning.

The positive impact of feedback to writing is well-studied. In keeping with Krogh (2010a, p. 27), we distinguish between language-focused disciplines and not language-focused disciplines. Language-focused disciplines are characterized by their use of language and texts as the discipline's media and content. Though research that focuses on both language/writing and discipline-specific content is sparse, as is evident below, we conclude it is possible to use knowledge of writing in language-focused disciplines in writing in non-language-focused disciplines. Research in subjects that include language and texts as content indicates that criteria-based feedback supports students' writing (Murtagh, 2014; Parr & Timperley, 2010; Timperley & Parr, 2009). Feedback is provided mainly on the task level, and to a lesser degree on the process level, whereas feedback on the self-regulation and meta-reflection levels is nearly absent (Christensen, 2015; Christensen & Hobel, 2020; Hattie, 2012). Students are most likely to use feedback on the local level (Bueie, 2016; Christensen, 2015; Igland, 2008) though some students also request feedback on a text's global level (Bueie, 2016).

Feedback on texts is often categorized as local and global (Igland, 2008; Kronholm-Cederberg, 2009; Smedegaard, 2016; Timperley & Parr, 2009). Unfortunately, there is no consensus on the meaning of these categories. For Underwood and Tregidgo (2006), feedback is categorized according to text levels. The local level encompasses grammar and mechanics, for example spelling and other elements that may be identified as correct or incorrect. Their global level encompasses content and structure. Otherwise, Underwood and Tregidgo call the two levels surface- and content-levels. Vardi (2008) categorizes feedback according to the information conveyed, and she adds the category of "unclear." Feedback on the text as a whole is labelled "global feedback," and feedback on a specific aspect of the text is labelled "local feedback." For example, feedback on the wording of a specific argument is categorized as local-level feedback, whereas feedback on overall argumentation is global-level feedback. Feedback on the structure of a paragraph, for example, the conclusion, is local-level feedback according to Vardi, but global-level, according to Underwood and Tregidgo. Vardi's "unclear" category is feedback that addresses neither the local nor the global level. Blåsjö and Josephson (2018) use the terms macro- and micro-levels, which correspond to Underwood and Tregidgo's global and local text levels. Between the two levels, they add a meso-level that comprises cohesion and paragraphs' structure, among other things (this is elaborated in the next section). According to their results, feedback from lecturers concerning this level is almost absent. A similar finding appears in a study on feedback from disciplinary writing tutors tofirst-year BA students (Christensen & Hobel, 2020).

The meso-level is explicitly mentioned in a study by Koffman et al. (2017). In their study, feedback is based on a rubric that includes discipline-specific content and linguistic elements at macro-, meso-, and micro-levels: thesis

statement or hypothesis, data analysis and interpretation, construction of an argument, paragraphs with a topic sentence and conclusion, appropriate syntax, and correct grammar.

The meso-level is implied in Lachner et al.'s (2018) investigation of the impact of computer-based feedback on students' development of cohesion in explanatory texts. Students' texts were analyzed with dedicated software, and hierarchies and other relationships between central terms are visualized in a concept map. The concept maps describe the structure of the texts' content, and are the foundation for the students' ongoing work. An analysis of the text's meso-level is a necessary element of the concept map, but the analysis is hidden by the concept map.

If we turn to investigations of writing in the natural sciences and history as taught subjects, we find a few studies. De La Paz (De La Paz, 2005) investigated how teaching knowledge specific to the disciplines, combined with generic writing strategies, supported students' reasoning about history and argumentative writing. The students were taught to develop ideas, compose sentences and paragraphs, including topic sentences, add supporting ideas, anticipate opposing arguments, and reach a conclusion. After the instruction, students wrote longer and more persuasive texts, and improved both argumentation and historical content. Two other studies investigate generic writing versus writing specific to a discipline (Smirnova, 2015; Van Drie et al., 2015).

