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1

Journaling: A powerful Academic Writing Learning Tool

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Abstract:

Students who engage in writing-to-learn activities do a better job of grasping the concepts being taught. Students may use journaling as a powerful learning tool to better grasp a subject and hone their analytical thinking abilities. In this regard, we conducted two long-term field trials. To keep track of their progress, students in Study 1 completed a learning diary after each of their biology courses. Student understanding, interest and critical reflection were higher in the intervention group than the control group (n=25) at study's completion. Increased interest in the subject matter led to a more critical examination through journal writing. Students' motivation to develop their critical thinking abilities was examined in the second study. In addition to the cognitive and metacognitive prompts, the experimental condition's (n=13) journal writers also got a personal utility prompt. The students in the control group (n=11) received just cognitive and metacognitive tests. The experimental group exhibited a higher degree of interest and a better level of critical thinking when it came to a bioethical problem than the control group. It is clear from these research that journal writing has a positive impact on student learning and critical thinking about difficult scientific topics.

Keywords: Learning journals, comprehension, interest, critical reflection, science education

According to Ford and Yore (2012), the purpose of science education is to help students, regardless of their past knowledge, grasp scientific concepts, think critically on scientific challenges, and establish a lifetime dedication to education (Ford and Yore, 2012; Salomon & Perkins, 1998). Tunnicliffe and Ueckert (2007). For example, in domains like human biology, where scientific knowledge builds up and shifts frequently, these goals are especially significant.. It's vital to look at tasks that help kids understand, reflect critically, and become excited about learning. Students in the subject of science have found writing-to-learn to be an useful tool for learning (Gunel, Hand, &Prain, 2007; Reynolds, Thaiss, Katkin, & Thompson, 2012; Webb, 2010). Studies show that even young students benefit much from journaling (Schmidt, Maier and Nückles, 2012); this seems to be true even for young students. Previous study has mostly concentrated on the impact of journal writing (e.g., Glogger et al., 2012; Schwonkeet al., 2012; Holzäpfel et al., 2012; Nückles et al., 2012; Renkl et al., 2012) on understanding. Recent studies show that keeping a learning journal might help students learn more than simply how to read better. This paper will make the case and explain how journal writing might assist students in middle and high school become more motivated and critical thinkers.

1. The effects of journal writing on comprehension, motivation, and introspection are investigated.

Composing essays or summaries has a positive effect on pupils' understanding of complicated topics in general (Bangert-Drowns, Hurley, & Wilkinson, 2004; Klein, 1999). Writers who use learning techniques (which allow for the integration of new learning information into the learner's preexisting cognitive representations) are particularly effective in transforming writing into a potent learning instrument, according to Nückles, Hübner, and Renkl (2009; 2012) (Mayer, 2002). Initiatives like the Science Writing Heuristic (SWH) show that writing-to-learn activities have a positive effect on learning when compared to normal writing assignments in a wide range of science disciplines and educational levels (Chen, Hand, & McDowell, 2013; Gunel et al., 2007; Martin & Hand, 2009). Writing-to-learn activities, according to Hand and colleagues, enhance the utilisation of deep learning processes. It has been suggested that writing-to-learn can be used to help students realise the three steps of self-regulated learning: planning, organising, and developing, and then checking their

comprehension thereafter. Individual goals and learning strategies are identified and then put into practise during the writing process as part of the planning phase. Some examples of this are structuring the learning materials (organisational methods) and relating new information to students' prior knowledge (for example, by generating comparisons or critically commenting on the learning contents) (elaboration strategies). Student monitoring helps them to discover their understanding gaps and devise remediation strategies to close them. "This is the writing process moving on to the next iteration of the circle of self-regulated learning," said Nückles, Zimmerman, and colleagues (2009; 2002).

In most cases, students are requested to recreate previously learned material in a learning journal. Using an outline, students may choose the most important and fascinating aspects of a topic, organise the information by creating an outline, then elaborate on the content by linking abstract ideas to actual experiences and articulating their own personal views and perspectives. While a student, you should be able to plan, monitor, and reflect on your learning process as you write. As a result, journal writing might be seen as a viable technique for encouraging students to employ cognitive and metacognitive processes (Berthold, Nückles, &Renkl, 2007; Glogger et al., 2012; Nückles et al., 2009; Nückles et al., 2012; Nückles et al., 2009). Learning activities are rarely undertaken by learners on their own will. Thus, it has been shown that providing journal writing tips is a good way to encourage students to write in their journals. When learners are prompted to use learning techniques they are capable of applying in concept but do not exhibit or demonstrate to an acceptable degree in practise, prompts are questions or clues. Prior journal writing studies (Berthold et al., 2007; Nückles, Dümer&Hübner&Renkl, 2010; Berthold et al., 2007; Berthold et al., 2007; Nückles et al., 2007) emphasised student involvement in organisation, elaboration, and understanding monitoring. An advantage of prompt journal writing over other learning tasks such as summative writing or concept mapping is that learners are encouraged to use both cognitive and metacognitive learning strategies at the same time. (Novak, 2010) (Novak, 2010; Franzke, Kintsch, Caccamise, Johnson, and Dooley, 2005; Novak, 2010). For example, Glogger et al. (2012) found that students who used both cognitive and metacognitive strategies in their journal writing performed better on tests of comprehension and long-term memory. Study after study in a wide range of subjects, including biology, mathematics, and

psychology, has found that journal writing improves learning outcomes in both laboratory and field settings.

In addition to helping students better understand and retain course material, learning diaries give them several opportunities to consider how the material they're studying relates to their own life. Effort and persistence are more likely to be put into learning if learners see the topic as personally relevant, beneficial, or exciting (Schunk & Zimmerman, 2008; Wigfield, Eccles, Roeser, &Schiefele, 2008; Wolters, 2003). However, in scientific classes, students are frequently unable to recognise the connection between the curriculum and their own life (Assor, Kaplan, & Roth, 2002). To put it another way, learning results can be adversely affected by learners' lack of identification with the learning topic and their lack of desire for high-quality learning processes and the development of thought-out solutions to complicated science issues (Kirby and Lawson, 2012). (Belland, Kim, &Hannafin, 2013). Keeping a journal can help students better relate to the material they are studying.

Writing in a journal, according to Schmidt et al. (2012), can help students reflect on the personal significance of scientific ideas, which in turn increases their drive to study. As part of a learning diary project for a biology class, students aged thirteen and fourteen were asked to answer a personal-utility question in addition to the usual combination of cognitive and metacognitive questions. Students in the control condition received cognitive and metacognitive signals as well, but no personal-utility stimuli were administered. Researchers found that the personal-utility prompt was an effective technique for helping students think on the personal usefulness of the learning materials they encountered. Compared to students in the control condition, who did not have access to a personal-utility prompt, students in the journal writing condition reported greater levels of interest in biology and higher comprehension scores after six weeks of weekly entries. A topic's relevance and personal value can help students connect more easily with the material and, as a result, their interest in it will grow.

Being able to see one's own value and having a clear comprehension of the circumstance may both be important catalysts for critical thinking (Rigby, Deci, Patrick, & Ryan, 1992). Scientific literacy is an important component of science education's primary goal of developing critical thinking (Ash & Clayton, 2009; Ford & Yore, 2012). What is critical

reflection? It is the process of critically reflecting on one's own thoughts and ideas in order to better comprehend one's own worldview (Ash & Clayton, 2009). Students can create a personal opinion about controversial scientific issues, such as whether or not antibiotic treatment should be used in specific circumstances, by applying critical thinking skills (Driver, Newton, and Osborne, 2000; Ford and Yore, 2012). What if, instead, I were to get a donor card? As a means of encouraging students to think critically about their own education, teachers often ask them to write argumentative essays. Students are required to make assertions and counterclaims, back them up with evidence, and summarise the topic in a final conclusion (Nussbaum & Schraw, 2007; Zohar &Nemet, 2002). Students' ability to comprehend information is improved when the information is presented in an argumentative manner (Wiley et al., 2009; Wiley & Voss, 1999). According to prior research (Nussbaum and Schraw, 2007), producing a cohesive argumentative essay that offers arguments and counterarguments in a balanced and integrated manner is a rhetorically challenging challenge for inexperienced writers. According to Nussbaum and Schraw (2008), interventions in persuasive and argumentative writing that focused on the structure of the text only resulted in minimal improvements in the argumentation quality. Argumentative essays, for example, adhere to a strict rhetorical framework, whereas learning journals don't. Flexible and expressive writing in a learning diary offers the student the freedom to determine whatever aspects of an educational experience are most important to him or her. Students with less writing experience may benefit from studying journal writing because of its low rhetorical demands, which enable critical thinking on disputed scientific issues, especially in the context of science education.

2. The current research consists of two parts.

In light of this, the current study sought to examine the impact of journal writing on students' understanding, interest in, and capacity for critical reflection on scientific subjects. Those who had completed their journal writing were split into two groups, while those who hadn't were kept together. As a consequence, we ran two quasi-experimental trials in regular high school biology classes, both of which were successful. As a starting point, we looked at how journal writing compared to more traditional assignment writing tasks influenced secondary science students' comprehension, curiosity (or "motivation to learn") and critical reflection. A

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second study investigated if journal writing's favourable effects might be improved even further by explicitly encouraging participants to write and reflect on their own personal relevance to the learning topic.

An experiment done by a group of 7th grade biology students in a German middle school was published by the journal Science for the first time. Journaling was a requirement for one class. Students were expected to keep journals throughout the semester. Students in the other course were required to complete a range of additional homework tasks during the intervention time (writing a summary, answering questions, and developing a concept-map). It was emphasised to the students in the control group that they should utilise the activities to reinforce and better understand the basic ideas of the learning subjects being given. When writing journal entries about their educational experiences, students in the journal writing course were given a variety of stimuli (see Table 1) that encouraged them to employ cognitive and metacognitive skills. Students who received both cognitive and metacognitive prompts were predicted to outperform those who received only cognitive prompts in the journal writing condition. This is because our previous journal writing research had shown that a combination of cognitive and metacognitive prompts, in particular, strongly promoted deep comprehension and sustained retention. They were more motivated and able to develop a reflected position on a topic-related, controversial issue than the students who participated in the traditional homework condition because the students in the learning journal condition considered the learning content to be more interesting. As a result of this, we predicted that students in the journal-writing condition would be better able to think critically about the complex and contentious character of the learning content, for example, by formulating alternative ideas or challenging a perspective.

It was the researchers' aim that by asking students to reflect on the personal significance of the topics they discussed in their learning journal, they may improve the predictability even more of the first study's results in the second study. As a result, we conducted yet another quasi-experimental study with a group of students in two philosophy classes at a German high school (10th grade). All students were asked to keep a learning diary over the course of several weeks in which they were prompted by a combination of cognitive and metacognitive signals. But students were also given a personal utility task in the experimental condition,

which asked them to write on how the subject matter was important to their own lives. Therefore, we expected that students who were asked to write on the topic's personal importance would find it more interesting and relevant. Because of their heightened curiosity, students should want to understand everything that they can about a disputed topic and, as a result, enhance their readiness to critically think about it.

3. STUDY NO. 1

Middle school students were compared to students who completed conventional biology homework assignments by doing journal writing accompanied by cognitive and metacognitive prompts in a quasi-experimental field research.

3.1 Participants and design of the method

There were 46 students (7th grade, ages 13-14) who took part in the quasi-experimental field research. In a tiny town in southern Germany, roughly 800 students and 75 instructors attended a high school with two biology classrooms at the time (about 12.000 residents). Immunology was the primary subject of biology studies throughout the time period in question (e.g., the functioning of white blood cells). After the introduction of sexual education, immunology was included into the larger topic of human biology. During the three weeks of the study, students in one class kept a learning journal in which they recorded their thoughts and reflections on the lessons they had just learned in biology. This led to a total of three entries (n = 21; 10 girls and 11 boys; 4 participants who were not born in Germany) reflecting on their experiences in class. Students in a different class were required to write regular learning diary entries as follow-up course work for three weeks, resulting in a total of 10 entries. As a follow-up course work assignment, standard homework (see the content component) was given to the other class (n = 25, with 15 females and 10 boys and 5 participants born outside Germany).

Our design was quasi-experimental in character due to the fact that students from a single class were assigned to either the experimental or control conditions. Taking into consideration differences between the pretest and posttest is therefore critical. Each participant had gone through the same two years of biology instruction as the others, with the same learning objectives. X2 (N = 46) = 0.71 for gender, F(1, 44) = 0.03 for age, and X2 (N = 46) = 0.01, ns for ethnic background also showed they were comparable. The findings of

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the pre-test score analyses showed that the students' previous knowledge scores, F(1, 44) = 0.38, ns, and their interest scores in the pre-test, F(1, 44) = 1.36, ns, were comparable. The students' prior knowledge scores were likewise comparable, F(1, 44) = 0.38, ns. We also made an extra effort to keep the two situations as similar as feasible by having the same instructor train both children on the same topic during the intervention period. Both courses received exactly the same curriculum and were taught using the same techniques. Post-testing comprised comprehension exercises, a critical reflection activity, and a question on the students' interest in the topic of the post-test. After the intervention phase, the posttest was administered immediately and again eight weeks later.

Materials

A 300-word introduction to the process of producing a learning diary was given to the 7th-grade students who participated in the study since they had no prior experience with journal writing. An emphasis was placed by the lecturer on putting the knowledge gained from the course materials into practise. In order to make journal writing simpler, instruction included two cognitive and two metacognitive prompts that promoted elaboration and organising procedures, as well as two metacognitive prompts that stimulated comprehension monitoring and preparation of corrective measures (see Table 1). No more teaching was given since an earlier research with a comparable age group found that kids can benefit from journal writing even without much training (e.g., Schmidt et al., 2012). Student learning diaries should be used to help students better comprehend the material they are studying. Each submission had an average word count of 82 words, with a standard deviation of 8.50 words. A research assistant recorded how many statements in the learning journals indicated that a learning strategy was being utilised in order to evaluate if our therapy was having the desired effect (for a detailed description of the coding system see Study 2). There were on average 2.85 (standard deviation 1.01) organisational strategies, 1.83 (standard deviation 0.81) expository strategies, and 1.52 (standard deviation 0.85) meta-cognitive strategies invoked by students in their learning diaries. In comparison, these sounds have low frequencies. Although journal writing was intended to help students structure and enhance their comprehension of the topic, students instead used it to merely repeat and regurgitate information they had been taught in

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class. Because they had obviously demonstrated some use of the indicated learning methods, we concluded that the therapy had been carried out as expected.

During the first week of class, students who were assigned conventional homework had to reread and summarise the material given during the lecture. Second, during the next week, they were required to summarise the lecture's main points in a concept map, sketch, or graphic. In the third and final weeks of the course, they were asked to reply to questions about the topic. To test this, we hypothesised that the activities (summary and concept mapping) would primarily activate organisational techniques since they required students to select the important concepts from a book and lesson, paraphrase, and organise them in a systematic fashion (in the case of summarising) (in concept-mapping). neither task clearly promoted or discouraged critical reflection, but they did not explicitly restrict such behaviours either. Answering preset questions was mostly about reinforcing previously learned material. Responding to questions was found to be the most effective method of fostering metacognitive experiences, particularly when students had difficulties answering the question. A quick introduction to summarising and concept mapping was given to students so that they could make the most of these learning exercises (about 200 words).

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Table 1. Prompts used in the writing instructions

Prompts	
Cognitive Prompts (Organization and Elaboration)	How can you structure and summarize the contents in a meaningful way?
	Which examples can you think of that illustrate, confirm or conflict with the learning contents?
Metacognitive Prompts (Monitoring and Planning of Remedial Strategies)	Which main points do you now understand, and which haven't you understood?
	What possibilities do you have to overcome your comprehension problems?
Personal-utility Prompt	Why is the learning material personally relevant for you at present or in future out of school?

Note. Students in Study 1 and students in the standard prompts condition in Study 2 received only the cognitive and metacognitive prompts. Students in the personal-utility prompt condition in Study 2 additionally received the personal-utility prompt.

Measures that are dependent

We devised a comprehension exam based on German high school biology curriculum standards to assess students' grasp of immunology. It was tested by two experienced biology instructors to ensure that it was curricularly legitimate (teaching experience 8 and 10 years). Both classes needed to be taught by professors to make sure that the activities' content was properly integrated into the class's biology sessions. Because the curriculum emphasises scientific literacy, such as the capacity to explain biological events scientifically, we devised explanation activities that tested understanding (e.g., "Explain the similarities and differences between an infection with bacteria and a virus" or "Explain what happens in the organism after an active immunisation"). As a result, students had to use what they'd learned in class to come up with explanations. The responses of the pupils were compared to the teacher's reference answers, and a trained research assistant who was unaware of the experimental conditions counted the number of right statements offered. One can get up to 18 points by answering all seven test questions properly.

Students were asked to write a short answer on the topic of "Should patients who show symptoms such as coughing and fever be administered with antibiotics?" in order to test their critical thinking skills on a difficult disputed matter. We appreciate you taking the time to write a quick remark and to explain your position. " When it comes to causal structure the subject matter has enough depth to warrant further investigation. During the intervention session, the participants were taught the relevant information they required to reflect on the subject matter. ' The subject has to be open to a variety of viewpoints, and we wanted to make sure that it could be controversially debated. Two untrained research assistants assessed the students' ability to self-reflect in a classroom environment that was not made clear to them. Phase one involved compiling all responses to the question and then evaluating each one as evidence of critical thinking by justifying or criticising each remark. A 5-point grading scale from 1 to 5 was used to rate the quality of the students' remarks in the second phase on a scale from 1 to 5. (high quality). The following table shows the many tiers of this rating scale. Interpreter dependability was found to be fairly high, with an ICC of.92, according to the intra-class coefficient (ICC).

Table 2. Description of the quality ratings

Level	Description
1	Students neither provided any reasons to justify a position nor did they criticize a position.
2	Students provided few and low elaborated arguments to justify a position. They did not criticize a position.
3	Students provided at least one elaborated argument for one position and questioned the other position.
4	Students provided at least one elaborated argument for each position and reflected on the validity of the arguments.
5	Students provided elaborated arguments for both positions and integrated them into a reflected overall conclusion by weighing, synthesizing or refuting arguments.

Students' interest in immunology was gauged using the Intrinsic Motivation Inventory (IMI; Deci & Ryan, 2006), which we translated and adapted for the purpose of this research. Five self-report comments were assessed on a scale of one to five, with one being highly dissatisfied and five being completely satisfied (for example, "I love discussing

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immunological concerns a great deal."). A high interest score indicates that students enjoy debating difficult immunology topics and are excited about the course's contents. In terms of internal consistency, Cronbach's alpha was.77, which indicated that the results were good.

Procedure

Over the course of thirteen weeks, the complete research was conducted. During the first week of class, both sets of students were given pre-testing to see if they were interested in and knowledgeable about immunology. The outcomes of the two groups were compared. During the second, third, and fourth weeks of the course, students took immunology twice a week with the same teacher using the same materials, methodology, and subject each time. Both groups had to do their homework (journal writing or conventional chores) once a week, which resulted in three journal entries or three regular homework projects each week. Students in both circumstances were handed a sheet of paper with instructions on how to complete their future homework assignments. The instructor collected the students' homework each week to make sure they had done it. For this reason, we opted to withhold feedback from students in order to keep the execution of the intervention as objective as possible. Taking an exam evaluated by an instructor on immunology did not bring the topic to an end, though. This meant that the students in both conditions had no explicit, extrinsic motivation.

In the fifth week of class, all students were given a post-test that was identical to the protest. Between the fifth and thirteenth weeks of the semester, students were taught about different biological subjects (such as sexual education). The children in both classrooms were still taught similarly by the same teacher, who employed the same strategies and resources in both settings (traditional in both classes). In the 13th week, the post-test was given once more, this time with a critical thinking problem. The testing circumstances were uniform because we checked to see that they were all the same across the board. Paper-and-pencil assessments were administered to students in a typical biology class, who were ignorant of the experimental conditions. After the delayed post-test, the students in the typical homework condition were exposed to journal writing in order to profit from journal writing as useful follow-up course work and after the completion of the study.

3.2 Discussion of the Findings

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There are two experimental settings, each with its own set of averages and standard deviations shown in Table 3. We used partial 2 qualifying values, with values less than.06 indicating a little effect, values between.06 and.13 suggesting a medium effect, and values larger than.13 indicating a big effect (see Cohen, 1988).