In the sciences, there is greater variation than in history with regard to the level of linguistic detail. Schmidt-McCormack et al. (2019) studied how students' discipline-specific writing about organic acid-base chemistry was scaffolded by writing-to-learn activities. The students received rubric-based feedback from a writing tutor. The researchers find that feedback leads to more precise writing about the acid-base concept. Finally, Morawski and Budke (2019) investigate the extent to which the use of peer feedback in the subject of geography may improve students' written argumentation. A list of three stages of feedback was designed to scaffold the peer feedback. The first stage concerns general linguistic matters, such as spelling and grammar. The second stage concerns subject-specific means and text coherence, and the third stage concerns arguments specific to geography. These three stages almost align with to the micro-, meso-, and macro-levels.

Very few studies address the text's meso-level, but several studies implicitly draw on awareness of this level. Research in the "new literacies" tradition (in Denmark, e.g.., Christensen, Krogh and Jakobsen, 2015; Krogh and Jakobsen, 2016) indicates that academic writing is not a generic matter, but discipline-specific. Subject matter is learned through writing in the discipline. Furthermore, enculturation in a disciplinary discourse is achieved through writing. However, there is a lack of knowledge about how a discipline's discourse is realized in student texts, especially at the meso-level. Knowledge about how to convert this knowledge into feedback and supervision in classroom practices is also missing.

3. Theoretical Understanding of the Connection between Writing and Learning

According to Vygotsky (Emig, 1977; Vygotsky et al., 1971) writing is a mediating tool for thinking and learning. Writing is not recording thoughts; thoughts emerge during writing. New Literacy Studies (Krogh & Jakobsen, 2016; Krogh et al., 2015; Street, 1997) are based on this understanding, and conceptualize literacy as the ability to decode, understand, and use speech and other kinds of semiotic resources. Literacy is a social practice that is acquired in a specific situation, for example a classroom dialogue or a medical consultation.

Shanahan and Shanahan (2012) emphasize that academic content is expressed, developed, and negotiated through language. Because of the close connection between language and thought, written texts are expressions of a learner's discipline-specific knowledge. The learner is enculturated through the situated practice of disciplinary writing (Prior & Bilbro, 2012). Variations in the disciplines' languages are connected to their epistemological focuses and associated ways of thinking about the disciplines (Kristiansen, 2017, chapter 3; Shanahan & Shanahan, 2012). Roughly speaking, the natural sciences are preoccupied with causal relationships in nature, the humanities are preoccupied with an understanding of human activity, and the social sciences are preoccupied with conditions in society.

Shanahan and Shanahan (2012) state that the natural sciences are generally focused on identifying and explaining causality. The results of scientific studies are communicated in genres, using unambiguous academic terms that are part of a strict classification system—the periodic table is an example. To describe experiments and natural incidents, temporal conjunctions such as *first* and *subsequently* are used, whereas causal conjunction, such as *because*, *consequently* and *as a result of* indicate explanations. According to Shanahan and Shanahan, the subject, "I," seldom appears in the text because the experiments and data on which the results are based must be repeatable by others, and thus the interpreting individual is insignificant. In the natural sciences, *causal explanations* with the form,' if the initial conditions Z are present, then X follows from Y' are used. In biology, *functional explanations*, with the form, 'the feature X in an organism in a population "wins" in the evolution if this feature X provides the organism with better conditions for reproduction than the alternatives' are used (Føllesdal et al., 1990).

Nominalization is often used: a verb denoting a process is hidden in the corresponding noun. Water may evaporate (verb), but scientists study evaporation (noun). Nominalization entails reification by hiding the process and the participants, on one hand; on the other hand, it benefits from the circumstance that causal relationship between two nominalizations is clearly expressed. For example, CO_2 emission (noun, verb: emit) causes global warming (noun, verb: warm up). The relationship between CO_2 emission and global warming is explained. However, who did what and when they did it is not explained.

According to Shanahan and Shanahan (2012), the general focus of history is to describe, explain, and understand connections at both the structural and the agency levels of society (Giddens, 1979). The loose structure of the essay as a genre is suited to broad and complex cognition. On the word level, metaphors may be used for their ability to convey possible global connections, based on an understanding of historical sources. When describing historical courses, temporal conjunctions are used, whereas causal conjunctions are used to describe possible causal relationships. History makes use of *causal explanations* and *functional explanations*, for example, a researcher may state that the nuclear family better ensure adequate childcare in modern society than alternative family structures. In contrast to natural sciences, history also uses *intentional explanations*: 'action X is, according to the participant, the best means of actualizing a desire in situation Y'. As a consequence of the focus on the participant, nominalization may be problematic, for example, steam-engine technology facilitated industrialization, because agency, the participants, their interests, and the balance of power are hidden, and the development appears natural. Finally, the first-person "I" is crucial to the texts, as historians are interested in other historians' argument or interpretations of a historical development.

The natural sciences and history use explanations to describe nature, and to understand history and interpersonal relationships, respectively. The character of the explanation and the linguistic form used vary from discipline to discipline. Scaffolding and providing formative feedback on students' ability to give explanations appears to be central to disciplinary writing. Furthermore, and with refence to the SOLO taxonomy (Biggs & Collis, 1982), students must be able to work relationally, rather than unistructurally or multistructurally, which means that they must discuss the relationships between various explanations, and base their discussion in the discipline, rather than deliver individual pairs of reason and consequence. Discipline-specific terminology and methods are warrant for the claims (Toulmin, 2003). Given this, all subjects are in fact language-focused subjects (Krogh, 2010b, p. 27; Wellington & Osborne, 2001). Although language as such is not the subject taught, as it is in Danish and English, the natural sciences and history also use language as a medium for constructing knowledge and meaning. Feedback on language as a medium for presentation, meaning-making, and developing knowledge of a discipline, is a key learning activity.

Summarizing, research indicates that feedback is under-prioritized and under-didacticized for example, attention to how the language is used in the disciplinary discourse is missing. Also, the levels of words, (including discipline-specific concepts), sentence construction, and the connections between sentences, including relevant concepts, paragraphs, and connections between them, are under-prioritized. To be sensitive to discipline-specific learning, feedback concerning these features must be included. We have been inspired by Blåsjö and Josephson's work (2018) to call this the "meso-level".

In Denmark, the text triangle (Dysthe et al., 2000; Hillocks, 1987), which describes the text and the writing process, is a widely-used model among researchers, teachers, and students.

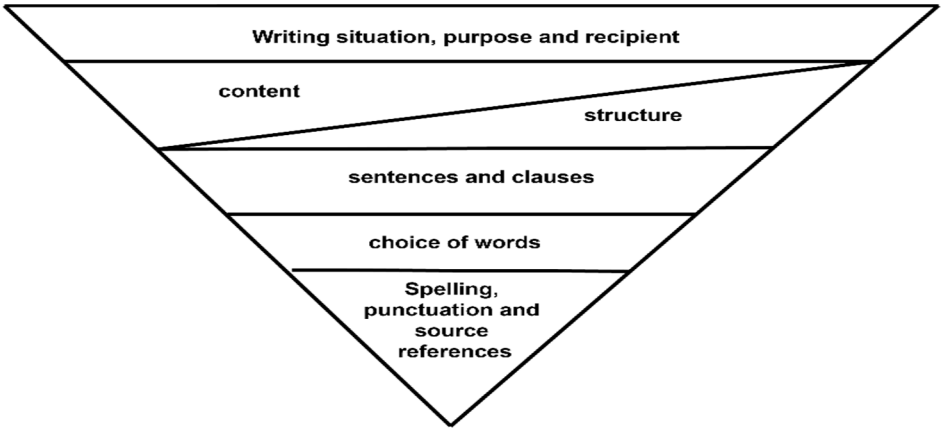

Figure 1. The text triangle (Dysthe et al., 2000—translated by the authors of this article)

The text triangle encompasses five levels, which visualize the elements of a text. The micro-level is the smallest triangle, which comprises formal elements, such as spelling, punctuation, and correct referencing. The macro-level is the writing situation (the setting in which the writing takes place), the purpose, the recipient (audience, reader), the main part of the content, and the structure of the entire text. The meso-level lies in-between, and comprises word choice and sentences, including the connections between sentences and the paragraphs. The argument concerns the text as a whole, but is realized through sentences and paragraphs. Feedback at the meso-level scaffolds the arguments and explanations specific to the discipline.