Comprehension

RMANOVA was performed to examine the pupils' understanding gains over time. Pretest and posttest results were employed as within-subjects variables and the experimental condition as a between-subjects factor to examine students' understanding gains. Both experimental condition and time were found to have a significant impact on comprehension; the latter was found to have an effect of F(1, 44) = 31.09, p.01, partial 2 =.41 and the former was found to have an effect of F(1, 44) = 9.34, p.01, partial 2 =.18, indicating an increase in comprehension across the board in both conditions. F(1, 44) = 24.17 p.01, partial p2 =.36 must be taken into account in conjunction with the main impact of time and experimental condition, F(1, 44) = 24.17, p.01. When the interaction effect was analysed, it was shown that students in the learning diary condition learned much more than students in the normal homework condition throughout their intervention period (see Table 3).

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Table 3. Descriptive statistics of dependent variable separately for the three points of measurement and each experimental condition in Study 1

		Experimental Conditions					
		Traditional Homework			Journal Writing		
Variables		Pretest $n = 25$	Posttest $n = 25$	Delayed Posttest $n = 25$	Pretest $n = 21$	Posttest $n = 21$	Delayed Posttest $n = 20$
Comprehension[a]	*M*	5.66	5.88	6.42	6.05	9.55	9.90
	SD	1.81	2.47	2.35	(2.46)	3.22	3.61
Overall reflection[b]	*M*			1.25			1.95
	SD			0.74			0.50
Reflection Quality[c]	*M*			2.38			2.86
	SD			0.92			0.79
Interest [c]	*M*	2.54	2.84	2.65	2.56	3.06	3.23
	SD	0.57	0.65	0.51	0.72	0.49	0.58

Note. a is the average number of correct answers (a maximum of 18 points was possible); b is the average number of statements coded as critical reflection; c was rated on a five point rating scale (1-5).

It is important to do a delayed posttest to see whether there have been any changes in the two conditions over the course of a week. As a consequence, we conducted a second repeated measure analysis of variance utilising the immediate posttest and the delayed posttest as within-subjects factors and the experimental condition as a between-subjects factor in the immediate posttest and delayed posttest. F(1, 43)=1.94, p.005, partial p2=.004, suggesting that knowledge scores grew somewhat between the second and third measurement points, revealed statistical analysis. Furthermore, experimental condition had a significant main effect: F(1, 43) = 19.29, p.01, and partial p2 =.31 and p2 =.31. With F(1, 43) = 0.04, ns, and partial 2 =.00 for the time x experimental condition interaction, it was determined that the interaction effect was not statistically significant. There was some improvement in students' ability to comprehend in each of these situations. Students in the journal writing class outperformed their counterparts in the standard assignment class around two months after the research began, despite the fact that the group differences remained stable over time.

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Eight weeks after the intervention period, we conducted a one-factor analysis of variance to see whether students in the journal writing class were better able to reflect on a complex, controversial issue in immunology than students in the traditional homework class. The dependent variable was the number of all statements students used to question, justify or criticise a position (i.e. overall reflection; see Table 3). (see Figure 1). F(1, 43) = 3.48, ns, partial 2 =.08, showing that the difference between the experimental conditions was not statistically significant. Nevertheless, in a second one-factor analysis of variance, in which the quality ratings were the dependent variable and the experimental conditions were the independent variable, F(1, 43) = 13.61, p.01, and a partial p2 =.24 demonstrated a significant main impact of the experimental condition. The second one-factor analysis yielded the following results: Students' remarks in the journal-writing condition were more critical than those in the standard assignment condition, as shown by a comparison between the two groups (see Table 3).

Interest

The pre- and posttest interest ratings were used as within-subjects factors and the experimental conditions were used as a between-subjects factor in a repeated measure analysis of variance in order to identify a possible rise in students' interest over the intervention period. Main effect: F(1, 44) = 8.11, P.01, and partial effect: F(1, 44) =.16, P = 0.01. Experimentation conditions were determined to have no statistical significance for the main impact or for an interaction effect between time and the experimental condition. Students' enthusiasm for immunology rose as a result of this (see Table 3). Between the journal writing condition and the other conditions, no change was found. The delayed measurement in this scenario would tell whether or not the effects on interest were stable in future weeks following the intervention period. A second repeated measure analysis of variance was performed, with the experimental condition serving as a between-subjects factor and the second and third interest ratings serving as within-subjects factors, as a consequence of which. F(1, 43) = 0.00, ns showed no significant main influence of time, while partial 2 =.00 showed a significant time effect. There was also a statistically significant interaction between time and experimental condition, F(1, 43) = 4.78 p.05, and the main effect of experimental condition was 7.30 p.05, with a partial 2 =.15, which was statistically

significant. However, the interaction between time and experimental condition was statistically insignificant. During the intervention period, students' interest in immunology increased even more than in the standard assignment condition, which dropped once students completed immunology in school and reverted to pre-test levels. Student interest in biological topics was found via journal writing to have a greater long-term impact than short-term course activities such as summarising, idea mapping, or responding to questions.

Establishing connections between understanding, interest and critical reflection can be done.

We did a mediation analysis (see Baron and Kenny, 1986) to examine if journal writing enhanced students' understanding and, as a result, their interest in the issue, because we hypothesised that better understanding would raise students' interest in the topic. First, we ran a regression analysis on the dependent variable (interest score on the postponed exam) to see if our hypothesis held up (experimental condition). Learner interest was significantly affected by the experimental condition, with a t(43) of 3.59 and ß of.48. In the second stage, we ran a regression analysis on the predictor using the potential mediator (the delayed test's comprehension score) (experimental conditions). Experimentation showed a statistically significant influence on understanding, with t(43) = 3.90; ß =.51; and P =.01. Thirdly, interest was regressed on the predictor (experimental condition) and mediator (involvement in the experiment) to arrive at the final results (comprehension). Comprehending the material had a substantial impact on interest (t(42) = 2.43; ß =.36; p =.05), but the experimental condition had a smaller impact (t(42) = 2.01, ß =.30; non-significant) than in step one (t(42) = 2.01; ß =.30; non-significant) than in step 1. They believe this pattern of data supports full mediation, meaning that the students' enhanced comprehension in the journal writing condition contributed causally to their increased interest in immunology.

To that end, we hypothesised that journaling would improve students' ability to critically reflect on their experiences by deepening their knowledge of and enthusiasm for the material. In order to evaluate this hypothesis, a second mediation analysis was conducted, using reflection quality as the dependent variable, experimental condition as the independent variable, and interest and comprehension as mediators. In step one, it was determined that the experimental condition had a statistically significant influence on reflection quality: t(43) = 3.69, ß =.49, and p.01. The experimental condition has previously been shown to influence

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interest and understanding in the prior mediation investigation. Only interest had a statistically significant influence on reflection quality, with t(41) = 2.43, ß =.37, and p =.05, whereas the effects of comprehension, with t(41) = 0.56, ß =.09, ns, and experimental condition, with t(41) = 1.52, ß =.25, p =.05, failed to achieve statistical significance. According to Baron and Kenny, we may conclude that interest worked as a mediator between the experimental condition and the quality of the reflected picture. According to a combination of the results from the two mediation experiments, journal writing improved understanding and improved understanding led to an increased interest in biology. Curiosity fueled critical reflection, but understanding alone had no positive effect on critical reflection other from the one already described in the preceding paragraph.

4. STUDY NO. 2

Journal writing is a more effective learning-to-write activity in scientific education than typical writing assignments, according to the findings of the first study, since it encourages deeper knowledge, interest in the themes, and critical reflection. On the other hand, the positive effects of journal writing on student interest took time to emerge. As a result, we aimed to pique students' interest in the topic covered in their learning diary by encouraging them to consider the issue's personal relevance. This encouragement was expected to boost the topic's perceived relevance and interest. Furthermore, we expected that enhanced attention would stimulate critical thinking, based on the findings of Study 1. To do so, we compared students who responded to a mix of cognitive and metacognitive prompts in their diaries with students who additionally received a personal-utility prompt as an extra prompt. In response to this prompt, the students were asked to think about and write about the topic's personal utility or significance.

4.1 Participants and design of the method

Quasi-experimental field research participants, aged 16-17 in the 10th grade, took part in a field setting. It was in a little town in southern Germany where they lived that they taught philosophy to a high school of roughly 1100 pupils with 81 teachers (about 25.000 residents). An experimental design with two experimental conditions was employed to examine our research question. There were six men and five females and one non-German-born student in the class (n = 11 students; standard prompts condition; n = 11 students; 6 guys, 5 girls, and 1

non-German-born student). Alternatively, in the second class, students received a personal-utility prompt in addition to the combination of cognitive and metacognitive prompts (personal-utility prompt condition; n = 13, including 6 males and 7 girls, as well as one boy and one girl who were not born in Germany). It is safe to say that our study was quasi-experimental in nature because each class was randomly allocated to either the experimental or the control condition. But the students who participated in the study had all been exposed to the same philosophy curriculum for three years, with the same learning objectives. Students' gender, age, ethnicity, and grades in philosophy were all equal (X2 [N = 24] = 0.17], while their interest scores before the intervention period were all equal (F(1, 22) = 0.22), as were their grades in philosophy and their F(1, 22) [N = 24] grades. "biology and ethical decisions" were covered by the poll's six-week period of study (e.g., pros and cons of genetic manipulation). Throughout the semester, they were all taught by the same philosophy instructor, who utilised the same teaching methods and materials. Immediately following each philosophy lecture, students were given 20 minutes to write a learning journal entry in their learning journals to reflect on what they had just learned. Because the learning diaries were included in class, it was easier for teachers to keep track of how much time each student spent on each assignment and to compare student progress across classes. There was a standard variation of 48.50 words in the average length of a learning journal post. Understanding of basic biological concepts, critical thinking skills, and a desire to participate in controversial topics were all examined as dependent variables. In addition, we examined the frequency with which different types of learning methods were utilised in the learning journals.

This study makes use of a variety of tools and metrics.

There was only one difference between this assignment and the one used in Study 1: the subject. Students in the personal-utility-prompt condition were also given a personal-utility prompt, which invited them to think about the topic's relevance to their own personal lives. It is shown in Table 1 how to respond to the two different scenarios.

It was determined whether or not the subjects were helpful and interesting by having students complete a motivation questionnaire that was administered to all of the students. Ten items from the intrinsic motivation inventory's value and interest scale were translated and adjusted

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for the current study, and these items were then employed as (IMI; Deci & Ryan, 2006). Items like "I found the biology-related topics in Philosophy to be quite interesting" and "I believe it is really important to discuss ethical issues in biology" were included. There had to be a 7-point rating system, with 0 being the lowest degree of agreement and 6 the greatest, in order for the objects to be evaluated (very high degree of agreement). Because of the high level of internal consistency (Cronbach's alpha =.82), we were able to calculate an average intrinsic motivation score for each student for both the pretest and post-test periods.

Students were tested on their knowledge of organ donation's legal foundations as well as standard operational procedures over the course of the comprehension assessment. Students in the philosophy programme learned a lot about this topic in-depth. Students might receive a maximum of six points if their responses were in line with the reference answers provided by their philosophy teacher.

Organ donation has both pros and downsides, and students were tasked with writing a brief essay on the subject to gauge their critical thinking abilities. The average number of words in the students' remarks was 102.54 (standard deviation = 28.90). In order to quantify critical reflection, we measured the number of topic-related statements that were supported by evidence or reasons (founded claims) and the number of topic-related statements that were not supported by evidence or reasons (unfounded claims) (unfounded claims). We assessed the comments on a five-point scale from 1 (poor quality) to 5 (great quality), just like we graded the comments in Study 1 (see Figure 1).

For the experiment's post-test outcomes, we aimed to identify learning approaches that could have contributed to them.. Therefore, we used and modified an existing coding method created by Nückles and colleagues. As a matter of fact, I am (2009). When it came to coding the learning diaries, we used two separate raters who each rated a single sentence. There were three sorts of statements: elaboration and metacognition were grouped together. In this situation, comments that emphasised the most essential aspects of the issue and how they interacted with one another were categorised as indications of organisational behaviour (e.g., students underlined important terms or highlighted them in different colors). We categorised statements in which students related the new topic to their previous knowledge, for example, by producing examples, analogies, or illustrations, in order to demonstrate their grasp. the

purely cognitive elaboration was distinguished from the personal-utility statements (e.g., "It is important for me to know how medical practitioners diagnose a brain death.") because the personal-utility statements included motivational aspects and they were triggered by personal relevance and importance of the topic (e.g., "It is important for me to know how medical practitioners diagnose a brain death.") We coded statements like "I am having difficulty understanding the differences between active and passive immunizations," and "I am having difficulty understanding the differences between active and passive immunizations," as metacognitive strategies and remedial strategy planning (for example, "I am going to rework the course materials and ask the teacher if I am not understanding everything."). Information from the courses was not encased in any code at all. In terms of Cohen's Kappa dependability, scores ranged from.88 for organisation to 1.0 for personal utility, with the greatest value coming from the latter.

Procedure

A total of eight weeks were dedicated to this programme. Class one received the usual prompts condition and class two received the personal-utility prompt condition; both classes were allocated to class one. For both groups, we had them take the intrinsic motivation survey during our first week of class That was followed by a lesson on how to compose a diary entry. Personal-utility prompts were exclusively given to students in the personal-utility prompt condition, and were not given to students in the other conditions of the course. At the end of each of the two philosophy classes, students were obliged to submit a learning journal entry for six weeks following the conclusion of the classes. In class, pupils were given 20 minutes to finish the journal entries, which they did. Neither the students, nor anyone else, got the six journal entries. In class last week, all students were expected to take a post-test, which they did. The same questionnaire that was used for the pre-test was utilised to determine the degree of interest of the students. For the comprehension exam and critical reflection activity, they were also expected to answer questions on their comprehension. Research assistants in a regular philosophy class gave the examinations in a paper-and-pencil manner with no awareness of the experimental conditions. Students were not given a graded test on "human biology and ethical decisions" since it was not finished. There was no explicit or extrinsic motivation for the youngsters as a result. To ensure that students writing

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subsequent learning diaries benefit from this better teaching, the control group got an extra session of training that contained the personal-utility prompt immediately following its end..

4.2 Discussion of the Findings

Standard deviations are included in parentheses for clarity in the comparisons between the two experimental settings in Table 4.

An analysis of variance was undertaken to evaluate if the students in the personal-utility prompt condition perceived the topics to be more worthwhile or intriguing than those in the normal prompt condition, and whether this difference was statistically significant (P 0.05). This study found no significance for the main impacts of experimental condition or time (F(1, 22) = 0.69, ns, partial 2 =.03) or the major impact of time (F(1, 22) = 1.55, ns, partial 2 =.07). However, as expected, the interaction effect between time and experimental condition was significant, F(1, 22) = 6.83, p.05, partial p2 =.24 and the interaction effect between time and experimental condition was significant, F(1, 22) = 6.83, p 0.05, partial p2 =.24. Personal-utility prompt conditions saw an increase in interest, but interest in the traditional fast condition remained stable throughout the intervention period (see Table 4). Consequently, encouraging students to write on the personal significance of learning materials may boost their interest in the subjects.

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Table 4. Descriptive statistics of dependent variable separately for the experimental conditions

	Standard prompts condition n = 11		Personal-utility prompt condition n = 13	
	M	*SD*	*M*	*SD*
Interest in Pretest[a]	4.61	0.48	4.68	0.72
Interest in Posttest[a]	4.45	0.53	4.99	0.71
Comprehension[b]	4.36	1.21	4.85	1.07
Critical Reflection				
Unfounded Claims[c]	1.45	1.04	1.54	1.05
Founded Claims[c]	1.27	0.79	2.31	0.75
Quality Rating[d]	2.36	0.92	3.69	0.75
Statements in the learning journals				
Personal Utility[c]	0.73	0.61	1.58	0.67
Cognitive Elaboration[c]	1.00	0.68	1.41	0.70
Organization[c]	1.06	0.46	0.72	0.34
Metacognition[c]	1.11	0.86	2.38	1.94

Note. a was rated on a seven point rating scale (0-6); b is the average number of correct answers (a maximum of 6 points was possible); c is the average number of statements per entry; d was rated on a five point rating scale (1-5).

Comprehension

We used an analysis of variance to see if students in the personal-utility prompt condition had a greater degree of comprehension than students in the conventional prompt condition. There were no statistically significant changes in the experimental conditions, according to the data ($F(1, 22) = 1.08$, ns, partial 2 =.05.) The results, on the other hand, revealed that both conditions had high levels of comprehension (see Table 4).

Discussion on the topic

Following that, the students' comments on the benefits and drawbacks of organ donation were analysed. First, we investigated whether students reached a firm conclusion. When asked to reply to the personal-utility rapid condition, 77% of students provided a final conclusion (2 students decided against and 8 students for an organ donor card). In the usual prompts situation, 36% of students gave a final conclusion to the inquiry (all for an organ donor card).

With X2 (N = 24) = 4.03 and a p-value of.05. the difference between the conditions was statistically significant. We utilised two analyses of variance to see if the students offered a different number of based and baseless assertions in the experimental circumstances. The overall number of baseless claims did not change between the circumstances, with F(1, 22) = 0.04, ns, and partial 2 =.00. We identified a statistically significant advantage for the personal-utility quick condition, F(1, 22) = 10.48, p.01, partial p2 =.33, and a large advantage for the personal-utility prompt condition, F(1, 22) = 10.48, p.01, partial p2 =.33, for founded claims. (Table 4) The quality of critical reflection was then investigated using a third analysis of variance, with the quality ratings serving as the dependent variable and the experimental condition serving as the independent variable. With F(1, 22) = 15.11, p.01 and partial 2 =.41, students in the personal-utility quick condition showed a statistically significant advantage. As indicated in Table 1, students in the personal-utility prompt condition had a higher level of critical thinking and provided a conclusion more often than students in the standards prompt condition.

You can record your learning techniques in the learning diaries. We utilised analyses of variance to see if students in the personal-utility prompt condition employed different learning techniques than students in the regular prompt condition. The experimental settings were employed as the independent variable, while the types of learning techniques were used as the dependent variables. Students in the personal-utility prompt condition wrote on the topic's personal relevance much more often than those in the regular prompt condition, F(1, 22) = 10.46, P =.001, partial p2 =.002. As a consequence, the intervention met its purpose. Students in the standard prompt condition used significantly more content organisation strategies than students in the personal utility prompt condition, F(1, 22) = 4.49, p =.05, partial p2 =.17, and students in the personal utility prompt condition used significantly less content organisation strategies (see Table 4). For simply cognitive elaboration approaches (F(1, 22) = 2.09, ns, partial 2 =.09) and metacognitive strategies (F(1, 22) = 4.07, ns, partial 2 =.16), we found no statistically significant differences in the experimental conditions.

Personal interests and critical reflection

We wondered if interest may operate as a mediating factor between the effect of the relevance prompt and the effect of critical reflection because the deployment of a relevance

prompt raised both interest and critical reflection. In order to test this mediation hypothesis, the dependent variable was quality assessments of reflection, the independent variable was experimental condition, and the mediator was interest, and the results were positive. A substantial influence of experimental condition (predictor) on the students' quality of critical reflection (dependent variable) and an effect of experimental condition on interest in the posttest (mediator), t(22) = 2.08 and ß =.41, respectively, were found to be statistically significant. The interaction between interest and critical reflection quality was statistically significant when t(21) = 2.27, ß =.37, and p 0.05 were used to regress critical reflection quality on both predictors (experimental condition) and mediators (interest in the posttest). Although the effect of experimental condition was smaller than in step 1, it nevertheless approached statistical significance (t(21) = 2.96, ß =.49, p.001), which is consistent with the previous stage's findings. As a result, partial mediation might be assumed.

In general, the findings are as follows: As indicated by our findings in the control condition, students in the personal-utility prompt condition utilised their learning journals more frequently to self-explain the relevance of the learning materials by relying on their own experiences and building personal examples. Students exhibited a higher interest in the problem and improved their critical reflection abilities after considering their personal significance of a topic during journal writing. We discovered no statistically significant differences in their comprehension of the content, despite the fact that the students made substantially more well-founded assertions and engaged in high-quality comments. Because virtually all students scored well on the comprehension exam, this indicates that a standard set of cognitive and metacognitive signals was adequate to generate good results on the comprehension test. However, by encouraging students to think about how the issue relates to their own lives, the impact on curiosity and critical thought might be amplified even further.