The text triangle is based on the understanding of writing as situated social practice in schools and as a part of education. The first step in writing is to consider the writing situation, the purpose of the writing and the reader. The content and structure are adapted to the purpose and the audience. The next step is to realize the content and structure on the word and sentence levels. Writing is a recursive process in two senses. First, the writer monitors his or her writing with respect to keeping the writing within the disciplinary discourse, and to meeting the purpose of the text. Secondly, the writer revises and adjusts the text continuously, or at least when a draft is finished. In other words, macro-level considerations are the first step in the writing process. Dysthe et al. (2011) suggest that feedback and revision should begin on the level of formal elements, words and sentences in the text triangle. However, feedback and revision on this level must be consistent with the disciplinary discourse, and must support the intended purpose. In other words, feedback and revision start at the micro- and meso-levels. Revision is recursive also because changes in one paragraph may demand revision of other paragraphs.

Formative evaluation of students' texts (Dysthe & Hertzberg, 2009; Hattie & Timperley, 2007) is task-level feedback. This feedback is based on an assignment's requirements, the success criteria, that is, it is goal-oriented feedback. Focusing on feedback on the task level implies the risk of losing the opportunity to generalize and support learning beyond the actual assignment. Feedback that addresses the writing process, and the link between the current and future assignments, supports long-term learning, that is, it is action-oriented feedback that may further expand and scaffold self-regulation and the monitoring of learning in the disciplines.

We conclude that mastering writing at the meso-level is a prerequisite for accessing a disciplinary discourse. Scaffolding students' learning in the disciplines through the writing process involves the ability to provide feedback on the meso-level. Feedback that scaffolds students' disciplinary writing cannot be limited to a focus on the genres specific to a discipline and it's conceptual apparatus (macro), and on spelling, syntax, and rules for references (micro).

4. Two Cases—Analysis and Reflection

The aim of this section is to exemplify how teachers may give feedback at the meso-level, and how teachers and students may develop, formulate, and use lists of criteria for good writing in the school subjects, which address the macro-, meso-, and micro-levels. We intend to demonstrate that focusing on the meso-level leads to a more in-depth understanding and mastery of a disciplinary discourse. Thus, the feedback functions as a formative evaluation. As our point of departure, we emphasize that all subjects become language-focused subjects by using language as a mediating tool for developing knowledge.

In this section we examine and analyze two completed assignments and the teacher's feedback on them. Our two examples are drawn from the Higher Preparatory Examination Programme, which is one of four programs in the Danish upper secondary school system. (Note 2) Interdisciplinary cooperation is mandatory in the Danish upper secondary school, and in the Higher Preparatory Examination, the Humanities and Social Science Group and the National Science Group are multi-subject courses. These courses conclude with an oral examination. Humanities and Social Science Group-students hand in a synopsis, which is presented at the oral examination as the starting point for a dialogue. In the Natural Science Group, the students present and discuss one of the multi-course subject reports written during the course.

The assignments discussed here, derive from a formative intervention project (Engeström, 2011) conducted by one of the authors at a Danish Higher Preparatory Examination Programme, from 2017 to 2020. In this intervention project, the teachers and the researcher developed new knowledge about writing in the disciplines, first and foremost about using lists of criteria, and about focusing on the meso-level when giving feedback, that is, about students enculturating themselves in the disciplinary discourse. In both classes, the teacher and the students developed lists of criteria for good writing in the discipline.

5. Humanities and Social Science Group—Focusing on the Subject History

The first assignment we discuss is about Greenland, and was handed in by a group of students in the Humanities and Social Science Group (History, Social Science, and Religion). The complete data set consists of the

synopsis, observations from the oral examination, and the feedback provided by the teachers. The teachers determined the problem statement: "What cultural and social developments has Greenland undergone since World War II?" The assignment on Greenland was handed in by a group of students, and presented at an oral examination. Oral and written feedback were provided.