5. Discussion on General Issues

The results of two quasi-experimental investigations, which are detailed in this paper, show that students' comprehension, interest in the topic they were obliged to write about, and their ability to critically reflect on an issue associated with the topic all improved after they wrote learning journals. We compared journal writing to a variety of different types of schoolwork in Study 1. Studies 1 and 2 were conducted to see if journal writing on curiosity and critical

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reflection might be bolstered even further by directing students to write on the personal importance of learning themes. The following are some broad conclusions to draw from the data:

5.1 Journal writing helps students improve their comprehension.

One research found that, on measures of comprehension, critical reflection, and self-reported interest in biology, students who kept a regular learning diary outperformed those who completed a range of other homework assignments such as concept mapping, summarising, and answering questions. Concept mapping (Novak, 2010) and summarising (Franzke et al., 2005) are two cognitive learning approaches that may be used to encourage the application of cognitive learning procedures, especially in organisational tactics. (e.g., identification and structuring of main ideas). Students were encouraged to employ both cognitive and metacognitive skills while writing their journal entries, which was a substantial benefit. Nonetheless, the prompted learning diary methodology has its advantages. Using this combination of cognitive and metacognitive techniques, we believe that students are more likely to engage in the whole cycle of self-regulated learning (Glogger et al., 2012; Nückles et al., 2009) based on past research. As a result, when students document their learning in a learning journal, they may better grasp the contents since they can organise and elaborate on the new knowledge. They may be able to identify and correct any gaps in their knowledge by employing remedial cognitive processes while evaluating their comprehension. Journal writing was shown to have improved comprehension ratings because of the employment of both cognitive and metacognitive processes throughout the writing process, which may have occurred from the joint use of both processes. However, even though students in the two groups utilised their learning diaries in somewhat different ways in the first study, adding a personal-utility challenge had no further favourable effect on comprehension. It was found that the students who were given the conventional prompts used more organisation strategies to structure their information while those in the personal-utility condition made more claims about their own connections with the issue Students in both scenarios performed similarly on the comprehension exam, resulting in equivalent but also high test scores on the test.

Learners' identification with the learning topic is facilitated by prompt journal writing.

After performing traditional learning exercises, learners may not be able to identify themselves with the subject matter, and they may be unable to see the personal value of what they've learned (Kirby & Lawson, 2012). A series of concept mapping, summary writing, and question answering tasks throughout the course failed to ignite students' interest in the topic to the same degree that regular journal writing as follow-up course work did (Study 1). In the next paragraphs, we'll look at two possible causes for the rise in topical interest: In Study 1, students in the journaling condition had a better understanding of the problem. If you have a good grasp of a subject, you may be more likely to identify with and be interested in the subject (Schunk & Zimmerman, 2008). Study 1 validated our initial hypothesis, showing that the experimental condition's impact on interest was mediated by learners' understanding of the condition. In addition, while journal writing had an instant impact on understanding, it took time for journal writing to have a positive impact on students' engagement, which was most likely due to the improved comprehension. As a result, students' interest in the course subject may have been boosted by writing about the personal meaning of learning knowledge. So, in Study 2, we found that a significant increase in student engagement could be achieved by asking students to write about how the material they were studying was relevant to their life. Students who are able to recognise or elevate the personal relevance of a topic are more likely to have a lifelong interest in that subject and participate in conversation about it (Salomon & Perkins, 1998). In today's knowledge-based society, both independence and participation are essential, especially in fields like biology, where new and expanding scientific knowledge accumulates and changes at a rapid rate (Tunnicliffe&Ueckert, 2007).

5.3 Journal writing encourages critical thinking and reflection.

Research on journal writing in the past has focused on the application of cognitive and metacognitive methods to facilitate self-regulated learning (Berthold et al., 2007, Nückles et al., 2009 and 2010, Schmidt et al., 2012, Nückles et al., 2013 and 2014). Research has shown that improving students' recollection and understanding, as well as their willingness to study, has a positive effect. To teach middle and high school students to be able to address contentious issues and use logical thinking is one of the most important learning objectives in education (Ford & Yore, 2012). As a result, critical thinking, which includes voicing

questions and competing ideas, is essential for students (Ash & Clayton, 2009). By allowing students to express themselves freely in their learning journals, teachers want to stimulate critical thinking and discussion about the pros and cons of difficult subjects based on their own personal interests and preferences (Nückles et al., 2009). However, previous research on journal writing has not focused on the importance of critical reflection as a learning result, which is an essential learning consequence, in the journal writing process itself. Consequently, in the current study, we investigated the influence of journal writing on students' capacity to critically reflect on a challenging subject in grades seven and ten. The findings of our present research show that students who wrote in a journal were better equipped to think critically about and resolve an ethical problem than students who did other homework tasks (Study 1). Learning to critically reflect requires more than just a solid grasp of the material; it also necessitates the learner's interest in the subject matter, which may be shown as an enthusiasm for the material. Students who view a topic as interesting and engaging are more likely to engage in critical thinking than students who view a topic as irrelevant or dull (Study 1 & 2). Students' ability to critically reflect on what they had learned was enhanced as a result of having a more personal connection to the material they were studying (Ford & Yore, 2012). In a way, our data show that journal writing supports a domino effect, starting with enhanced understanding and moving to increased engagement and critical thought.

6. Study stipulations and restrictions

A focus of our research was the use of journal writing in middle and high school science classes, specifically as a quasi-experimental, longitudinal field study. Given that both theoretical and practical considerations drove our study, we classify our findings as "use-inspired research" (Renkl, 2013). To maximise ecological validity while keeping the advantages of a laboratory study, we carried out experimental treatments in a real field situation (e.g., controlling for potential confounds). There are advantages and downsides to allocating entire classes to an experimental condition rather than randomly assigning individuals. Other uncontrolled confounds may have affected the intervention study results, despite the fact that we took into account students' pre-existing individual differences and possible confounds throughout the intervention research (such as teacher, teaching methods,

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materials, and time on task). Our findings must be replicated using genuine experimental designs in which students are randomly assigned to different experimental settings.

This is a key drawback of our current research, as the conclusions cannot be generalised to other fields. This is especially true in the case of human biology, where students instantly grasped the personal value of their studies. Because of this, we believe that the content domain's accessibility is a significant factor in the powerful impacts of the personal utility prompt shown in Study 2. With these findings in mind, it remains to be seen how well we'll fare when it comes time to apply our methods to more distant realms of study (e.g., particle acceleration in physics). Therefore, the findings must be replicated across a range of age groups and environments.

7. Ending thoughts

Studies like this one show that journal writing helps students build their critical thinking skills as well as a passion for learning and a desire to continue their education throughout their lives by fostering their comprehension of scientific concepts, topics, and concepts in general. For middle and high school students, journal writing proved to be more useful than other standard writing assignments for self-regulated learning in human biology than other traditional writing tasks. Using learning journals to assist students practise writing to learn has been recognised as a specific technique for fostering the growth of students' scientific literacy. Using learning diaries, students were able to practise the kinds of excellent learning practises that help students retain information better, increase their enthusiasm, and improve their critical thinking abilities. The favourable effect of journal writing on students' participation in the course was further strengthened by providing writing instruction that not only focused on cognitive and metacognitive processes, but also on motivational components, such as the personal significance of a specific problem. According to the findings of this study, journal writing has far-reaching advantages that go beyond merely helping students understand and retain course information. Learners' interest in difficult skills like critical reflection may be piqued and acquired with the help of learning diaries, according to this research.

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2

Collaborative Writing and Self Confidence among Vocational Education Learners

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Abstract

Almost universally, professional development courses combine classroom and real-world training. Students in vocational education have trouble combining the formal explicit information they learn in school with the informal tacit knowledge they learn on the job. There will be an investigation into the role of writing and peer cooperation in articulating conceptual and experiential knowledge during this design research project. At a school for social and health care assistants, 40 first- and second-year students wrote about real-world experiences, shared them with their peers, and participated in written and spoken conversations with their classmates and the teacher. It was made possible for participants to collaborate and write on the web using a wiki, a web-based platform for collaborative writing. Study results indicate that first-year students developed a lot of self-assurance, but sophomores performed less well on a competency assessment. Its collaborative character was also a big hit with students. The discussion focuses on the creation of writing and peer feedback-based learning activities for students to explain their intellectual and experiential knowledge.

Keywords: “vocational education and training, written peer feedback, computer-supported collaborative learning, self-efficacy”

For the most part, professional development programmes include both classroom and workplace training under the direction of a supervisor. All educational levels, from secondary school to college and vocational training (VET) to adult education and lifetime learning, utilise this method. While most students will have some form of job experience, there are a range of methods to make use of it (in terms of duration, articulation with school, conditions, and supervision). Because of the inclusion of a variety of educational environments, students have the opportunity to gain the breadth of information they'll need to succeed in the workplace. A research by Filliettaz (2010) and Tynjälä (2008) demonstrated that this integration does not occur spontaneously and must be arranged during training.

It is possible to teach vocational students to communicate their theoretical and practical training via the use of writing and cooperative situations. Writing may be used as a cognitive tool to assist students abstract and conceptualise practical experience, while cooperation can be utilised to encourage students to move beyond their own personal experiences and generate a genuine communication scenario in professional training.

1. The first step is to do a literature review.

1.1 Accurately communicating how one learns at work and in education.

One's field of expertise requires more than simply knowing what to do, how it should be done, and why; it requires adaptability in the face of new or unexpected conditions (Billet, 2006; Mann, Gordon, & Macleod, 2009). So that they can deal with such novel and crucial circumstances, students need to develop both “hard skills” and “soft skills,” which refer to behaviour, communication norms, and other interpersonal skills related to the job (Kumar & Hsiao, 2007). Participation in a professional community shapes one's identity as a professional (Lave & Wenger, 1991). As part of a vocational education programme, students are taught in the classroom and on the job, culminating in a theoretically competent practitioner after they complete their studies.

They are typically juxtaposed rather than integrated since they have to be taught in different places and by means of different methods (Billett, 2001; Filliettaz, 2010). In terms of educational possibilities, internships offered by businesses might differ greatly (Billet, Fenwick, & Somerville, 2006). In the absence of practise or application, it is likely that students will not obtain the greatest benefit from their education. Some students may also

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gain knowledge of the theoretical underpinnings of a subject by working on professional projects. Because of this, it is difficult to incorporate a wide range of practise into the classroom without specialised training. Thus, Tynjälä (2008) and Tynjälä&Gijbels (2012) developed an integrated pedagogy model, which describes the numerous forms of information that professionals need to acquire and investigates how to facilitate their articulation in the classroom. Consequently (Figure 1).

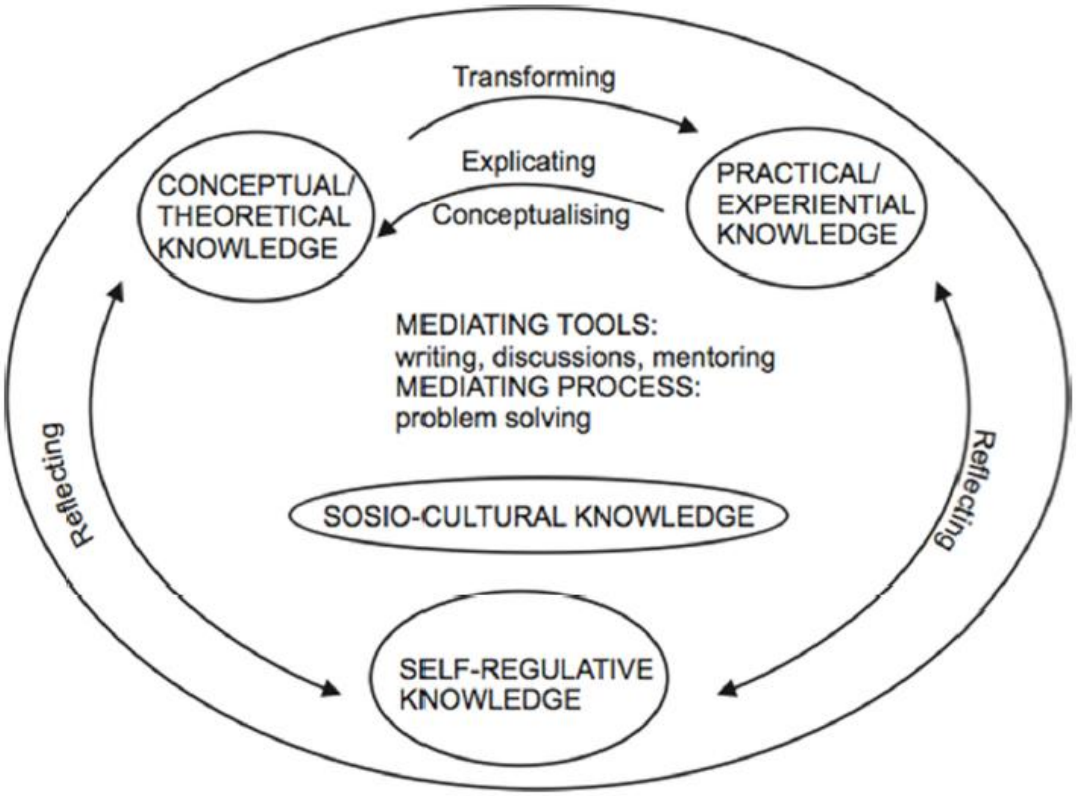

Figure 1. Integrative pedagogy model (Tynjälä & Gijbels, 2012).

Practical, conceptual, self-regulatory, and sociocultural knowledge should not be treated individually in vocational education, according to this paradigm; instead, they should be addressed jointly (knowledge that is embedded in the social practises of workplaces and is learned through participation in these practices). Mediating tools, such as tutoring/mentoring, discussion, and writing activities, should be provided in the instructional setting to support the transformation and linking of practical to conceptual knowledge, while also reinforcing self-regulation and socio-cultural knowledge (through participation in group activities) (by

way of discussions). Writing and collaboration, two key components of this system, are discussed in detail in the next two sections.

1.2 Writing and learning are discussed in detail in Section

When it comes to understanding how writing affects the brain's ability to learn, little systematic study had been done prior to the 1970s. Throughout the ages, writing has been used as a way to help children remember, reflect on, and conceptualise information. New concepts in the text have to be negotiated with long-term memory, according to Hayes and Flower (1980), who showed for the first time that writing involves a negotiation between new ideas created in the text and long-term memory. The authors then outlined two different scenarios, each of which had different consequences for the development of writers' expertise. Two situations have been identified by Bereiter and Scardamalia (1989) as having distinct effects on authors' ability to elaborate their knowledge. Writers in a knowledge-telling context don't go into great detail on the topic at hand; instead, they just communicate what they know. It's more accurate to say that when authors are transforming knowledge, they do so by considering the end goal of their work and then adapting to the surrounding circumstances. When it comes to the idea that the explicit achievement of rhetorical goals is beneficial to knowledge transformation and, therefore, to the process of learning, Galbraith (1999) was critical. It has been proposed by Galbraith (2009) that writing is the result of a two-stage process of discovery: an explicit planning phase to meet rhetorical objectives, and a more spontaneous, less controlled text production phase that leads to the development of understanding through an implicit reorganisation of semantic memory.

It has been widely agreed upon by scholars of cognitive science that writing involves deep processing, which results in conceptual reorganisation of information, abstraction (Olson, 1994), and the generation of new knowledge. There are many conflicting and equivocal findings in the literature about its teaching effectiveness, however (for critical reviews, see Ackerman, 1993; Bangert-Drowns, Hurley, & Wilkinson, 2004). An important factor in Tynjälä's (1998) investigation into the reasons for these seemingly contradictory results was the fact that traditional learning outcomes of writing activities have been evaluated using quantitative testing on recall tasks, with no regard for the quality of higher-order learning that takes place. Learning activities that focus on conceptual and knowledge change, rather than

memory retention, are more likely to provide positive results when students write about their experiences.

According to Tynjälä, Mason, and Lonka, students' past knowledge and views should be taken into account before learning a topic by employing free-writing activities (2001). It's also recommended that students work on solving practical difficulties, as stated by Tynjälä, Mason and Lonka (2001). Lastly, the concept that writing is both an individual and a collective endeavour is reflected in this condition. When teaching writing, Tynjälä (1998) found that the most effective way to accomplish learning objectives was to combine it with oral dialogue and reading. Although planning and implementing collaborative education is a tough endeavour in and of itself, as explored in further detail in the next section, it requires careful consideration of a number of factors.

1.3 Collaborative learning, computer support, and peer feedback are all important components.

Cooperative learning refers to a range of scenarios in which students work together to complete a given set of activities in a scenario that is generally very precise in terms of how the work should be planned and distributed over the period of time (Dillenbourg, 1999). Students are more likely to join in group conversations when they are exposed to collaborative settings, which allow them to demonstrate their own understandings while simultaneously learning from the viewpoints of others (Dillenbourg& Fisher, 2007). It's possible that students will have to alter their concepts if they encounter opposing viewpoints. Some of the students may be able to work out their differences with each other (Suthers, 2006). There are a lot of elements that influence whether or not students can engage in constructive exchanges during cooperative learning, but it has the potential to be a strong learning tool if used correctly (Stahl, Koschmann, and Suthers, 2006). This research into the characteristics that promote the formation of beneficial interactions among students has taken more than two decades, according to researchers in collaborative learning (Scanlon, 2011; Suthers, 2006).

With the development of computer technology and the proliferation of Internet connections, computers have become an important part in collaborative learning research. Computers not only allow students to interact across time and space, but they also allow them to track and

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update their work over time. Computer-supported collaborative learning (CSCL) is a unique area dedicated to promoting deep and long-lasting learning by encouraging collaboration amongst peers in computer-supported environments (Puntambekar, Erkens, &Hmelo-Silver, 2011; Spada, Stahl, Miyake, & Law, 2011). Computer-supported collaborative activities have two important elements to consider, as explained in Dillenbourg and Fischer (2007): In order to foster cooperation among peers, the activities must be designed in a way that encourages and facilitates it. An effective activity will require students to interact with others while also giving them all the knowledge they need to manage their interpersonal connections. Individual and group tasks that can be accomplished with computers as well as those that cannot be completed with computers should be included in instructional situations to begin (Dillenbourg&Jermann, 2010).

Peer feedback is one of the many collaborative writing tasks that might be made feasible with the use of computer technology. Many different kinds of peer feedback have been tried and tested to see what impact they have. In order to improve the quality of their classmates' work, students are asked to provide constructive comments and ideas (Gielen, Peeters, Dochy, Onghena, &Struyven, 2010; van der Pol, van den Berg, Admiraal, & Simons, 2008). Peer-assessment activities need that participants evaluate and rate the performance of their peers (De Wever, Van Keer, Schellens, & Valcke, 2011; Gielen& De Wever, 2012; van Gennip, Segers, &Tillema, 2010). Some students may be wary of peer review because they don't want their work to be judged by someone they don't know, or because they question that person's qualifications to perform this task (Kaufmann &Schunn, 2010). In contrast, students' doubts regarding peer criticism may lead them to join in discussions and search for confirmation of statements mentioned in textbooks and other media (Yang, Badger, & Yu, 2006). When it comes to feedback from professors, students seldom challenge or seek clarification from other sources because it is widely regarded as such. According to van Gennip et al. (2010), learners' first hostility toward peer feedback may be caused by a lack of a proper introduction to the method. It becomes easier for pupils to understand and appreciate the activity when they have more experience to this type of evaluation (Dochy& McDowell, 1997). Peer contact has the ability to have a variety of substantial beneficial effects on the learning process in terms of its impact (Davies, 2002). Dochy and McDowell (1997) claim that a

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range of strategies can assist in the development of essential abilities such as communication, self-evaluation, observation, and self-criticism.

1.4 Beliefs in one's own ability

As a research objective, this study examines if students may develop comprehensive understanding and convey their intellectual, practical, sociocultural, and reflective knowledge through writing and peer evaluation. An individual's identity and self-beliefs are also anticipated to be developed in this environment, particularly in regards to their belief that they are capable of succeeding. In terms of self-efficacy, it refers to the belief that a person has in their own capacity to carry out the steps necessary to accomplish a certain goal (Bandura, 1997; 2006). This conviction in one's own abilities is considered the cornerstone for self-motivation and self-accomplishment since it gives individuals a sense of control and encourages them to engage in activities like goal setting and strategy selection by monitoring and evaluating themselves (Zimmerman, 2000).

Self-efficacy beliefs may be traced back to one of four main sources, according to Bandura (1997). Achievements in performance management make up the first component. Self-confidence is a direct result of one's own personal practise and experience. If one succeeds or fails at a certain aim, one's perspective of one's own abilities will be influenced by the outcome. The emphasis on the fact that a well-developed feeling of efficacy is not affected by single successes or failures indicates that their impact is more meaningful when they occur early in the learning process or when they occur frequently (van der Bijl & Shortridge-Baggett, 2001). It is possible to identify a second source of self-efficacy through the use of vicarious experiences. In addition to providing examples of successful performance and information regarding the difficulty of the activity, seeing others do a task successfully can boost students' self-confidence. Increasing one's self-efficacy through verbal persuasion is a third and extensively employed strategy. When it comes to convincing health care workers that they are capable of taking on difficult tasks, Van der Bijl and Shortridge-Baggett (2001) write, "verbal persuasion is frequently used." Finally, physiological knowledge is a substantial source of self-efficacy and motivation at the last place on our list. A person's capacity to complete a task will be assessed by examining and interpreting a variety of emotional and physiological aspects, such as stress, fatigue, discomfort, and so on.

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Individuals must use information from a number of sources to determine their capacity to perform certain activities. Each of these sources must be given distinct weights when making a judgement on one's or another's ability to accomplish certain activities (Bandura, 2006). In this study, self-efficacy beliefs were viewed as a viable indication for the development of a comprehensive awareness of professional contexts because of their interconnected character.

1.5 The current investigation and research questions

The current study suggests an educational intervention based on Tynjälä's (2008) and Tynjälä and Gijbel's (2008) integrated pedagogy model (2010). (2012). An important part of the goal of this intervention is to help students build a thorough understanding of professional contexts by expressing concepts and practises in a unified manner. As part of a design-based research methodology, the literature has been evaluated for the purpose of developing suggestions for the design of writing and collaborative learning activities—especially peer feedback—for higher education institutions. In addition, in-depth discussions with instructors at the partnering vocational school have been done to identify and address the instructional obstacles that occur when trying to combine theory and practise. As a consequence of the two lines of work, an educational intervention (see 2.2 for more details) that is incorporated into the school curriculum is developed (as shown in Figure 1). One's own writing, written peer criticism, an in-class discussion, and a written individual wrap-up were the main components of the intervention.

Our belief is that writing exercises, when used in conjunction with collaborative activities, can aid students in better articulating their knowledge and comprehension of theoretical, practical, self-regulatory and sociocultural aspects. Writing is meant to aid in the understanding and conceptualization of practical knowledge (Galbraith, 1999). Yang et al. (2006) recommend that students participate in a conversation that exposes them to other people's perspectives as well as their own, fostering the ability to reflect on one's own behaviour and generate new knowledge (Davies, 2012; Dochy&McDowel, 1997). Lastly, students can reinterpret their unique experiences in the context of a collective interpretation with conceptual aid from the teacher through whole-class discussion. As a result, writing acts as a tool for accumulating and storing for future use the communal interpretation of one's own unique experiences (Scardamalia& Bereiter, 1994; 2006).

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In order to perform a design study, we came up with a list of questions. If the intervention as a whole fulfils the purpose of thoroughly understanding a professional issue, this is the first question to answer. To attain this purpose, the following outcomes have been examined: A declarative competency exam meant to measure students' capacity to grasp a complicated scenario and behave correctly, as well as their self-efficacy views about the subject matter at hand; It is our view that students' performance on the competence test and their self-efficacy in respect to the problem will increase as a consequence of the intervention and that their general professional expertise will be enhanced by the transfer process. Studying the effects of a complete educational intervention in real-world conditions is the goal of this research project. Writing, peer criticism, and conversation are all components of a larger intervention, thus it will not be feasible to isolate their individual impacts. The second question in this research is to determine the link between students' involvement in the activity and their progress in terms of their understanding of the subject and their perceptions about their own ability to solve problems successfully.. This will be taken into account because recent research (Ortoleva et al., 2013) showed a positive correlation between students' participation in peer comments and their post-test performance.

2. Method

These findings were made possible thanks to funding from the Swiss government, which supported the research conducted out at the Geneva canton's School for Social and Health Care Assistant (ASSC). Children in this school have finished their compulsory education in Switzerland, which lasts until the age of 16. Some of them had prior professional experience, while others had already finished other types of education before commencing this VET programme. The three-year programme for social and health care assistants comprises half of the time spent doing internships in the field. Nursing assistants can work in a number of situations after finishing the training (e.g., hospitals, retirement homes, or home care).

2.1 Participants

To conduct this study, 20 second-year students and 12 first-year students (mean age: 23.3 and 23.3, respectively; SD: 6.02 for the first-year group and 3.18 for the second year group) were surveyed. In the scenario's creation and implementation, two instructors, both of whom were

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female, were involved. More than 10 years of experience as nurse practitioners preceded their licensure as teachers.

2.2 Scenario for instructional purposes

According to the teacher, the educational intervention took place in a class dedicated to the articulation of theory and practise. This class mostly consisted of discussing scenarios provided by the presenters, who encouraged the students to analyse the issues using their own life experiences. The professors were dissatisfied with the difficulties they had enlisting the full involvement of the students in the debate.

The scenario that was implemented consisted of three phases that were stretched out across three one-and-a-half-hour learning sessions. Because the sessions were two weeks apart, the full exercise took six weeks to complete from start to finish (not including the pre- and post-tests which were administered in separate sessions). During this time, the students only attended school for general education classes (French, foreign languages, etc.) and were forced to engage in workplace practise four days per week. The third phase of the scenario was somewhat changed for first-year students as part of a design-based research technique after being successfully deployed with second-year students in the prior phase (see details below). These changes were made after taking into account student behaviour as well as observations made by both the researchers and the teachers at the school.

The first portion of the scenario, which comprised writing and getting peer assessment, was dominated by the writing job. Patients' contacts with second-year students and first-year students' washing of a patient were two instances of work experiences that were linked to certain professional qualities. Professors identified these themes as the essential abilities that participants should develop at each step of the learning course. It was suggested that participants write about a key scenario they experienced on the job on their own page on the wiki site (see 2.3). Students were given guidance on how to utilise the critical-incidents approach after learning how to characterise the critical situation they experienced (Flanagan, 1954; Schluter, Seaton, &Chaboyer, 2008). The students were asked three leading questions, which were as follows: (1) What occurred exactly? (2) What were your initial reactions to the situation?

(3) What were the consequences of this specific situation?

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After that, each student was asked to give criticism on two of their classmates' written works. According to Kaufmann and Schunn (2010), students were given specific instructions and prompts to prevent the possible issues of peer criticism for those who were inexperienced with it. These instructions and prompts led students through the process of creating constructive critique, as well as accepting and incorporating other people's comments. They were given the following instructions: (1) construct questions (King, 2007); (2) make comments and recommendations; and (3) reflect on any comparable experiences they had; otherwise, they were asked to consider how they would behave in a similar situation (King, 2007). Kuhn, Shaw, and Felton (2000).

At the end of the session, students were instructed to return to their respective wiki sites. In addition, students were asked to: (1) answer to questions provided by their peers; (2) analyse and explain their reactions to others' remarks and views; and (3) assess how they would react to a similar situation if they encountered it again.

To make it simpler to distinguish between the text created at various times throughout the task, students were instructed to use different colours to separate it (Figure 2).

Melinda (M) and Fabio (F) made remarks on the show, which Diana (D) reported on (F)

D1 says, "I am in charge of a schizophrenic patient who lives at home," I have to give her the medication she requires, but she has repeatedly refused to take it and tossed it on the floor, resulting in her behaving violently. She threatens to leap out the window to achieve what she wants, which she has done once or twice before. My attempts to be strict, reframe the situation, and speak to her in a stern but calm manner all failed. Because the situation was so distressing, I had to leave the flat. It terrified me to death that she'd hurt herself and I'd be held responsible."

M: Could you describe the many techniques you tried with her?

My intention was to be firm, reframe the situation, and speak to her in a firm but calm tone... D2: I tried to calm her down by allowing her to express herself by shouting at me, but it didn't work.

M: Could you explain me why she needs your help? Is it your obligation to provide her the meds she needs? Is it really essential to clean her?

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The second individual is schizophrenic with cancer, and she is undergoing an incredibly expensive therapy that she is unable to accomplish on her own, and she need assistance with personal hygiene.

F: Have you ever been nervous when caring for this specific patient?

D2: Yes, I was worried that she might hurt herself as a result of my counselling, and that I would be held responsible.

F: Does this patient have any relatives? D2: She is alone; she does not have anyone with her.

M: I suppose I would have behaved similarly, seeking to engage with the patient and questioning as to why she was acting so violently and how she felt when I arrived to care for her. Although I agree it is acceptable to refer her to a doctor, why don't you make an attempt to explain her health conditions and why she need her medications? Always try to maintain a safe space between you and her in case she strikes.

F: I suppose I would have acted similarly, but I would also have sought to engage her family (if she has one) as well as the doctor in the situation. I'd explain the treatment's side effects to her and make an attempt to build a stronger bond with her. I would also make every attempt to collaborate with the patient in order to find appropriate accommodations (e.g. she takes her medicine and you do not bother her with her toilette).

D2: We seek the doctor's aid on a frequent basis. The type of accommodation you describe, on the other hand, is something I would not want to do (if you do, I won't bother you...) since she may take advantage of her circumstances. If she refuses to listen, I shall leave her alone. When she is in severe need of help, she will beg me to accompany her.

The scenario's second part, which included class discussion, was completed during a second session two weeks later. There were no written comments; instead, the teacher moderated an oral conversation that included all participants. Prior to this session, the teacher worked with the researchers to group the students' episodes into thematic clusters, which were then discussed in class the following day. The purpose of the conversation was to find viable answers to the critical issues that the learners had highlighted to the facilitator. Everything was recorded on video.

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The third half of the scenario, which took place in a third session and differed for first-year and second-year students, focused on final text development. Second-year students were asked to edit and comment on their own pages, as well as the pages of their classmates, based on what they had learned from the previous semester's writing assignments and spoken conversations with their teachers. Because it was too similar to what they had done in the previous two sessions, first-year students were not required to engage in this exercise.

The distribution of external materials (journal articles, book sections, and video clips) to first-year students was a new addition to this exercise, and it gave fascinating insights into the topics that developed during their episodes and debate. Students were asked to assess the subject matter provided after reading and seeing the material and come to new conclusions about how they would handle the circumstances mentioned by themselves or their colleagues if they were to encounter them in their future practise.

2.3 Material

2.3.1. Materials for the pre- and post-test

Learners were given pre- and post-tests before and after completing the educational activity, and the results were analysed. The following are some of the assessments' findings:

A competence exam is used to assess students' declarative understanding of the professional practise in question (see Appendix A for the pre-test administered to second-year students). For each year of study, one crucial circumstance connected to the technique under research was given: the interaction with patients was explained for second-year students, and the washing of a patient was described for first-year students. Each student had to select one of the seven potential replies and reply to two open questions (explain why you chose this option, and explain what else should be done in this situation). To prevent the learning effect, the pre- and post-tests utilised two distinct cases, but they were structurally equivalent to avoid the learning impact. These exams were given to the students after being developed in consultation with the school's instructors, who ensured that the difficulty levels of the two situations matched to the students' educational levels. The pre-test dealt with how to handle the relationship with a patient and her family after the patient experienced an unexpected problem and felt neglected, while the post-test dealt with how to handle the relationship with

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a patient and her family after the patient experienced an unexpected problem and felt neglected.

The competency exam's results were made up of two separate scores that were combined together. The learner's response was given a first score in the multiple-choice question, which was then multiplied by two. The maximum score was given to an option that described a correct reaction and all subsequent actions to be taken; a score of 2 was given to an option that described a correct reaction but was missing one key element; a score of 1 was given to an option that was only partially correct and missed key elements; and a score of 0 was given to an option that described an incorrect reaction and all subsequent actions to be taken.

The academics presented a grid that highlighted eight critical characteristics crucial to comprehending the topic at hand and the measures to be done, which was used to evaluate open questions. The researcher was able to evaluate how many key elements the students had indicated in their replies after analysing their writings and comparing them to the grid (with a maximum score of 8). To test the reliability of the pupils' replies, many independent coders were requested to grade their responses. This was done to guarantee that all open questions were thoroughly investigated. The Spearman inter-rater reliability value was r =.863, suggesting a high level of trustworthiness (good agreement). The developers' conflicts of opinion were resolved by reaching an agreement.

Questionnaire regarding self-confidence in one's ability to succeed: This questionnaire measured three dimensions of self-efficacy: professional self-efficacy (covering various aspects of professional tasks), efficacy specific to the competence under investigation (relationship with patients for second-year students and washing a patient for first-year students), and school-related self-efficacy (covering various aspects of school-related tasks) (covering various tasks associated with the school context). A copy of the self-efficacy questionnaire that was given to second-year students at the start and end of the semester may be found in Appendix B. The items in this questionnaire were designed expressly for this purpose in accordance with Bandura's recommendations since they are very relevant to the profession of social and health care assistants, as well as the specific method under study (2006). Teachers cooperated on the preparation of these items to ensure that they were relevant to the practical experience students would have at their places of employment. The

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questionnaire's reliability was extraordinarily high across all aspects assessed, according to Cronbach's alpha, including: Professional self-efficacy (5 items, pre-test.93, post-test.93); unique to professional process (5 items, pre-test.92, post-test.94); school-related (5 items, pre-test.92, post-test.94); (4 items, pre-test.87, post-test.94).

Subjective assessment of the instructional scenario: Nineteen questions were asked of students to assess their perceptions of learning through the activity (4 items), perceptions of learning through collaboration (3 items), appreciation of the activity (3 items), appreciation of the collaboration (4 items), appreciation of the wiki platform (3 items), and willingness to reuse it in the future. Objective assessment of the teaching situation: (2 items). All of these items were prepared expressly for this study since they asked very specific questions about how our activity was implemented in all of its varied aspects. Learners were asked to complete a questionnaire using a 4-point Likert scale, with responses ranging from (1) strongly disagree to (2) disagree to (3) agree to (4) highly agree.

2.3.2. The computer-supported environment

Wikispaces (www.wikispaces.com) was used for the activity. Wikis are particularly built to facilitate collaborative writing by allowing access across place and time, the ability to build hyperlinks and new pages, and the ability to trace all changes and their authors (Parker & Chao, 2007). Each student was given an account to use the site during the first session. Each learner had their own page on the site, which allowed them to write about their key occurrence and receive feedback and questions from their peers.

2.4 Procedure

The instructors who participated on the design and execution of the activity explained the three sessions of the scenario a few weeks before the intervention began, detailing the activities planned in each portion and how they would be implemented. They presented the study's lead researcher (the paper's first author), explaining that the action was part of a university research effort. In this context, students' agreement to participate in the study was secured. A 45-minute pre-test session was held during the session preceding the intervention. The competency exam and the self-efficacy questionnaire were given to the students to complete. Following that, the three scenario sessions were held two weeks apart. After the scenario had been fully completed, students were requested to complete a post-test session in

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which they were asked to complete the second version of the competency test and the self-efficacy questionnaire, as well as their questions and opinions about the activity.

3. Results

"As second- and first-year students followed different instructional scenarios, results are presented separately for each class."

3.1 Competence test performance

Because the data did not match the conditions for homogeneity of variance or normality of distribution, the students' pre- and post-test scores were compared using a non-parametric test for related samples (Wilcoxon-Signed Rank test Z).

3.1.1. Performance of second-year students

Table 1 shows the results of second-year students on multiple-choice and open questions; the n does not equal the total number of participants since only those who attended all of the sessions were included in the analysis. The scores on the multiple-choice exam did not change significantly between the pre- and post-test (Z =.612, p >.05). There was a marginally significant difference between the pre- and post-tests in terms of open questions (Z = 1.854, p =.0684), with higher scores in the post-test.

Table 1. Competence test results of second-year students (N=16)

	Pre-test		Post-test	
	M	*SD*	*M*	*SD*
Multiple-choice question (max =3)	2.31	1.25	2.56	0.52
Identification of key elements (max = 8)	3.13	0.96	3.75	1.34

3.1.2. Performance of first-year students

Table 2 summarises the outcomes of first-year students. The selection of the most suitable reply differed significantly between the pre- and post-tests for the multiple-choice question (Z = 2.743, p.05). The open questions, on the other hand, did not show a significant difference between the pre- and post-test (Z = 1.581, p >.05).

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Table 2. Competence test results of first-year students (n=12)

	Pre-test		Post-test	
	M	*SD*	*M*	*SD*
Multiple-choice question (max = 3)	0.25	0.87	1.50	0.67
Identification of key elements (max = 8)	3.67	1.16	4.42	1.17

.2 Self-efficacy beliefs

There are three aspects to students' judgments of their skills in a series of activities, and the self-efficacy beliefs questionnaire assessed these perceptions on all three levels. Table 3 shows results for second-year students, while Table 4 shows results for first-year students. Data were neither homogeneous in variance nor normal in distribution, thus the pre- and post-test scores were compared using a non-parametric test for related samples (the Wilcoxon-Signed Rank test).

3.2.1. Results of second-year students

"There was no significant difference between the pre- and post-tests for any of the dimensions observed (Z =.450, p > .05 across all dimensions)."

Table 3. Self-efficacy beliefs of second-year students (n = 18)

	Pre-test		Post-test	
	M	*SD*	*M*	*SD*
Professional	58.93	18.14	61.31	17.71
Specific to the procedure	70.57	22.97	71.34	20.30
School-related	67.49	16.96	68.99	21.08
Mean of all dimensions	64.72	17.40	66.56	18.27

3.2.2. Results of first-year students

Students' self-efficacy views improved on every parameter examined by the questionnaire, in line with our expectations (professional self-efficacy: Z = 2.934; particular to procedure: Z = 1.961; school related: Z = 2.668), according to the statistical analysis.

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Table 4. Self-efficacy beliefs of first-year students (n=11)

	Pre-test		Post-test	
	M	*SD*	*M*	*SD*
Professional	67.64	17.64	84.62	9.51
Specific to the procedure	82.48	16.70	92.83	7.00
School-related	76.82	20.11	92.11	9.15
Mean of all dimensions	76.19	17.28	90.21	7.64

3.3 Participation

The mean amount of words written by each student for each assignment throughout the first phase of the scenario was used to evaluate their overall involvement in written assignments (for both second- and first-year classes). The quantity of words written by students can be used to measure their level of participation in an activity, despite the fact that the number of words does not indicate the quality or meaning of the material (Jermann&Dillenbourg, 2008). Recorded lectures were analysed to determine the percentage of pupils who took part in the oral discussion by counting the number of times each learner addressed the class (see below). Table 5 of this report contains the data. According to both researchers and practitioners, the overall participation of students in writing tasks (M = 545.15 for second year students; M = 389.22 for first year students) was rated highly satisfactory, especially when taking into consideration the researchers' and practitioners' previous experiences with students in this educational path. A between-subject ANOVA was done on their participation in all three phases of the writing assignment to see if there was a significant difference in their results between second and first-year students. Second-year students wrote much more to describe their crucial situation than first-year students, $F(1,32) = 11.123$, $P = .01$, and partial eta-square $= .002$ following an analysis of variance. There was no significant difference between the groups in the peer comments as a consequence ($F(1,32) = 2.561$, $p > .05$). Similar to the results, there was no significant difference between groups in the conclusion ($F(1,32) = .438$, $p > .05$.).

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Table 5. Participation in the writing tasks (mean number of words produced) and in the class discussion (mean number of interventions)

	Second-Year (N = 21)		First-Year (N = 13)	
	M	*SD*	*M*	*SD*
Critical incident	247.10	97.52	147.15	58.12
Peer comments	185.43	73.41	146.15	62.55
Conclusion	112.62	78.47	95.92	58.00
Intervention in the class discussion	6.59	5.87	11.40	5.77

Pearson correlation analysis (Pearson correlation) was done between the participation data for the total sample and the multiple-choice question outcomes at pre-test and post-test. Both pre- and post-test scores (r =.584 and r =.459, respectively) were shown to be statistically linked to the quantity of words written in the important episodes (r =.584, p.001 for the pre-test score and p.05 for the post-test score). A correlation between engagement in the comments and competency test scores was not statistically significant at either the pre-test (r =.255; p >.05) or post-test (r =.124; p >.05.) level. For some reason, a negative correlation was found between the duration of the first session's description of the key episode and classroom participation in the oral discussion, with a R=-.435 and p=.002 respectively.

3.4 Evaluation of the activity from the participant's perspective

First- and second-year students' scores in each of the six dimensions examined are shown in Table 6. (four-point Likert items). Overall, all of the ratings were higher than 3, suggesting that the participants had a positive experience with the wiki platform and its collaborative nature. The majority of participants (mean scores below 3) were not confident that they had learned anything from it, yet all other scores were greater than 3.

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Table 6. Subjective evaluation of the activity by first-year and second-year students

	Year I (n = 23)		Year II (n = 11)	
	M	*SD*	*M*	*SD*
Learning through activity	2.77	0.70	2.71	0.52
Learning though collaboration	3.31	0.50	3.20	0.36
Appreciation activity	3.43	0.52	3.00	0.54
Appreciation collaboration	3.79	0.32	3.45	0.38
Appreciation wiki	3.53	0.46	3.17	0.58
Willingness to reuse wiki environment	3.40	0.43	3.10	0.49

4. Discussion and consideration of future directions

Although writing can be an extremely effective instructional method for fostering individual knowledge construction (Galbraith, 1999), it is rarely used to foster discussion and collaborative knowledge construction (Scardamalia& Bereiter (1994, 2006), as well as collaborative knowledge construction (Tynjälä et al (2014). This study employed Tynjälä's integrated pedagogical paradigm, which includes writing about a crucial working experience, peer criticism, and class discussion.