First, we present the list of criteria for writing about the subject, agreed on by the students and the teacher. Then, we analyze how Greenland's cultural and social development are explained in an excerpt from the history segment of the assignment.

The list of criteria included 28 criteria for a good assignment. With respect to the text levels, according to the text triangle, they were distributed in this way:

- Eight criteria relate to the writing situation, and address the interdisciplinary character of the assignment.
- Five criteria relate to content and structure. Four of these address the use of discipline-specific concepts, and one addresses the use of quotations as documentation.
- Three criteria relate to sentences/clauses, and state that sentences should be "concrete," and that questions formulated by the students should be "specific."
- None of the criteria relate to word choice.
- Twelve criteria relate to formal elements, and address footnotes, references, and copy editing.

As is evident, the meso-level has low priority.

Next, we analyze an excerpt from the assigned text:

The assignment	Causal relations
When Denmark reconnected with Greenland after WWII Greenland had changed,	(The excerpts begin with a temporal conjunction.)
it had been affected by American culture,	That is, Greenland's society had changed, *because of* American culture.
which had spread across the country.	The influence of American culture *resulted in* a demand for independence (causal conjunction packed in the verb).
This resulted in Greenland's demand for self-governance They wanted to determine their own policies, and to make their own laws and rules. In other words: they demanded independence.	Denmark did not accept this (no cause is given), *and because of that*, the G50 and G60programs were implemented
That could not be accepted by Denmark, and because of that the G50 and G60 programs were implemented.	That is, *as a result* of the programs, home rule became an option.
This was a way to modernize Greenland under Danish control. Finally, in the late 1970s, Greenland was granted home rule,	T*hus*, Greenlanders were granted home rule.
which included the establishment of a parliament and thereby the right to self-determination.	

Figure 2. Excerpt from the history section of the synopsis. Yellow = given; Red = causal conjunction

There are many options for providing feedback on the meso-level.

One may begin by saying that the text is chronologically structured. Each sentence begins with a pronoun or a noun. This pronoun or noun refers to what is known from the previous sentence (this does not apply to the penultimate sentence). Then, new information follows. This establishes cohesion and coherence. Furthermore, there are causal relationships between the sentences—implicit or marked with causal conjunctions. A chain of monocausal explanations is established. These explanations are unistructural (B is followed by A), and the initial conditions are not presented explicitly (under what conditions may there be a desire for independence?).

Societal structures and agency are packed into the concepts of "Greenland" and "Denmark." Therefore, it is unclear whether the explanations are intentional or causal. Thus, it is crucial to discuss how intentional explanations are realized on the sentence level. Feedback on the sentence "That could not be accepted by Denmark, and because of

that the G50 and G60 programs were implemented" should discuss these questions: Who is "Denmark"? Why was "Denmark" opposed to Greenland's self-governance? Who acted, with which intentions, in which context of politics and power in Denmark? Who acted, and with which intentions on Greenland's side? Furthermore, does hiding societal structures *and* agency in the concept of "Greenland" imply a deterministic approach that makes agency and intentions invisible? And finally, which theory may be used as a back up for the claim about the developments in Greenland? And how is this argumentation realized on the sentence level? Thus, feedback may be given on how complex and multicausal explanations may be formulated on the sentence level.

During the oral examination, the history teacher urges the students to apply disciplinary concepts (disciplinary concepts as the vocabulary of the subjects). But he does not comment on the use of disciplinary concepts in the students' argumentation (disciplinary concepts as the subjects' syntax—How do you formulate valid sentences, for example, explanations, concerning the various subjects, using the disciplinary concepts?). Neither does he question the theories embedded in the concepts, nor how the students use the concepts in causal explanations. He does not assess whether or not their explanations are valid.

After the oral examination, the teacher provides little oral feedback. Instead, he refers to written feedback on the synopsis. However, the teachers emphasize that the students are supposed to learn from this mock examination. The self-regulation and the meta-reflection levels are briefly mentioned.