4.1 Did the pupils gain any new knowledge as a result of this intervention?

Students' ability to pass a case-based competency exam and their self-efficacy attitudes about the issue should both represent their level of comprehension after this intervention, according to the study's first research question. First-year students increased their capacity to correctly answer a multiple-choice question whereas second-year students improved their ability to recognise the most important aspects of a situation in the post-test findings, which was encouraging (a marginally significant improvement). For this reason, first-year students may differ from their more experienced peers in terms of how well they pick an acceptable reaction to hardship. However, more experienced students may need to work on increasing their ability to explain their judgments and forecast future behaviours. There is a possibility that second-year students have a better grasp of the material because they wrote much more than first-year students. Additionally, the lack of substantial gains in performance might be

ascribed to the brief period of the intervention, which is especially true when conceptual comprehension is involved (Bangert-Drowns et al., 2004).

Only a partial confirmation of our assumptions was found when it came to people's faith in their own abilities to achieve. All indicators of self-efficacy beliefs increased for first-year students, but second-year students' views did not appear to alter. According to Bandura (2006) and Renninger, Hidi&Krapp (1992), it is probable that second-year students had a more solid and accurate picture of themselves that was less prone to change or adjustment in similar contexts. It is possible, however, that the instructional scenario was altered from its first execution with second-year students to its second implementation with first-year students, which might have affected the outcomes. Because the intervention lasted for eight weeks, it's likely that first-year students' self-efficacy improved as a result of their regular professional growth occurring during that time.

4.2 Participation in the study as well as subjective evaluation

Although the results measures were not totally conclusive, students' involvement in the writing tasks was significant throughout the whole exercise. Student involvement and subjective evaluations show that students were satisfied with the instructional scenario created by following the guidelines of Tynjälä et al. (2000) for the design of writing tasks. As a result of Tynjälä's integrated educational paradigm (Tynjälä, 2008), the collaboration phase, which was particularly highly welcomed, was a noteworthy highlight. Experimenting with a real scenario and receiving feedback from their peers is a way for students to expand their learning and generate an abstract vision that can be used for future practise. Furthermore, there was a statistically significant negative correlation between oral conversation participation and written description involvement. It is important to note that this link is based on a large sample of students and implies that students who are more comfortable with writing communication are less likely to be comfortable discussing their professional practise in an oral classroom discussion. In light of these findings, Tynjälä (1998) claims that the most successful technique for conducting writing activities in which all students are included and engage in the learning scenario is a combination of oral and written exchanges and talks. A previous study (Authors, 2013) found no correlation between the competence test score and the number of words produced in the peer commenting phase, but there was an opposite

relationship between the competence test score and the number of words written in the critical incident before and after the test. This might be because more talented students went into greater detail about their critical situation. There were a few problems with this approach, the most obvious being that counting the quantity of words pupils wrote was a sloppy way to gauge their level of interest in the material. If the crucial occurrence is of high quality, as well as students' written remarks, this will give a more accurate image of the student's involvement in the activity. 3).

4.3 Limitations

According to a design-based approach to research, this study had certain drawbacks. However, even though it covered all students in their first and second year of study, this research's sample size (40 students and two teachers) was too small to conduct quantitative data analysis and generalise. This study's design lacks a statistically valid control group, making it hard to infer that the intervention was the only source of the observed increases in learning gains and self-efficacy beliefs and not any other part of their training that took place simultaneously. While they were not enrolled in academic programmes, they were nonetheless compelled to do internships in the workplace over the course of the intervention. If the intervention is regarded as a whole, it is impossible to isolate the benefits of writing and peer feedback from the effects of class discussion and the effects of instructors' interventions with new content and explanation. Secondarily, this is a major negative. Despite the fact that the study's primary goal was to assess the intervention's overall success, the scope of the intervention prevented it from being able to pinpoint the most critical instructional components. To better understand students' written outputs and the conditions under which productive interactions occurred, additional analyses are currently being conducted on the written productions (Dillenbourg& Fisher, 2007; Hämäläinen& De Wever, 2013). 1) A third constraint is related to the tools used, and in particular to the competency of the people who use the tools. Because it was created in real time with teachers, this case-based test is authentic and reliable for instructional purposes only; nonetheless, it cannot be relied upon as a scientific tool. According to Tynjälä et al. (200), writing intervention studies are hindered by the lack of an instrument to quantify complex learning, such as the articulation between conceptual comprehension and behavioural adaptation in a practical scenario. This topic

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needs more investigation, with the objective of developing a wide range of evaluation instruments that incorporate both quantitative and qualitative indicators, the reliability of which might be tested prior to the intervention.

4.4 Recommendations for classroom instruction

If you're trying to teach students how to make connections between the classroom and the workplace, we recommend using an instructional intervention that combines individual writing with peer and instructor feedback, embedded in an authentic classroom setting and incorporating discussions and teacher feedback. As a consequence of this study, three recommendations may be made. When students work alone before discussing ideas, it is highly interesting for students and possibly more productive since learners first organise their thoughts through writing before benefiting from the viewpoints of others. (Galbraith et al., 1999; 2009) (Galbraith, 1999). It is based on (Scardamalia and Bereiter, 1994). Another benefit of scaffolding interactions with cues that encourage good dialogue, such as questions, recommendations, and making connections to students' own experiences, is that students are more likely to provide written feedback to one another (King, 2007; Kuhn, Shaw, & Felton, 1997). Third, students and instructors may reap the benefits of computer capabilities such as history monitoring and modification, as well as collaborative features, without having to deal with technological barriers thanks to simple web-based wiki settings. Individual and group writing activities are expected to be studied in the future to better understand how they interact with one another, with the ultimate goal of developing instructional methods that are built on a solid knowledge base of the mechanisms underlying the observed gains in student learning.

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3

Studying Academic Writing Skills among Doctoral Research Scholars

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Abstract

This study looked at students' thoughts on writing and how they regarded themselves as writers. The Writing Process Questionnaire was used to gather students' views on academic writing. The connection between PhD students' mental health and their writing ideas was also of interest. A survey of 669 PhD students from a big Finnish institution was used in the research. Scales for assessing blockages, procrastination, perfectionism, intrinsic talent, knowledge transformation, and productivity were created using 26 questions. The six-dimensional construct was confirmed using CFA. It was revealed that emotional weariness was associated to a greater risk of procrastination as well as a decreased rate of output. LISREL research verified the six-factor structure of the writing scale. For the study of academic writing and its emotional components, the questionnaire appears to be a useful and reliable tool.

Keywords: Academic writing: writer's block; procrastination, perfectionism, PhD education; doctoral students, writing process; learning environment; stress; feedback, commitment, instrument, questionnaire

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1. Introduction

All academic endeavours necessitate some form of writing. Experimenting with literate practises is especially beneficial for PhD students, as it offers them the skills they need to contribute to their areas in an important way (Bazerman, 2006; Dysthe, 1993; Kamler, 2008; Lea & Street, 1998). Developing new scientific ideas and information through academic writing is an important part of collaborative knowledge growth (Hakkarainen et al, 2004; Paavola, Lipponen, &Hakkarainen, 2004). All in all, PhD studies revolve around writing.

For those who want to pursue doctoral degrees, the process of writing a dissertation will take months or even years. However, a small number of PhD candidates are capable of writing a dissertation but never finish it (Boice, 1993; Golde 2000; Lovitts, 2001; McAlpine and Norton, 2006). There is a significant absence of academic writing help to blame for this difference (Boice 1993). It's difficult to improve one's academic writing abilities since it takes a long time to become well-versed in the conventions of academic writing. Consequently, teaching and exchanging academic writing is quite challenging (Lonka, 2003). PhD education often emphasises the end result, the thesis or degree, rather than the process of writing itself as a learning opportunity to be actively supported (Aitchison 2009; Björk&Räisänen 1996; Pyhältö, Stubb&Lonka 2009). Research suggests that putting too much emphasis on a product (like a thesis) might be detrimental to one's well-being as well as one's capacity to complete the thesis. As a result, new educational methodologies and procedures are needed to identify the most pressing challenges in PhD students' academic writing instruction.

Students' views of writing may have a significant impact on how they approach thesis writing, how they explain their successes and failures, how committed they are to improving their academic literacy, and how they actually write. An abundance of misguided and prejudiced notions is prevalent in academic circles. This influences people's interactions. For this survey, we were interested in finding out how PhD students see themselves as writers, as well as how they see their personal writing problems. Writing Process Questionnaire (Lonka, 1997; 2003) was designed to verify an instrument for measuring PhD candidates' understanding of academic production, particularly in terms of thesis writing.

2. Writerly notions

Besides being an isolated activity, academic writing is also a social one: it serves as a means of integrating oneself into the academic community and culture (Dysthe, 1993; Lea & Street, 1998; McAlpine & Amundsen, 2008). For decades, academic writing has relied on genres and procedures that have been relatively stable, yet that are still used today (Bazerman, 2004). Genre may be described as a type of communication or discursive practise that has implicit social and cultural standards (Hyland, 2004). Understanding the literary standards and styles of thought of a tradition is essential for PhD students when they participate in scientific activity. Using specialised vocabulary and making arguments requires adhering to strict disciplinary and regulatory guidelines. Participants' implicit knowledge of academic genres is more frequent than they realise, making the technique more difficult to complete. Comprehension of textual practises is the foundation from which writing notions are generated (Lonka, 2003).

If you want to progress as a scholar, you can't do so without learning about the field's textual practises. It is vital for people to gain the required skills and information in order to fulfil their social and authorship tasks. Writing their dissertations is a form of "authoring themselves" for the students, who are finding their own unique academic voices (Holland, Lachicotte, Skinner, & Cain, 1998). As with any other author, PhD students (like any other writers) may get frightened when confronted with a large number of prospective present and future reviewers, which can lead to procrastination, perfectionist tendencies, and writer's block. It is common for beginners to produce scholarly writings that just rehash what has already been expressed, rather than providing fresh insights (Bereiter &Scardamalia, 1987). If you're a doctoral student who struggles with writing, you might want to avoid using technical writing guides (Thomson &Kamler, 2007). Instead, identity, conversation, and discursive labour challenges associated to academic writing (e.g. Ivani, 1998) are all too common. There are a variety of "side effects," to academic writing that have a positive impact on both the author's self-esteem and interpersonal relationships (Perpignan, Rubin, & Katznelson, 2007). Cognitive and epistemic processes impact the writing process, but so does the scientific community's culture and standards for exchanging information as they relate to research and scholarship. As a whole, PhD students perceive academic writing to be a challenging

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endeavour. If PhD students do not receive enough support, they may create and maintain writing notions that are not optimal for completing their doctorate studies.

2.1 Writing concepts that can be adapted

Scientists need a wide variety of skills and knowledge to write their work effectively. Academic talents that are related to specific topic knowledge are referred to as "literate expertise" by Scardamalia and Bereiter (1991). According to their original definitions, there are two main ways to reading and writing: "knowledge telling" and "knowledge transformation" (Bereiter and Scardamalia, 1987). Instead than requiring pupils to exert a great deal of mental energy, reproducible activities promote the use of writing as a tool for learning and growth.

Changing your mindset The research on skilled writers has indicated that knowledge-transforming abilities such as creating a detailed mental image of the work, actively and reflectively addressing problems, responding to the underlying qualities of the task, and reflecting on and relating to one's target audience are crucial (e.g. Hildyard, 1996; Olson, 1994). (1987) by (Bereiter and Scardamalia). According to our idea, PhD students who have learned to consider academic writing as a tool for knowledge transformation rather than just replication are more likely to finish their dissertations. They would view writing as an act of cooperation and creation rather than a simple repeating of already known material. Instead of working alone, they prefer working in groups, producing several draughts of their work, and then iterating on those draughts depending on feedback they get. An specialist in academic writing must have an in-depth awareness of the numerous disciplinary genres that may be employed to produce a compelling and rigorous "narrative" of one's research.

Effectiveness and self-confidence. Students who are enthusiastic and confident in their writing talents are more likely to succeed as authors, according a study by our team. Step one in this process is to consider oneself as a contributor and active part of the academic community. According to Bandura, all psychological activities have an impact on task-specific self-efficacy (1977). We put in more effort when we believe we are capable of completing a task than we do when we don't believe we are capable at all. Self-efficacy can help you avoid undesirable habits like procrastination when it comes to writing.

Bandura was also aware of social conditions that might contribute to collective inefficacy (1982). To put it another way, a lack of awareness for the need of intentional and methodical efforts to develop one's writing ability may be connected to a common idea that writing is an innate "gift" Writing self-efficacy is strongly reliant on one's own estimation of one's own output. Maintaining a positive self-perception of oneself as a productive member of society and a successful author is essential, regardless of the obstacles faced while working on the thesis.

2.2 Faith in one's intrinsic abilities

Many people feel that authors have an inherent ability to communicate their most significant ideas clearly and succinctly, even though this is not always the case (see, e.g. Sawyer, 2009). Writing may appear to be done in solitude, but it is actually a kind of communication that is becoming more and more popular in research. Writing study emphasises the importance of perseverance, habit, and the presence of supportive friends and family members (Boice, 1993). Students' self-perceived ideas about what they can and cannot know can influence their academic performance in college (Lonka et al., 2008). Knowledge is divided into two camps: those who believe that knowledge is organised and absolute, while those who believe that knowledge is a collection of interpreted and integrated viewpoints (Lonka& Lindblom-Ylänne, 1996; Lonka& Lindblom-Ylänne, 1996).

One cannot rely solely on the dualist/relativist epistemologies split of Schommer (1990; 1993). She created an epistemological quiz to assess a person's personal epistemology based on a variety of different criteria. An important impact was the students' belief that they were born with a natural ability to study. Because of this, writing may be seen as a creative and collaborative act of knowledge transformation. As a result, this thought can take root in places where individuals are encouraged to pursue their own unique paths (Sawyer, 2009). Perhaps the capacity to write is seen as a "toggle switch" that can be turned on and off at will. There is a correlation between these beliefs and a lack of effort to improve as an author.

2.3 Problems in writing

Writing, as previously noted, involves adopting disciplinary genres as well as the individual act. In order to study academic writing, one must overcome the difficulty of translating information into an understandable and discipline-acceptable entity for a specific audience.

For this to work, a person must not only accept the discipline concepts and theories as true, but they must also learn how to apply them in practise, which is something that can only be done gradually and in an encouraging atmosphere. Academic literacy development may be hindered by some writing assumptions and practises.

The inability to write effectively, but not because of a lack of literary or intellectual capacity, is known as "writer's block" (Rose, 1980). Even the most accomplished and experienced authors have their share of writer's block. Anxieties about failure, perfectionist tendencies, childhood trauma and bullying were all cited as reasons for writers' block in Boice's (1993) study. His conclusion was that blocking is seldom a singular phenomenon, and that it might be produced by a range of misguided beliefs. It was a self-help guide for academic writers that contained a self-diagnostic quiz for identifying poor writing habits. From an educational perspective, inflexible rules, early editing, and the writer's limited alternatives for coping with complexity can all contribute to these problems (Thompson &Kamler, 2007).

It is the practise of delaying or ignoring to begin duties that are crucial to one's success, which lowers one's productivity. Failure to self-regulate is a typical problem in academic research (Steel, 2007). A study by Onwuegbuzie (2004) found that 42 percent of graduate students delay on writing projects, 40 percent on exam reading, and 60 percent on weekly reading assignments, respectively. Klassen et al. showed that writing assignments were more responsive to academic procrastination than other activities (2009). Due to the nature of writing, procrastination may be more prevalent than in other pursuits (Boice, 1990).

There are two sorts of procrastination: adaptive and maladaptive (Schraw et al 2007; Howell et al., 2007; Lee 2005; Chu & Choi 2005; Moon & Illingworth 2005; Klassen et al., 2008; Kearns et al., 2008a; Schraw et al., 2007; Ferrari& Thompson 2006; Knaus 2000; Ferrari et al., 2005; Bui, 2007; Spada et al., 2006). In the first example, procrastinators seek to improve their time management and efficiency. An adaptive procrastination may also involve a last-minute effort that results in high levels of involvement. The maladaptive version happens when children fear failure, are anxious, or lack motivation.

To be perfect in academic writing, one must be fixated on the idea of producing a faultless piece of work, even if it means attempting to change the content till it is perfect or just giving up (Boice, 1990). Anxiety over failing, a desire to avoid criticism, or an attempt to impress

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others are all common causes of this sort of behaviour, and it can make it difficult for students to share draughts and get feedback, which can lead to writing problems. Procrastination is often tied to a person's perfectionism (Boice& Jones, 1984; Kearns et al., 2008a, 2008b; Onwuegbuzie, 2000; Ferrari & Thompson, 2006; Alexander & Onwuegbuzie, 2007; Bui, 2007; Steel, 2007; Van Eerde, 2003). It was Neumeister (2004; also see Seo, 2008) who first identified two sorts of perfectionists, the self-directed and the socially mandated. The self-directed perfectionist works hard and procrastinates less, whereas the socially mandated perfectionist attempts to prevent failure. To achieve this goal, one might either procrastinate or work harder to avoid failing at any costs.

Intertwined with academic writing difficulties (Boice, 1993). Students who delay in the face of negative criticism run the risk of being enmeshed in a self-perpetuating loop. Anxiety, a sense of failure, and a complete lack of creativity can all result from a lifetime of terrible events. Getting stuck in a rut and putting things off are two of the worst things you can do for your work and well-being. Starting to write might be difficult because of procrastination, but finishing it can be difficult because of perfectionism. It is obvious that a complete block means that nothing is being made. Procrastination, on the other hand, is more likely to have a negative impact on productivity than perfectionism.

2.4 Emotions that are generally dysfunctional when it comes to writing

Traweek, 1988; Delamont and colleagues, 2000): Writing a PhD dissertation is tough and even stressful. Almost all PhD students face some type of socio-emotional stress during their study. Stubb, Pyhältö, and Lonka (2009; 2011a) similarly found that Finnish PhD students reported feelings of frustration, inadequacy and bewilderment (Pyhältö et al., 2009). Anxiety during PhD studies was found to have a detrimental effect on thesis work and productivity.

According to research, there are conflicting findings on the relationship between the many factors that may cause a student to struggle with thesis writing. Blocks and procrastination, for example, were cited by Gute&Gute as examples of academic disengagement (2008). When it comes to procrastination, it has been found to be associated to feelings of exhaustion, exhaustion, and burnout (Schraw et al 2007; Blunt &Pychyl 2000; Chu and Choi 2005). (Ferrari & Thompson, 2006). Procrastination has been linked to anxiety (Schraw et al., 2007; van Eerde's meta-analysis, 2003; Fritzsche et al., 2003; Spada et al., 2006; Neumeister, 2004;

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Alexander & Onwuegbuzie, 2007); however, Steel's (2007) meta-analysis disputed this assertion. Anxiety has been linked to procrastination.

PhD students' approaches to writing assignments are examined in the current research. To ensure the validity of the writing questionnaire, this research was conducted. Disadvantageous feelings such as stress or boredom or exhaustion may be connected to writer's block, procrastination or perfectionist tendencies (Lonka et al., 2008).

3. The Purposes of the Research

When it comes to understanding how PhD students perceive academic writing, there has been no instrument expressly built for this purpose until now. However, despite the existence of a number of instruments that assess "by-products" of writing, a systematic and easy-to-use tool has not yet been developed. Researchers in this study are working to close the knowledge gap by creating a questionnaire to assess PhD students' understanding of scientific writing. We use data from a sample of Finnish PhD candidates to test the instrument's reliability and validity, with the objective of discovering student dispositions that may or may not aid their doctoral studies. Criteria factors that indicated negative emotions such stress, concern, boredom, and exhaustion were used to examine the validity of students' ideas about academic writing

3.1 Questionnaire on the Writing Process Development

According to a Lonka instrument, the Writing Process Questionnaire has a 25-item scale (1996, 2003). Rather than focusing just on PhD applicants, she developed a test to evaluate academic writing in higher education in general. The purpose of this study was to gather the viewpoints of PhD students on academic writing, thus we adjusted the questions to match the doctoral context. This questionnaire was put through its paces in a preliminary research. 41 PhD students from various fields, including physics, biology, and meteorology, were given the original scale. Based on the results of the pilot study and feedback from students, researchers, and academics, we revised and/or deleted any parts of the instrument that were found to be unclear. Writing Process Questionnaire, which featured six sub-scales on adaptive concepts or challenges in writing, comprised six sub-scales: (1) Block; (2) Procrastination; (3) Perfectionism; (4) Innate Ability; (5) Knowledge Transforming; and (6)

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Productivity. This study examined the reliability and validity of the final version of the Writing Process Questionnaire.

3.2 Research Issues

These four research questions are at the heart of our project: Reports say the Writing Process Questionnaire was designed to gather six distinct views on writing. This led us to believe the scale would include six factors (see Figure 1). But a more general two-factor structure was identified, based on adaptable writing concepts (formed by the items on knowledge transformation and productivity) and the other based on writing challenges (formed by the items on Block, Procrastination, Perfectionism and Innate Ability). This led us to the following questions: (I) Are Block, Procrastination, and Perfectionism all captured by the Writing Process Questionnaire? and (Ii) Are Natural Talents, knowledge transformation and Writing Process Productivity all captured by this questionnaire? The answers to both of these questions are yes. Or does it merely capture (1) difficulties and (2) adaptable thoughts about the writing process in general? For this question, the structure of the Writing Process Questionnaire was analysed using confirmatory factor analysis. The goodness-of-fit indices for a six-factor model were projected to be much higher than those for a two-factor model. (II) How consistent are the subscales of the Writing Process Questionnaire's sub-questions? A minimum of 0.6 was envisioned for the internal consistency of each scale. What are the relationships between the subscales, and how do these scales relate to the problematic emotions or dispositions that emerge throughout the writing process (e.g., stress, exhaustion, lack of interest, and anxiety)? Knowledge Transforming and Productivity were projected to have positive relationships, and so were Block, Procrastination, Perfectionism, and Innate Ability, among other factors. However, the other four factors were predicted to have a negative impact on Knowledge Transforming and Productivity. Knowledge Transforming and Productivity may also suffer as a result of unpleasant emotions.. Block, Procrastination, Perfectionism, and Innate Ability, on the other hand, have been found to be connected with negative feelings. These questions were crucial for testing the instrument's credibility. Last but not least, are there any differences in the performance of pupils in different groups? Studying for a lengthy amount of time was expected to cause difficulties with writing. As far as demographics were concerned, we had no expectations.

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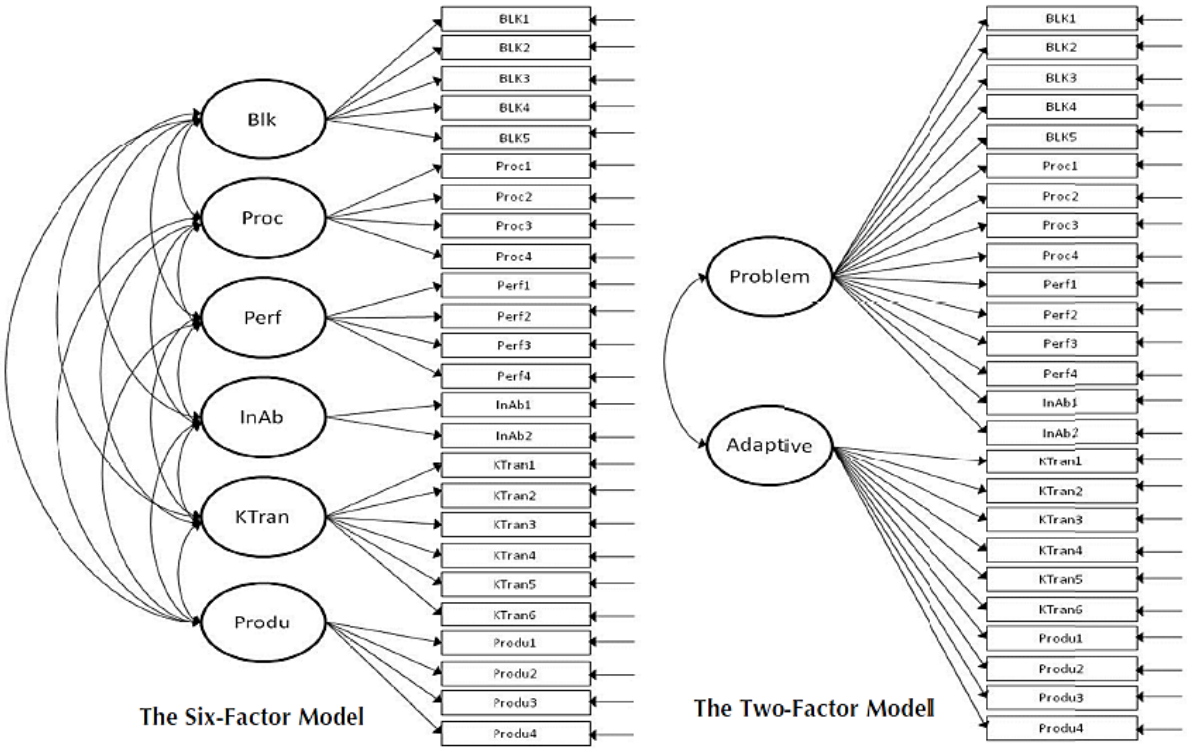

Figure 1. The hypothetical six-factor and two-factor model: Blk= Block, Proc = Procastination, Perf = Perfectionism, InAb = Innate Ability, KTran = Knowledge Transforming, Produ = Productivity, Problem = Problem in Writing, Adaptive = Adaptive ideas for Writing.

4. Method

4.1 Participants

It was found that the data in this study came from three different colleges at Helsinki University: the faculties of arts, medicine, and behavioural sciences. Six hundred and sixty-nine doctoral candidates participated in the survey (female: 496; male: 168; mean age: 39; Med: 35). 384.4% of people took the time to respond. A questionnaire was completed by 664 of these people, and their results were included in the research. Those in attendance all had master's or licentiate degrees and were in various stages of PhD study. There are half-time workers on their theses and full-time workers on them, as can be shown in Table 1. The majority of them worked alone, although one-fifth were part of a study team.

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During the thesis writing process, 43 percent of students contemplated quitting their PhD programme. For this study, a small sample of 41 PhD students in natural sciences participated in a pilot study and provided feedback on an earlier draught of the survey.

Table 1. Age, gender, research group status and working status of the participants (Stubb, 2012)

	Medicine	Arts	Behavioral Sciences	All
Age (mean/median)	38/34	34/34	34/34	39/35
Gender				
Women	129(80%)	244(70%)	123(79%)	496(75%)
Men	33(20%)	102(30%)	33(21%)	168(25%)
Research group status				
Alone	65(43%)	314(93%)	117(78%)	496(78%)
Both	29(19%)	14(4%)	20(13%)	63(10%)
In a group	59(38%)	9(3%)	13(9%)	81(12%)
Working status				
Full-time	85(55%)	183(55%)	51(34%)	319(50%)
Part-time	70(45%)	143(46%)	101(66%)	314(50%)

4.2 Materials

Pyhältö, Stubb, and Lonka (2009) conducted a bigger investigation that provided the data for this paper. This study employed the Writing Process Questionnaire, which includes Likert-scaled questions that indicate negative feelings and thoughts about writing. In addition, there were inquiries concerning the severity of the applicant's mental health and other relevant information.

The process of composing a piece of writing. Many facets of writing were addressed in the Writing Process Questionnaire. Table 2 covers the statements used to measure hurdles, negative thinking, knowledge transformation, productivity, procrastination, perfectionists, and intrinsic ability.

A lot of unreasonable emotions to cope with. These were assessed using a modified version of the MED NORD questionnaire (Lonka et al., 2008; Stubb, Pyhältö, &Lonka, 2011ab).

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Emotional dysfunction was measured by Elo et al., 2003, fatigue (Maslach & Jackson, 1981), anxiety (Mäkinen et al., 2004), and lack of interest (Mäkinen et al., 2004). Doctoral students' involvement in the thesis process also included a background inquiry on their intentions to take a break from their studies.

Table 2. The Writing Process Questionnaire

Scale	Items
Blocks	(Blk 1) Q6:"My previous writing experiences are mostly negative"
	(Blk 2) Q10:" I sometimes get completely stuck if I have to produce texts"
	(Blk 3) Q14:"I find it easier to express myself in other ways than writing"
	(Blk 4) Q15:"I only write when the situation is peaceful enough"
	(Blk 5) Q19: "I hate writing"
Procrastination	(Proc 1) Q3:" I often postpone writing tasks until the last moment"
	(Proc 2) Q9:"Without deadlines I would not produce anything"
	(Proc 3) Q11:"I find it difficult to start writing"
	(Proc 4) Q18:"I start writing only if it is absolutely necessary"
Perfectionism	(Perf 1) Q5:"I find it difficult to write, because I am too critical"
	(Perf 2) Q24:"Writing is difficult because the ideas I produce seem stupid"
	(Perf 3) Q21: "I could revise my texts endlessly"
	(Perf 4) Q17:"I find it difficult to hand over my texts, because they never seem complete"

Innate ability	(InAb1) Q16:"The skill of writing is something we are born with; it is not possible for all of us to learn it"
	(InAb2) Q23:"Writing is a skill, which cannot be taught"
Knowledge transforming	(KTran1) Q26: "Writing often means creating new ideas and ways of expressing oneself"
	(KTran2) Q27: "Writing develops thinking"
	(KTran3) Q25:"Rewriting texts several times is quite natural"
	(KTran4) Q4:"Writing is a creative activity"
	(KTran5) Q1:" It is useful to get other people's comments on texts"
	(KTran6) Q2:"When I write I am concerned about whether the reader understands my text"
Productivity	(Produ1) Q8: "I produce a large number of finished texts"
	(Produ2) Q20" I am a regular and productive writer"
	(Produ3) Q7:"I write regularly regardless of the mood I am in"
	(Produ4) Q22:"I write whenever I have the chance"

Note. All the scales ranged from one to five; "1" meaning "Do not agree" and "5" meaning "Fully agree". In single item stress scale "1" meant "Not at all" and "5" meant "Very much".

The demographics of the population are discussed in Section 3. Student demographics, such as age and gender, as well as whether they worked full or part time throughout the semester, were covered in 18 questions (see Table 1). Additionally, students were required to answer a series of questions regarding their major subject, principal funding source, and how much time they spent working alone, in a research group, or with other researchers. How many alternative responses there were for each question was dependent on the type of question.

4.3 Information gathering

The spring 2006 semester saw the completion of the PhD student survey. Finnish and English questionnaires were first sent via mail to the students' homes, depending on the student's language preference. After that, an email was sent to each student's inbox with a reminder and a link to the survey, which they were expected to complete.

4.4 Statistical Investigations

A confirmatory factor analysis (CFA) was performed on the scale items using Mplus statistical programme version 7.11 (Muthén&Muthén, 2013). This was done to ensure that the hypothesised factor structure of the scale's items was correct. In order to construct

measurement models that may be used to verify or question the anticipated latent variable structures, researchers can utilise it to describe the relationship between variables and latent factors (Byrne, 1998). According to Steiger (1990), the Root Mean Square Error of Approximation (RMSEA), the Comparative Fix Index (CFI), and the Standardized Root Mean Square Residual (SRMR) were used to evaluate the CFA model's statistical adequacy.... (1990). (SRMR). An excellent match was found when researchers looked at the data and found an RMSEA of less than 0.08, a CFI equal to or more than 0.09, and an SRMR of less than 0.08. (Kelloway, 1998; Hu &Bentler, 1999; Diamantopoulos &Siguaw, 2000). These are the methods used to conduct CFA analyses: a To begin, the two- and six-factor theoretical models of the Writing Process Questionnaire were separately estimated using Maximum Likelihood estimation to account for any missing data points. As a next step, we assessed the goodness-of-fit of the two hypothetical models based on their two statistics to see which was better at fitting the data as an alternative hypothesis. After completing the CFA questionnaire, Cronbach's alpha was calculated for each subscale to address the second research question. To answer the third research question, correlations between subscales and negative emotional measures were produced utilising data. In the end, several t-tests were conducted to see whether there were differences in ideas for writing items between a) male and female PhD students, b) students who have considered interrupting their studies and those who have not, c) students who are writing their theses in a monograph or summary of articles, and d) students who worked full-time and those who worked part-time. This is known as Cohen's d, which is the coefficient of determination used to calculate the t-test effect sizes. An effect size of 0.3 to 0.5 was deemed to be of little significance; the difference in significance between 0.5 and 0.80 was considered to be of medium importance; an effect size of higher than 0.80 was judged to be of substantial significance. Significant significance was defined as an effect size larger than 0.80, according to Cohen (1988).

5. Results

5.1 The Questionnaire on the Structure of the Writing Process

The instrument under inquiry, the Writing Process Questionnaire, has a latent component structure, which is the primary focus of the research. The Writing Process Questionnaire was also tested to see if it was better suited to measuring problems in writing and adaptive ideas

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about the writing process in general, or if it could capture six distinct constructs, such as block, procrastination, perfectionism, knowledge transformation, innate ability, and productivity. In order to address this question, the six-factor and two-factor models were each described in detail (see Figure 1). It appears that the six-factor model correctly predicted the data, according to the goodness-of-fit indices: CFI =.9; 2 = 917.1; df = 260; 664; p =.001; RMSEA =.06; RMMR =.06. Therefore, the two-factor model failed to adequately represent the data: RMSEE = 1,1, CFI = 0,6, and SMR = 0,9, all of which were statistically significant (p =.001). In a follow-up examination of the two models' 2 indices, it was shown that the six-factor model had a statistically significant improvement in fit compared to the two-factor model. Df = 14, N = 664, p =.001 for a two-way ANOVA According to these results, the Writing Process Questionnaire contains the six latent components, as anticipated and planned during questionnaire development. measurement invariance in terms of precision and dependability

The internal consistency of the questions and subscales of the University of Michigan's Writing Process Questionnaire is the subject of the second research. Scale descriptive analyses include, as indicated in Table 3, item counts, internal consistency (Cronbach"s Alpha), means, standard deviations, and maximum and lowest values for each variable. Table 3: Scale descriptive analysis Analyzing the item factor loadings on each subscale is done through the use of a CFA model (except innate ability, as such procedures could not be done on a subscale with only two items). There were loading factors of 0.24 to 0.68 for blocks, 63 to 79 for procrastination, 38 to 84 for perfectionism, 0.27 to 78 for knowledge transformation, and 53 to 75 productivity. Following procrastination and perfectionism in terms of loading coefficients were blocks. Each scale's reliability was found to be adequate or good, according to the results.

It was determined that measuring invariance may be used in order to compare male and female production in the areas of procrastination/perfectionism/knowledge shifting. Each subscale was compared to a baseline model with less restricted factor loadings, as opposed to a measurement model in which factor loadings were limited to be equal across genders (i.e., metric invariance model). It appears that the connections between items and their latent dimensions are equal for men and women in all three measures of procrastination, knowledge

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transformation, and productivity (RMSEA =.02 to.08, CFI =.99 to.99, and SRMR =.03 to.07). An analysis of block metrics (RMSEA =.06, CFI > 95%) confirmed prior findings that blocks are somewhat invariant (SRMR = 0.05). An experiment was conducted to compare metric and non-metric invariance models for procrastination, knowledge transformation, and productivity. Males and females were given equal intercepts. An invariance in the scale of scalar invariance (RMSEA =.03, CFI =.99 and.99) was found for procrastination and productivity, respectively (SRMR =.04 and 03, CFI =.99 and.99). RMSEA =.08, CFI =.92, SRMR =.07 were found with low RMSEA, CFI, and SRMR for knowledge change. Based on data, perfectionism did not show any indication of invariance between genders.

Measurement invariance studies were used to compare the subscales across individuals from the Faculty of Arts, Faculty of Medicine, and Faculty of Behavioural Sciences. RMSEA =.04, CFI =.99, SRMR =.05 were shown to be true for procrastination in terms of scalar invariance. Partially scalar invariance was found for knowledge transformation and productivity (RMSEA =.07 and.05; CFI =.90 and.99, SRMR =.08 and.06) whereas partial metric invariance was found for blocks (RMSEA =.06, CFI =.95, SRMR =.05). Measurement inconsistency across faculties was not found for Perfectionism.

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Table 3. Descriptive analyses of the scales, internal consistency (Cronbach's Alpha), scale means, standard deviations (SD), and minimum and maximum values.

Scale	N	Alpha	Mean	SD	Min	Max
Conceptions of writing						
Blocks	5	.60	2.3	.67	1	4.6
Procrastination	4	.81	2.8	.95	1	5
Perfectionism	5	.67	2.7	.79	1	4,75
Knowledge transforming	6	.63	4.4	.47	2.67	5
Innate ability	2	.75	2.0	.88	1	5
Productivity	4	.76	2.7	.83	1	5
Negative emotions						
Stress	1	_	2.8	1.2	1	5
Exhaustion	4	.82	2.7	.92	1	5
Lack of interest	2	.76	2.1	1.1	1	5
Anxiety	3	.65	2.7	.97	1	5

5.3 Validity (convergent, discriminant, and concurrent)

The validity of the concept is the focus of a third study. Convergent and discriminant intercorrelations between the six subscales of the Writing Process Questionnaires were observed. Correlation tables are included in Table 4 for each subscale. A positive correlation was found between impediments, procrastination, and perfectionism, as well as between knowledge transformation and productivity, as one might predict. These results confirmed the validity of the subscales. Procrastination, obstructions, and a lack of interest were all linked to lower productivity. Blockages and natural ability were also inversely related to knowledge transformation. Results like these showed that the subscales' discriminant validity was solid.

These subscales were correlated with negative mood measures in order to examine their contemporaneous validity with the Writing Process Questionnaire. Table 3 shows that all negative emotions were linked to writing problems. Blocks, perfectionism, and

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procrastination were all associated to stress, weariness, concern, and a lack of interest. Stress, exhaustion, worry, and boredom were more common symptoms in students who had difficulty getting started on their papers, as were procrastination and perfectionism. Furthermore, productivity was shown to be inversely associated to feelings of boredom, stress, and exhaustion. As a result, the lack of interest in writing might be connected to the belief that writing is something that comes naturally. Academic indifference was lowest among students who reported high levels of productivity and who viewed writing as a way of transforming information.

5.4 Comparisons between subgroups

Studying further, researchers found that students who considered interrupting their studies differed from others in terms of blocks, procrastination and perfectionist tendencies (t = 5.518, df = 656, p.001, Cohen's d = 0.43), as well as productivity (Students who contemplated interrupting their studies reported more roadblocks (mean = 2.43) than those who did not (mean = 2.15).) Compared to the general population, they had higher mean procrastination (2.59, mean perfectionism = 2.61) and perfectionism (2.80) scores. Another study found that pupils who didn't think about stopping school had a higher productivity rate than those who did (mean = 2.88). Productivity was higher among full-time students (t = 1.983, df= 622, p.05; Cohen's d = 0.16) than among part-time students. In comparison to full-time students, part-time students (mean = 2.67) reported being more productive. There were also less blocks (t=-4.082 df=645, p.001, Cohen's d=0.33) and more knowledge-converting writing (t=3.182 df=642, P.001, Cohen's D=0.24) for students producing monographs than for students writing papers (t=2.429 df=640, p.05, Cohen's D=0.2). It was also shown that students who were working on a monograph had greater degrees of perfectionism than their counterparts When it came to the transformation of information, males and females differed (t=3.498, df=657 p.001, Cohen's D=0.3). Writing is more likely to be viewed as knowledge altering by women (mean = 4.45) than men (mean = 4.31). For each of the comparisons above, we utilised Mplus (excluding those based on intrinsic ability). We evaluate two models for each subscale: one that constrains the means across groups to be equal, and the other one that does not. The outcomes of these investigations followed a similar trend.

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Table 4. Correlations among variables

	1	2	3	4	5	6	7	8	9
Problems									
1 Blocks	1								
2 Procrastination	.525**	1							
3 Perfectionism	.415**	.378**	1						
4 Innate ability	-.006	-.017	.011	1					
Adaptive ideas									
5 Knowledge transforming	-.164**	-0.005	.078*	-.175**	1				
6 Productivity	-.435**	-.586**	-.226**	.052	.126**	1			
Negative emotions									
7 Stress	.224**	.249**	.231**	.006	-.049	-.109**	1		
8 Lack of interest	.235**	.284**	.150**	.155**	-.163**	-.295**	.260**	1	
9 Anxiety	.327**	.446**	.326**	.039	.028	-.294**	.540**	.444**	1
10 Exhaustion	.300**	.234**	.263**	.019	-.048	-.085*	.678**	.274**	.592**

Note. ** Correlation is significant at the 0.01 level (2-tailed).* Correlation is significant at the 0.05 level (2-tailed)

The correlation between age and the belief that writing is an intrinsic skill was statistically significant (P=.099, p .01). When it came to reporting, older PhD students were more likely than younger students to see it as an inherent skill.