The teachers provide 12 feedback comments on the synopsis.

- Addressing the writing situation (four comments): The teachers remind the students that the section accounting for the historical development in the synopsis must be the longest. Thus, they do not need to repeat the findings presented in this section during the oral examination. Instead, they should focus on analysis and discussion. The teachers add that the problem statement must be addressed in the conclusion.
- Addressing the content and structure levels (seven comments): The teachers praise "the fine structure" of the completed assignment. They urge the students to use the compendium of texts handed out in class. By referring to these texts the students document the claims, they stress. The teachers urge the students to use disciplinary concepts, and to critically evaluate their sources.
- Addressing the level of formal elements: "Footnotes are good."

It appears that the teachers do not address the meso-level, for example, how explanations of the historical events are realized on the sentence level, and how sentences are connected.

Teacher feedback that scaffolds linguistic development and disciplinary learning could address terms or concepts such as "Greenland" and "Denmark." These function in the same way as nominalization. Social structures and agency are embedded in these concepts. If the concepts were developed, more complex explanations of the structure and agency levels could be one result.

If the teachers want to challenge the students' use of monocausal chains of explanations, they could urge the students to present various explanations given by various researchers or textbooks. They could urge them to evaluate the various sources, and to consider whether—and how—the various explanations complement each other.

6. Natural Science Group—Focusing on the Subject Biology

The second assignment we discuss is a biology journal on the digestion of fat as part of a lesson plan about "Health and living conditions," for the Natural Science Group (Biology, Geography, and Chemistry). The complete data set was drawn from a biology journal written by a student, based on an experiment conducted by two students, peer feedback from one student (video recorded), and feedback provided by the biology teacher. The journal describes how bile salts and the enzyme, lipase, break down fat in the process of digestion.

The journal has six sections: aim, hypothesis, materials, procedure/method, results, and notes on the results. We present two pivotal excerpts from the journal handed in by a student:

The student present this as her hypothesis:
"*We* expect *the one* that changes quickest to be the one containing lipase as well as bile salts, because only in this one *both* are included, and not only one of them." (Our italics).
An excerpt from the section, "Notes on results," starting with the question put by the teacher in the instructions, and followed by the answer given by the student:
"Why does the liquid change color? Explain."
"Because of the fatty acid."

Figure 3. Excerpts from the biology journal

At first, in the hypothesis we notice:

- A "we" that refers to the two students who conducted the experiment is included.
- To what do the pronouns "one" and "both" refer? This is unclear.
- There is a causal connection ("because").

When answering the question asked by the teacher, the student just write, "because of the fatty acid."

The students of the class and the teacher have agreed on a list of seven criteria for the successful biology journal. The criteria address three levels of the text:

- Content/structure (five criteria): Use the disciplinary concepts. Use graphs, tables. Include theory, hypothesis, conclusion.
- Sentences/clauses: "Provide a good description of the results. Important: a description is good if it is detailed. Describe in your own words."
- Formal elements: spelling must be correct, and sentences must have correct syntax.

We note that only one criterion addresses the meso-level. But exactly what it means to describe the results in a way that is "detailed" enough for biology is not explained.

The teacher writes ten feedback comments in the student's biology journal.

- Seven comments address content/structure: She says that "Discussion" is a part of "Notes on the results" in a journal. She praises that the student comment on a picture and a diagram.
- Four feedback comments address disciplinary concepts. The teacher suggests writing "emulsify" instead of the more imprecise "shatter into pieces". Addressing the hypothesis, she writes, "You have to explain what 'the one' means." Thus, she calls for conceptual precision.
- One comment addresses the sentence level: She urges the student to expand, "because of the fatty acid" to a full sentence. "You have to elaborate on this and give an explanation."
- Finally, two comments address the writing process. The structure is good, she writes, but the student must provide more exhaustive answers.