5.5 Comparisons with national data are made

We compared our group of participants to the overall population of Finnish PhD students, adjusted for gender and age disparities, in order to evaluate their representativeness (Table 5). Our sample represented a decent reflection of the broader population when it came to gender distribution. While medical students tended to be slightly older than the average participants, students in humanities and behavioural sciences appeared to be younger. There was a little overrepresentation of PhD students in the latter third of their programme in the sample. As a result of their greater experience, these students may have felt more secure in their abilities to explain their whole approach.

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Table 5. Statistics (year 2008) of gender distribution and mean age in different disciplines in the University of Helsinki according to Statistics Finland and the university's own statistics

Stub Head	Women	Men	Age (mean)
Humanities	66%	34%	42.4
Behavioural sciences	76%	24%	53.1
Medicine	71%	29%	35.3

Our sample was also compared to a bigger national survey of Finnish PhD students, which was done in the lack of particular national level information on Finnish doctorate students, to assess its representativeness (Hiltunen and Pasanen 2006, International Postgraduate Student Mirror 2006). A comparable percentage of full-time and part-time students (both 50 percent) as in our sample (both 50 percent) may be found in this data (both 50 percent full-time students). As far as working conditions go, there was little difference. Most students (71%) said they worked alone on their research projects, with only 6 percent saying they worked mostly in groups. This conclusion was based on data collected from students around the country. Only 23% of respondents said they could not tell the difference between working alone and in a group. A total of 78 percent of the participants in our study reported working alone; 13 percent reported working in a group; 9 percent of participants reported working in a group at the same time. According to our survey, the vast majority of students who replied were in their last year or two of their PhD studies, but in the national research, the vast majority of students were still in the early stages.

6. Discussion

All in all, the Writing Process Questionnaire appears to be a reliable and useful tool for appraising the ideas of PhD students who plan to write professionally. According to the available data, the instrument has a specific structure in place. There were other methods in which the foreground variables may be linked to the writing scales, as well.

Avoiding writing barriers requires an understanding of writing concepts and notions (Boice, 1993). The ability of writers to actively participate in and reflect on their writing will allow them to discuss challenges and approaches, to successfully monitor their work, and to develop a variety of adaptable writing abilities as they go through their careers (Lonka,

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2003). A new instrument was needed to capture some of the most fundamental aspects of textual communication, therefore it was necessary to design a new one. In practical workshops, PhD students found the Writing Process Questionnaire to be useful in reflecting on their writing processes. After developing an instrument based on a large data set, it seemed necessary for testing it in a situation where it would be acceptable and useful, such as in the framework of PhD studies.

Consequently, the study found a link between decreased productivity and scientific writing issues such as procrastination, perfectionism and the idea that writing is a natural talent. Self-reported productivity is positively associated with perceiving writing as a process of information transformation, whereas productivity was shown to be negatively associated with viewing writing as an intrinsic skill. For those students who believed in the transforming potential of information, our predictions came true: they were more likely to view writing as a skillset that could be developed through practise than as a natural ability.

Academic writing success may be predicted by one's understanding of writing, according to the findings of this study. Most individuals don't only regard them as unique ideas; they also see them as common worldviews. As a PhD student, your supervisor, and your classmates can all benefit from pause and consideration of such fundamental assumptions. How people relate to one another is influenced by their shared values and worldview. For example, if the PhD student feels that writing is a process of knowledge transformation and the supervisor believes that writing is a natural skill, communication difficulties may occur. One way to influence both individual and communal agency is through the concept of "self-efficacy" (Bandura, 2006). Self-efficacy beliefs about academic writing were thought to be at play when participants in this study reported feeling productive.

6.1 Representativeness

Humanities, social sciences, and behavioural sciences were all considered as possible target populations. University of Helsinki PhD students' gender and age distributions were quite consistent with those of other PhD students at the university. It's natural that postgraduate students are on average older than part-time students because part-time students are often working adults. Additionally, our demography was quite similar to those found in polls conducted across the country and around the world.

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Due to the lack of interest, the response rate was rather low. We couldn't acquire a greater response rate since students didn't sign up for the survey. While we sent out a questionnaire to every registered PhD student in each of the three settings, our data also contain a substantial number of students who had enrolled but were no longer actively engaged in their thesis projects. As late as a few years ago, it was feasible to keep registering, no matter how far along the process was. A PhD student in Finland enjoys several benefits, and many prefer to remain on the list even if they are not actively pursuing their degree. These persons could not be removed from our distribution list, for lack of a better alternative.

This study included interviews with students who had not finished their coursework by the conclusion of the semester under consideration. Follow-ups every three years at Finnish institutions have opened up this possibility: individuals who have not advanced must either resubmit a research plan or give up their status as a PhD student.

6.2 Reliability

There was a high degree of internal consistency among the six measures in terms of dependability. The questionnaire's six-scale structure was confirmed using the confirmatory factor analysis approach. Because the questionnaire is not meant to be a psychological exam, the Cronbach's Alphas are at the very least acceptable. The following are the trustworthiness metrics. Stumbling blocks, knowledge transformation, and perfectionist inclinations are all worth 70 points in this test. More than one dimensionality was predicted to be measured by these models, as was expected. Knowledge shifting, for example, asked participants about their chances of editing their writings and whether or not they considered writing to be a collaborative endeavour. For our part, we intended to preserve the idea of several dimensions as an abstract concept. In the same manner, severe self-criticism and the practise of continuously modifying a work characterise perfectionism. In the future, it's feasible that these two characteristics will be divided into two distinct scales. Writer's block is the most complex and nuanced statistic we have at our disposal theoretically. Even though procrastination, natural ability, and productivity were all shown to be one-dimensional constructs, the scales employed to assess these three qualities proved to be more stable.

6.3 Validity

One such argument is that every new context in which a research instrument is used should be verified from the bottom up. Researchers have found that occurrences that appear to be identical, but are perceived differently depending on the system or culture analysed, have been discovered in studies across different systems of higher education (Richardson 2004). The results of a questionnaire are particularly sensitive to little differences in wording and meaning. We spent several years translating and customising our instrument for use in both Finnish and English. Pilots and back-translations were used extensively.

To be considered "construct valid," a scale must be able to accurately measure the objects for which it is designed. Factor analyses are commonly used to measure concept validity in psychometrics. Due to our testing of our questionnaire's format in the context of giving confirmation studies, our analyses were adequate in this context. In terms of content validity, we may state that our exploratory analyses were valid because they were in line with well-established theories of writing while also introducing some new and surprising components. In order to increase criterion validity, the scales and variables that describe emotional discomfort were linked to each other. The Writing Process Questionnaire appears to be a viable and reliable tool for assessing PhD students' attitudes toward writing.

A great deal of testing has been done on both the Finnish and the English translations. In addition to the United States, this instrument can be utilised in other nations for research purposes. When working with people from diverse cultures and languages, a cross-cultural validation approach is highly suggested. There is already a Spanish version of the questionnaire, and preliminary findings show that it will be beneficial. It will be interesting to see if or not this instrument is linked to the creation of more and better works in the future.

6.4 Implications for education in terms of improving the PhD writing process

The intellectual and scientific community provides a supportive environment for graduate-level research. Researchers believe that the scientific community is an ideal learning environment because it includes practises such as monitoring and education in addition to the actual physical learning environment. (PyhältöStubbLonka 2009; PyhältöStubb and Lonka 2009). According to research, a student's thoughts and academic writing habits are influenced by the learning environment in which they are enrolled. As a result, the challenges posed by

the learning environment may make it difficult for PhD students to adopt a knowledge transformation approach, which is a trait shared by great authors (Bereiter &Scardamalia, 1987).

A PhD student's past learning experiences, objectives, and techniques are all crucial aspects to examine when it comes to the relationship between a student and his or her learning environment. Postgraduates' views on their learning environment have been shown to impact supervisors' supervisory methods and their views on R&D (McAlpine & Weiss 2000; Zhao, Golde, McCormick 2007). There may be a positive or negative effect on learning when students have preconceived beliefs about what it means to write a thesis or an academic paper.

We found a link between PhD students' general happiness and their ability to generate good ideas for new research papers. Written communication has an important instructional function in addition to its technical significance (Perpignan, Rubin, & Katznelson, 2007; Thomson &Kamler, 2007). The development of literate knowledge and reflective thinking is crucial while dealing with PhD students.. Modes of instruction such as process writing and tactics for constructive criticism may help to prevent students from abandoning their PhD programmes in the future (Lonka, 2003). Writing clubs and various types of assistance have been suggested as feasible remedies in the previous months, but, Academic writing abilities should be given more emphasis in doctoral studies, according to academics. One of the most important facets of this evolution is the encouragement of flexible approaches to academic writing that boost output while also improving well-being. This circumstance may benefit from the use of the Writing Process Questionnaire as a diagnostic test.

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4

Teaching Writing to Elementary School Learners: A Study

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Abstract:

The majority of students in the Netherlands, as well as in other countries, are unable to write at a high enough level by the end of elementary school, according to research. The time allotted to writing is extremely constrained, and only a small percentage of institutions are successful in imparting this skill effectively. There is little doubt that the way writing is taught in elementary schools has to be improved upon. In order to uncover effective techniques to teaching writing to kids in grades 4 to 6, a study of writing intervention studies was conducted. There were eleven intervention categories: strategy teaching, text structure instruction, prewriting activities, peer aid, grammar instruction; feedback; evaluation; process approach; goal setting; and revision. Each intervention category had its average impact size computed. Five of the 10 categories had statistically significant results. In a pairwise comparison of these categories, goal setting (ES = 2.03) was found to be the most effective intervention for improving students' writing performance, followed by strategy instruction (ES =.96), text structure instruction (ES =.76), peer assistance (ES =.59), and feedback (ES =.88), all of which were found to be effective. Finding out how these therapies may be applied in the classrooms of primary school students will require further research.

Keywords: Writing, meta-analysis, intervention, composition, elementary, school

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1. Introduction

The extensive use of computers, tablets, and mobile phones in Western civilization over the last two decades has resulted in a rapid rise in literacy. Increasing usage of e-mail and text messaging has resulted in a rise in the requirement for individuals to be able to communicate effectively in writing. Those who don't have a firm grasp on the principles of writing will have a hard time engaging fully in the activities of everyday living in the long run. When it comes to academic and professional success, writing skills are more vital than ever for children to develop at an early age (National Commission on Writing, 2003).

The great majority of students in the Netherlands are unable to meet the writing competency standards necessary for success in both academic and professional endeavours, according to a recent study (Henkens, 2010). For example, according to a nationwide assessment study conducted in the Netherlands, most primary school students are unable to write texts that effectively communicate one simple idea or point to a reader by the end of grade six. In addition, this study found that children's writing skills don't improve much between fourth and sixth grade. Fewer than one-third of eighth-graders in the United States scored at or above competent on a national writing assessment (Salahu-Din, Persky, & Miller, 2008). At high school and college, writing becomes an increasingly important tool for learning and communication. Inadequate writers are at a considerable disadvantage (e.g. Bangert-Drowns, Hurley, & Wilkinson, 2004).

It was observed in a research by Kühlemeier and coworkers (2013) that writing education at the primary level in the Netherlands is undervalued. According to Dutch education inspectors (Henkens, 2010), just a small percentage of schools are doing a good job of teaching students how to write well. Even in their professional training, Dutch teachers do not receive enough writing instruction, nor are they equipped to teach writing to their pupils (Leeuw, 2006; Smits, 2009). Additionally, it was found that language teaching resources (such as textbooks and teacher guides) typically lack the advice teachers need to support their students' writing processes and offer suitable feedback (Stoeldraijer, 2012). To summarise, it is evident that the Netherlands' basic writing curriculum has to be improved.

It is essential that primary-school writing instruction be based on therapies that have been proven to improve the quality of students' written texts, rather than on experimental discoveries. Children in upper elementary school were the focus of our study, and we sought for effective methods for teaching composition to those students. Research into writing interventions continues to grow, and we now have a growing body of work that examines a wide range of approaches to writing education. We conducted a meta-analysis of writing intervention studies including experimental and quasi-experimental approaches aimed at students in grades 4–6 in order to get insight into the most effective teaching methods for this age group. Meta-analysis is the approach of choice since it allows for a systematic study of the size and direction of effects from a large number of studies.

There have already been a number of meta-analyses in the field of writing research. When it comes to writing, strategy teaching has a major impact on pupils in grades 1 through 12. Graham (2006) showed that approach education greatly enhanced students' writing ability in another research involving children in grades 1 to 12. Students in grades 1 through 12 were studied in 29 research done by Graham and Sandmel (2011), which used the process approach to writing. Students' writing quality improved statistically significant but somewhat as a result of process writing education, the researchers found. There have been three meta-analyses that looked at the impact of word processing on text quality in children in grades K to 12, all of which showed that this therapy was beneficial, especially for poorer writers (Bangert-Drowns et al., 1993; Goldberg and Russell 2003; Morphy& Graham 2012).

Hillocks (1984) was the first comprehensive meta-analysis of experimental and quasi-experimental writing intervention studies; Graham and Perin (2007) was the second; and Graham, McKeown, Kiuhara, and Harris (2012) was the third. The interventions used in the three research varied slightly due to the diversity of the groups being studied. There was still a great deal of overlap in the results. Meta-analyses found that grammar instruction had a negative influence on the quality of the text, with effect sizes [ES] of -.29 (Hillocks, 1984) to -.41 (Stanford et al, 2009). (Hillocks, 1989). (Graham and colleagues, 2012) There was an ES of.56 for the study of models and an ES of.28 for inquiry, which were all determined to have an ES of.56 and.28. Sentence combining (combine basic sentences) was found by Hillocks (1984) and Graham and Perin (2006). The process of writing (ES =.09), strategy instruction

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(ES = 1.03 and.02), prewriting activities (ES =.42 and.54) and peer assistance during writing (ES =.70 and.89) all had a significant positive effect on text quality, according to Graham and Perin (2007) and Graham and colleagues (2012). Additional effective practises for improving elementary students' writing were identified by Graham and colleagues (2012), including feedback (adult and peer), the use of creativity and imagery (ES =.70), text structure instruction (ES =.59), teaching transcription skills (ES =.55), assessing writing (ES =.42), and comprehensive writing programmes.

Meta-analysis of 88 single-subject design studies conducted by Rogers and Graham (2008) found that strategy instruction, word processing, prewriting activities, goal setting, and sentence construction were all effective in improving student writing performance in high school and college. Teaching techniques for constructing paragraphs, as well as teaching abilities for editing, were all shown to be effective by Rogers and Graham (2008) for both normal and struggling writers. It was shown that grammar training had a positive impact, contrary to previous study. Some of the authors hypothesised that poorer writers could have benefitted from specific grammar training or that the teaching style (teacher modelling) might have had a role in boosting the efficacy of grammar instruction.

Because we concentrated on successful instructional practises for beginning writers (grades 4-6) in a normal educational context rather than on writing teaching in general, our meta-analysis can be regarded an improvement on prior meta-analyses of writing instruction. A wide range of ages and grade levels were represented in past meta-analyses of several therapies, including primary school pupils, teens, and students from elementary through college (Hillocks, 1984). Even though we had projected that different sorts of treatment would be effective for different groups of children, we were shocked by the outcomes. We did this study to see if our hypothesis was valid, based on the idea that intervention types would alter amongst elementary, secondary, and college students. A distinction between students in the lower and higher elementary grades was also something we expected. Bourdin and Fayol (1994) found that students up to the fourth or fifth grade performed better orally than in writing when it came to developing tales. When there is no automated writing, they found that young pupils are forced to focus on low-level writing tasks like lexical access and sentence production instead of more advanced abilities like content development. This

interferes with their ability to think critically and plan ahead. Writing performance in the early primary grades is heavily dependent on the development of lower-level skills that are necessary for writing, according to Berninger, Yates, Cartwright, Rutberg, Remy, and Abbott (1992). Pupils in upper elementary school are expected to be able to concentrate only on the composing process by the time they reach this point in their development (Kress, 1994). Pupils are more open to teaching and have more practise with essential composition skills at this time, we feel. The outcome was that instead of focusing on students in the lower grades of primary school, we decided to only include research focusing on students in grades four through six.

In addition, prior evaluations included research that focused on specific student groups, such as struggling writers, kids with learning disabilities, bilingual students, or high achievers. We feel that it is essential to exercise care when extrapolating results from studies that have been undertaken with such narrow groups to the larger population of all youngsters in a typical school context, because the instructional demands of distinct groups are bound to differ. While struggling writers may benefit from more instruction in the principles of writing, multilingual children may require additional grammatical and linguistic help, and bright kids may demand more challenging writing assignments and strategies in order to excel in the classroom. That is why we opted to include research that aimed at a broad cross-section of students in a normal classroom setting.

No previous studies went beyond summarising effects and comparing therapy to discover whether they differed significantly in terms of efficacy, which is the most crucial thing to highlight. As a result, they may be viewed as statistical reviews rather than actual therapies, as they provided reactions to the degree of variation in efficacy across interventions. Supplementing previous meta-analyses, our study found that advantageous therapies were not only identified, but also statistically proven to be more effective than alternative treatments.

Because a quarter of the publications we uncovered were not previously included in prior meta-analyses, our study may be seen as an update to the past meta-analytical research.

"Which instructional strategies are most effective in improving the writing skills of students in the upper elementary school grades?" was the question that prompted this meta-analysis. A systematic evaluation of 32 quasi-experimental writing intervention studies involving

children in fourth through sixth grades provided the answer to this question. The findings of this meta-analysis have significant significance for the production of instructional materials and the training of teachers in upper elementary school composition.

2. Method

2.1 Inclusion criteria and search procedure

In order to be included in the meta-analysis, studies had to meet the following five criteria. First and foremost, the research required to involve kids enrolled in a regular school environment in upper elementary school classrooms (grades 4-6). Studies done in a specific educational setting or involving only struggling authors were excluded from this analysis.. Only studies that examined at least two instructional circumstances were included, rather than studies that compared only one instructional condition, as was the case in previous research. Some studies have found that participants are better off receiving an alternative therapy as part of a control condition, while others have found that participants are better off receiving no further instructions. Correlational and qualitative studies were not included in this meta-analysis as a result of this As a last consideration, each research required to provide a final quality assessment to determine the impact of an intervention on students' writing skills following the study. Students are given a grade for text quality based on a reader's overall assessment of the student's writing, which takes into account a range of criteria such as the content, organisation, vocabulary, and tone and style. A few studies reported on other outcomes, such as the length of texts or student motivation, but they couldn't be included in the meta-analysis since they weren't provided in all trials. In order to be evaluated for inclusion in the analysis, research must supply the data required to compute a weighted effect size. Finally, only papers that were published in English were included in the meta-analytic process.

Meta-analysis includes studies that were identified through searches of the PsychINFO, ERIC and Google Scholar databases, as well as others. For our study, we used the same method of searching as Graham and colleagues (2012), but we added additional search terms to indicate the type of "intervention," such as: assessment; collaborative learning; creativity; dictation; free writing; genres; goal-setting; grammar; handwriting; imagery; inquiry and mechanics; motivation; peer collaboration and peers. planning and pre-writing. This was followed by the

addition of editing and feedback as well as modelling and observational learning as well as outlining and revision to our search to see if there were any current studies that may help us find effective approaches. The references of previous meta-analyses, reviews, and acquired publications were also used to identify relevant studies.

Databases of theses, dissertations, and conference proceedings, among other sources, were searched for unpublished research on the subject. Additional citation searches of earlier reviews and meta-analyses were conducted in Web of Knowledge utilising citations from the preceding studies.

As a consequence of using this procedure, around 2000 results were retrieved, which were thoroughly analysed. There were no non-intervention and no study focused on pupils in grades 4 through 6 in the first step. Next, we ruled out any study that was not experimental or quasi-experimental. Our next step was to exclude studies that had adequate controls, and then we discarded any research that focused on a single subgroup, such as pupils who had difficulty writing, were learning-disabled, or were bilingual or otherwise academically successful. There were 37 studies found that met all of the criteria for inclusion. Although data from five trials was available, the necessary statistics for calculating effect sizes were missing. We tried to contact the authors of these research to get their permission to use their data, but got no answer. These studies were not able to be included, for obvious reasons. Our meta-analysis was completed after identifying 32 papers that were appropriate for inclusion in the meta-analysis method as outlined in the preceding paragraphs.