By urging the student to "elaborate" and to "give an explanation," she encourages the student's construction of causal explanations of the subject, but she does not show how to do it. When asked, the teacher responded with an email to the authors of this article, and suggests that the student could have put it this way:

"Lipase breaks down triglycerides into fatty acids and glycerol. The sebacic acid (the -OOH group) will make the water's pH value fall as the hydrogen ion is released into the water. Thus, the solution, which contains the pH indicator, phenol red, will change color from red to yellow as the pH value falls."

Figure 4. An explanation. The first sentence: Topic sentence. Green: Disciplinary concepts. Yellow: causal relations

In the journal, the student answered the teacher's question about the explanation of the color shift with the incomplete sentence, "Because of the fatty acid." The teacher's suggestion above states that, in short, the liquid changes color when lipase is added, because the pH change. But her wording reflects connections between the subject matter content and the disciplinary discourse. In the first sentence the causal relationship is packed into the verb, "breaks down"—this verb is a disciplinary concept. In the next two sentences the causal relationships are realized with conjunctions. The number of disciplinary concepts in this paragraph is large, and they are included in a valid chain of explanations. The precondition for this biological reaction—that the liquid may have a maximum temperature of 50° C—is omitted. This is a complex explanation. Linguistically, it is compact. When discussing how to present explanations in the disciplinary discourse of biology, the teacher and the students could deconstruct this paragraph.

When giving a student the foregoing kind of feedback, the teacher addresses the difference between everyday spoken language and writing for a discipline. When answering the teacher's question in the journal, the student construct it as though she is giving an oral response. The teacher urges the student to write in a completely expanded and decontextualized way. Then it will be possible for the reader to understand the text without

additional oral explanations. The teacher does not show the student how to do it, but when we email her, she shows us how write a full paragraph.

7. Discussion

In this article we have argued for a close connection between mastering writing on the meso-level of the text and learning a discipline. Thus, providing feedback on the meso-level of the text scaffolds students' writing development and their learning paths, and eases their enculturation in disciplinary discourses. A discipline's language and subject matter content are interwoven, and by writing in the subjects, students learn the subjects. The disciplinary discourse is articulated on the macro-, meso-, and micro-levels, but apparently, mastering meso-level wording is particularly important.

Central elements of a disciplinary discourse, for example, explanations and argumentation, are realized on the meso-level. Providing, receiving, and discussing feedback on this level bring the teachers and students closer to the core of the disciplinary discourse. Thus, the students work their way into the disciplinary discourse by participating in the teachers' explicit linguistic modelling. They are given the opportunity to access the disciplinary discourse. Writing is a situated meaning-making process, and mastering the meso-level seems to be a precondition for writing academic texts, and for developing valid arguments and explanations in the disciplines.

Scaffolding the students by means of feedback may strengthen their attention to the writing process, and lead them to consider the character of a disciplinary discourse. Feedback on the task level visualizes the realization of the discourse, for example, regarding terminology and coherence. By offering feedback on the self-regulation and meta-reflection levels, the student is offered an opportunity to apply the specific contextualized knowledge to general insights into the subject matter content.

The dearth of existing research on the subject of meso-level feedback suggests that it is under-prioritized by teachers. In this article we have provided a description of a *theoretical subject didactic sensitive* connection between language, disciplinary knowledge, and feedback. Applying this knowledge in practice requires knowledge of the disciplinary discourse and texts, which is implicit to many teachers who teach non-language-focused disciplines. Correspondingly, teachers of the language-focused disciplines are seldom familiar with the discourse of non-language-focused disciplines. This division of knowledge is a challenge for the necessary *empirical subject didactic sensitive* study of the practice of teaching discipline-specific writing. Researching the connection empirically, we suggest performing formative intervention studies with teachers acquainted with the various disciplinary discourses. We also need more empirical evidence about feedback on assignments in upper secondary schools. At the theoretical level, we need to clarify and expand the insights of this article.

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Notes

Note 1. In this article, didactic is to be understood as it is used in the German and Nordic traditions, and covers the questions of the content to present and processes to teach, the reasons for these choices, and reflection on this.

Note 2. Cf. https://eng.uvm.dk/upper-secondary-education/national-upper-secondary-education-programmes