2.2 The process of encoding

The following variables were coded for each study included in the meta-analysis: grade, number of participants, description of experimental and control conditions, publication type (Journal, Dissertation, Report, Conference Presentation, Paper), and the genre of the post-test measure (Expository / Narrative / Informative / Persuasive). Coding was limited to post-test measures since we needed to know effect sizes, which is why they were the only measures included. A variety of factors were categorised for which we believed they may explain for discrepancies in effect sizes across trials, making things more challenging. Attrition (% of total sample), intervention time (in days) and intensity (in minutes) were all categorised, as were the individuals instructing (researchers, teachers, teaching assistants), and the conditions

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to which instructors were randomly assigned. It was difficult to administer a single overall reliability score across all of the studies because of the wide range of scoring procedures and the differing interpretations of dependability of scoring. As a result, we coded aspects of studies that were known to be associated with the reliability of writing quality scores, such as the type of assessment of writing quality (holistic or analytical), the number of writing tasks completed, and the number of raters who evaluated the post-test measure's quality (e.g. Rijlaarsdam et al., 2011). First author and a qualified helper coded all trials in this research. Both coders were 97 percent consistent in their coding of a random sample of 10 studies (one-third of the total sample).

2.3 Interventions are classified.

All studies were extensively analysed and then classified according to the intervention's emphasis for the purposes of the study. Categorization followed, and studies with comparable emphasis on intervention were drawn from previous meta-analyses for inspiration (e.g. Graham &Perin, 2007; Graham et al., 2012; Hillocks, 1984). There were several categories from prior meta-analyses that we preserved in our analysis: strategy teaching (text structure instruction), peer help (process method), feedback, grammar instruction, and prewriting exercises.

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Table 1. Description of intervention categories

Category	Description
Strategy instruction	Explicit and systematical teaching of writing strategies
Text structure instruction	Explicit teaching of knowledge of the structure of texts
Peer assistance	Students engage in joined activities during (parts of) the writing process
Evaluation	Teaching students to evaluate their own work with specified criteria
Goal setting	Students are assigned specific product or process goals before writing
Feedback	Students receive comments from others on their writing
Grammar instruction	Explicit teaching of grammar and/or construction of sentences
Revision	Focus on revising draft versions
Prewriting activities	Students engage in activities before writing: generating content/planning
Process approach	Focus on writing process and subprocesses: planning-writing-revising

To avoid confusion, we used the phrase 'goal setting,' rather than 'product goals,' because our sample included a study in which researchers specified process objectives along with product goals. We couldn't classify our sample's two sorts of intervention using the previous reviews' categories, so we came up with two new ones: evaluation and revision. Finally, eleven categories of interventions were found, as shown in the following table: 1. Prewriting and editing, for example, are part of both process and strategy training, therefore it is important to note that the intervention categories are not mutually exclusive. We categorised studies in accordance with the principal topic of instruction that the authors had identified. Using Bui, Schumaker and Deshler (2006) as an example, the authors characterise their intervention as a writing strategy that incorporates the process approach, which the authors define as Since this intervention's major goal is to provide children with writing methods, it was decided to classify this research under the heading of strategy training. The research by Wong, Hoskyn, Jai et al. (2008), which combines self-regulated strategy development with feedback, is one of the interventions that contains features from more than one category. The study was included in this category rather than the feedback classification system since the major intervention is strategy instruction.

The explicit teaching of planning, interpretation, translation, and editing procedures is included in strategy instruction. According to Harris and Graham (1996), the bulk of studies in this area uses the Self Regulatory Strategy Development (SRSD) model devised by them in which students are also taught self-regulation skills to manage the writing process and procedural information about writing as well. It's the instruction of a certain genre's text structure, such as the organisation of a persuasive essay, the plot sections and interconnections of narrative writings, or the framework of a compare/contrast paper. To employ peer aid, you either have students engage at various stages of the writing process (planning, formulating, and revising), or you must use some type of tutoring. An essential component of assessment is helping students learn how to analyse and reflect on their own work. In the bulk of studies in this field, the 6+1 Traits Writing Model, which was developed in the United States in the 1980s, was used (Northwest Regional Educational Library, 2013). It is suggested that students use the 6 (+1) Traits Writing Model to assess their work in terms of the following areas: ideas, organisation and voice; word choice; sentence fluency; conventions and presentation. Use of reflective questions and rubrics helps students analyse their writing. Before pupils begin writing, it is necessary to provide them with writing objectives, such as constructing paragraphs or creating a draught (e.g. acquiring a learning strategy). Feedback investigations are studies in which students receive feedback on (aspects of) their writing from a teacher or a peer. Interventions in grammar education are designed to help pupils construct correct sentences. Revision studies are those in which students are taught how to improve draughts of texts. Prewriting tasks include research on content creation and planning processes, such as brainstorming and the use of graphic organisers, as well as writing exercises. When using a process-based approach, students work through a series of planning, formulation, and editing steps, as well as writing for a variety of real-world audiences and purposes, all while honing their writing abilities. Individualized education is provided to pupils in the form of mini-lessons, writing conferences, and teachable moments. In addition, students are encouraged to take responsibility of their written work by emphasising the significance of self-reflection and assessment. Students cooperate in a supportive and non-threatening setting when they write (Graham &Sandmel, 2011).

In the three studies we chose (Arter, Spandle, Culham, and Pollard, 1993; Saddler and Graham, 2005; as well as Dejarnette, 2008), researchers compared the effects of two types of

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intervention. Each treatment was given an effect size estimate before being separated into two groups depending on size. The study by Schunk and Swartz (1993) also looked at the efficacy of identifying product objectives in addition to the success of developing process goals. We estimated unique effect sizes for each of the situations where this was the case.

Analysis of statistical data and the calculation of effect sizes

Each research included in the analysis was given an effect size for writing quality based on the findings of the posttest. As long as the overall score was known, the effect size was determined using that score. In order to get a single impact size for the full writing sample, different effect sizes were calculated for each facet of writing quality, such as organisation, ideas, or word choice. Means and standard deviations were used to compute the effect sizes. Effect sizes were calculated using Hedges' g (standardised mean difference) by subtracting the mean performance of a control group from that of a treatment group at posttest and then dividing the result by the combined standard deviation of both groups. For smaller samples, Hedges' g provides a somewhat more accurate estimate than Cohens d. (Borenstein, Hedges, Higgins, & Rothstein, 2011).

A random effects model was used for the meta-analysis since it was expected that the genuine effect would vary from study to study due to variations in participants, as well as changes in treatments and the implementation of interventions. A random effects model tries to estimate the mean of a distribution of impacts instead of trying to estimate a single impact magnitude. This makes it possible to extrapolate the findings to populations other than those involved in the original research... (Borenstein, et al., 2011). We calculated the average effect size, confidence interval, and statistical significance of the effect sizes found in each treatment category. In this way, it would be feasible to compare the results of different therapies. In addition, a homogeneity test was carried out to see if there was a bigger variation in effect sizes than predicted based on sampling error alone. To determine if identifiable variables like treatment length, publication kind or grade may account for the heterogeneity, a moderator analysis was performed when the homogeneity test was statistically significant.

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2.5 Description of studies included in the meta-analysis

Table 2. Description of included studies grouped per intervention category

Study	Publication type	Grade	N	Intervention	Genre	Effect size
				Strategy instruction (*k*=11)		
Brunstein & Glaser (2011)	J	4	115	Strategy instruction + self-regulation vs. strategy instruction	N	0.84
Glaser & Brunstein (2007) 1	J	4	72	Strategy instruction vs. didactic lessons in composition	N	0.48
Glaser & Brunstein (2007) 2	J	4	79	Strategy instruction + self-regulation vs. didactic lessons in composition	N	1.12
Mason et al. (2012) 1	J	4	47	Strategy instruction + self-regulation (TWA + PLANS) vs. no treatment	I	1.13
Bui et al. (2006)	J	5	99	Demand Writing Instruction Model vs. traditional writing instruction (+Prewriting activities)	n.s.	0.34
Barnes (2013) 1	D	5	178	WISE (Writing In School Every day) vs. no treatment	N,I,P	0.11
Barnes (2013) 2	D	5	189	WISE + professional development vs. no treatment	N,I,P	0.33
Mason et al. (2012)	J	5	48	Strategy instruction (TWA) vs. no treatment	N	0.81

Each study that was included in this analysis and its impact sizes are listed in Table 2, which is organised by the kind of intervention. There is a hierarchy of interventions based on the number of impact sizes they include, with strategy instruction having the highest (11 effect sizes). Subjects are presented in alphabetical order by grade level within each category. There is a brief discussion of each study's intervention and control conditions, as well as a brief description of how the posttest measures were conducted, as well as an explanation of how large an effect size was found.

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Study	Publication type	Grade	N	Intervention	Genre	Effect size
Fidalgo et al. (2015)		6	41	Strategy instruction vs. normal curriculum	I	2.11
Torrance et al. (2007)	J	6	95	CSRI (Cognitive Self Regulation Instruction) vs. normal curriculum	I	3.57
Wong et al. (2008)	J	6	57	SRSD strategy instruction + CHAIR + adult feedback vs. CHAIR + constant training time	P	0.64
				Text structure instruction (*k*=9)		
Fitzgerald & Teasley (1986)	J	4	49	Instruction in story constituents and interrelations vs. dictionary use and word study	N	1.07
Gordon & Braun (1986)	J	5	54	Instruction in narrative structure vs. instruction in poetry writing	N	0.32
Bean & Steenwyk (1984) 1	J	6	41	Direct instruction rule-governed vs. advice to find main ideas	I	1.07
Bean & Steenwyk (1984) 2	J	6	39	GIST: direct instruction intuitive approach vs. advice to find main ideas	I	0.84
Crowhurst (1990)	J	6	46	Instruction model for persuasion + writing practice vs. group discussion activities	I	1.11
Crowhurst (1991) 1	J	6	50	Instruction model for persuasion + writing practice vs. reading novels and writing book reports	P	1.10
Crowhurst (1991) 2	J	6	50	Instruction model for persuasion + reading practices vs. reading novels and writing book reports	P	0.78
Crowhurst (1991) 3	J	6	50	One lesson persuasion vs. reading novels and writing book reports	P	0.34
Raphael & Kirschner (1985)	C	6	45	Instruction compare-contrast text structure vs. normal curriculum	I	0.26
				Peer assistance (*k*=9)		
Paquette (2008)	J	4	50	6 + 1 Traits model with cross-age tutoring vs. no extra instruction (+ Evaluation)	n.s.	1.27

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Study	Publication type	Grade	N	Intervention	Genre	Effect size
Puma et al. (2007) 1	R	4	1249	Writing Wings (cooperative writing) vs. normal curriculum	N,I	0.07
Saddler & Graham (2005) 1	J	4	44	Sentence combining with peer assistance vs. grammar instruction	N	1.66
Puma et al. (2007) 2	R	5	347	Writing Wings (cooperative writing) vs. normal curriculum	N,I	0.03
Yarrow & Topping (2001) 1	J	5	14	Metacognitive strategy instruction with peer assistance (tutor) vs. metacognitive strategy instruction with no interaction	N	0.70
Yarrow & Topping (2001) 2	J	5	12	Metacognitive strategy instruction with peer assistance (tutee) vs. metacognitive strategy instruction with no interaction	N	0.52
Brakel Olson (1990) 2	J	6	41	Writing lessons + peer partner vs. writing lessons only	N	0.42
Hoogeveen (2013) 1	D	6	96	Specific genre knowledge + peer response vs. no extra instruction	N,E	1.11
Hoogeveen (2013) 2	D	6	93	General aspects of communicative writing + peer response vs. no extra instruction	N,E	0.30
				Evaluation (*k*=7)		
Collopy (2009)	J	4	100	6 Traits writing model vs. no extra instruction	N	0.31
Paquette (2008)	J	4	50	6 + 1 Traits model with cross-age tutoring vs. no extra instruction (+ Peer assistance)	n.s.	1.27
Tienken & Achilles (2003)	J	4	98	Skills and strategies to self-assess writing vs. no extra instruction	N	0.41
Ross et al. (1999)	J	4/5/6	296	Self-evaluation with rubrics + teacher feedback vs. normal curriculum development	N	0.74
Arter et al. (1994)1	C	5	132	6 Traits writing model vs. observation (normal curriculum) (+ Process approach)	E,N	0.20

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Study	Publica-tion type	Grade	N	Intervention	Genre	Effect size
DeJarnette (2008)	D	5	131	6 + 1 Traits writing model vs. Writing workshop	N	0.73
Coe et al. (2011)	R	5	4134	6 Traits writing model vs. no extra instruction	E	0.01
				Goal setting (*k*=6)		
Schunk & Swartz (1993) 2	J	4	20	Process goal + progress feedback vs. general goal (+ Feedback)	E,N,I	3.03
Schunk & Swartz (1993) 2	J	4	20	Process goal vs. general goal	E,N,I	2,62
Schunk & Swartz (1993) 2	J	4	20	Product goal vs. general goal	E,N,I	1,05
Schunk & Swartz (1993) 1	J	5	30	Process goal + progress feedback vs. general goal (+ Feedback)	E,N,I	3.15
Schunk & Swartz (1993) 1	J	5	30	Process goal vs. general goal	E,N,I	2.66
Schunk & Swartz (1993) 1	J	5	30	Product goal vs. general goal	E,N,I	1.65
				Feedback (*k*=4)		
Schunk & Swartz (1993) 2	J	4	20	Process goal + progress feedback vs. general goal (+ Goal setting)	E,N,I	3.03
Schunk & Swartz (1993) 1	J	5	30	Process goal + progress feedback vs. general goal (+ Goal setting)	E,N,I	3.15
Holliway (2004) 1	J	5	55	Feedback + rating vs. one sentence	E	0.84
Holliway (2004) 1	J	5	48	Feedback + reading as the reader vs. one sentence feedback	E	0.69
				Grammar instruction (*k*=4)		
Saddler & Graham (2005) 1	J	4	44	Grammar instruction vs. sentence combining with peer assistance	N	-1.66
Gein (1991) 1	D	4	109	School grammar vs. direct writing	E,N	-0.05
Gein (1991) 2	D	4	110	Sentence construction vs. direct writing	E,N	0.06
Gein (1991) 3	D	4	111	School grammar vs. sentence construction	E,N	-0.11

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Study	Publication type	Grade	N	Intervention	Genre	Effect size
				Revision (*k*=3)		
Brakel Olson (1990) 1	J	6	40	Revision instruction vs. no extra instruction	N	0.04
Brakel Olson (1990) 3	J	6	37	Revision instruction + peer partner vs. no extra instruction (+ Peer assistance)	N	0.85
Fitzgerald & Markham (1987)	J	6	30	Revision instruction vs. reading good literature	N	0.89
				Prewriting activities (*k*=3)		
Brodney et al. (1999) 1	J	5	51	Reading combined with prewriting vs. no extra instruction	E	0.93
Brodney et al. (1999) 3	J	5	49	Prewriting only vs. no extra instruction	E	0.17
Bui et al. (2006)	J	5	99	Demand Writing Instruction Model vs. traditional instruction (+ Strategy instruction)	n.s.	0.34

A total of seven groups, with an average impact size of four, may be identified. We admit that the sample sizes employed in this study are too small to draw firm conclusions. However, for the sake of completeness, these categories were included in the study, since doing so would at the very least give a notion of the possible efficacy of these sorts of treatments. Total impact sizes were derived from 32 studies, which were divided into 10 groups according to the treatments used.

				Process approach (*k*=3)		
Arter et al. (1994)	C	5	132	Process approach vs. 6 Traits model (+ Evaluation)	E,N	-0.20
DeJarnette (2008) 2	D	5	131	Writing workshop vs. 6 + 1 Traits writing model (+Evaluation)	N	-0.73
Varble (1990)	J	6	128	Whole language group vs. traditional language instruction	I	0.16

Note: For ***study***, numbers behind the references indicate that effect sizes were calculated for multiple conditions, or groups; these effect sizes are reported separately. For ***Publication*** type, J: Journal, D: Dissertation, R: Report, C: Conference presentation, P: Paper. For ***Genre***, N: Narrative, E: Expository, I: Informative, P: Persuasive, n.s.: not specified. When a study is included in another category as well, this is mentioned in parentheses.

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3. Results

To begin, the meta-average analysis's impact size was calculated using a random effects model, which was applied to all of the included investigations. The total effect size, g =.72, was computed using a 95 percent confidence interval between [.49 and.94]. For this reason, more research was needed to evaluate whether or not a combination of effect sizes in the sample produced an appropriate assessment of an individual's overall effect size. A product homogeneity test can reveal this information. Using this test, researchers may assess if the variability in effect sizes is more than the predicted variability based only on sampling error. The homogeneity test confirmed our suspicions that there was substantial heterogeneity: Q = 51151; df = 54; p.001 was obtained. As a result of the wide range of study topics and methodologies represented in our sample, we anticipated high levels of variation. However, the results showed that it was impossible to assume a single impact size for all studies.

This meta-analysis began with an investigation of publication bias by performing a moderator analysis on each article that was a part of it. Researchers found that the effect sizes of research published in peer-reviewed journals did not differ in a systematic way from those of research published in other outlets like books or newspapers (p =.22), according to the findings of this study. By using these 10 categories as explanatory variables, we were able to estimate the success of various intervention types. Our inquiry came to an end here. It was found that the inclusion of the intervention categories considerably improved the model, with X2 = 19.69, df = 9, and p.001 for inclusion of the intervention categories in a likelihood ratio test. The sort of intervention utilised accounted for some of the variation in effect sizes, so to speak.

Table 3 lists all intervention types in the same sequence as Table 2, with data for each type provided in Table 2. Each intervention has its own effect size, standard error, 95 percent confidence interval, and heterogeneity statistics Q (test statistic for heterogeneity) and I2 (% of overall heterogeneity/variability) for each intervention. There are other statistics to examine.

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Table 3. Summary of statistics for intervention categories

Intervention	N	Average	SE	95% Confidence		Heterogeneity	
				Lower	Upper	Q	I^2
Strategy instruction	11	0.96 ***	0.19	0.59	1.33	109.99***	94.30
Text structure	9	0.76 ***	0.21	0.34	1.18	11.91	33.87
Peer assistance	9	0.59 **	0.21	0.17	1.01	56.05***	89.83
Evaluation	7	0.43	0.23	-0.01	0.87	66.56***	87.57
Goal setting	6	2.03 ***	0.33	1.37	2.68	13.47*	62.61
Feedback	4	0.88 *	0.38	0.14	1.61	25.08***	91.08
Grammar	4	-0.37	0.30	-0.97	0.22	20.16***	91.84
Revision	3	0.58	0.38	-0.17	1.33	4.14	51.59
Prewriting activities	3	0.13	0.36	-0.58	0.85	3.91	48.57
Process approach	3	-0.25	0.34	-0.92	0.41	12.78**	84.58

Note: *** $p < .001$, ** $p < .01$, * $p < .05$

Two unfavourable impacts were shown in Table 3: one for grammar teaching and one for the process technique." There was no improvement in the quality of the students' writing as a result of these exercises. As far as I can tell, everything else was okay. Among these beneficial benefits, five key impacts were determined to be significantly different from zero. In that order, goal setting, strategy teaching, feedback, text structure training, and peer support were the most effective treatments. Post-hoc analysis was carried out using contrast analysis, which compared all treatments pairwise. Following education and counselling, goal setting was found to be the most effective intervention (X2 = 36.81, df = 1, p.001) in these analyses. Although Table 2 shows that a single research comparing various circumstances and grades was used to determine the impact sizes in the category goal setting (Schunk & Swartz, 1993). Although this result is significant, it should be approached with care. A statistically significant outcome (p =.006) was found when technique teaching (2 = 26.06, df = 1, p =.001), text structure instruction (2 = 12.82, df = 1, p.001), and peer help (2 = 7.64, df = 1, p =.006) were implemented. Various studies having nine or more effect sizes resulted in the creation of three distinct classifications of research. In addition to prewriting activities, feedback was shown to be a useful intervention. However, it was not found to be more helpful than prewriting exercises alone.

A significant amount of residual heterogeneity (QE = 283.18, df = 45, P =.001) was found in the sample after the homogeneity test. As a consequence, we evaluated the funnel plot (see Figure 1) in order to detect outliers that may be a source of heterogeneity. Convergence of an intervention's influence on study size is represented by a "funnel plot." Figure 1 depicts the funnel plot of the model residuals versus the standard error of the mean after including the intervention categories as explanatory variables (right). There is no uniformity in Figure 1, thus the straight lines reflect the area where 95% of the studies were expected to take place. This illustrates that the studies were symmetrically distributed around the overall average impact size, and that the bulk of the points were located in the region between the straight lines (see figure). Our sample's lack of persistent heterogeneity was revealed by this finding. Only 6.25% of the data was affected by the two outliers that were found in the sample. These outliers were found to be studies done by Torrance et al. (2007) and Saddler et al. (2007), according to the forest plot (see Appendix) that we produced (2005). So while in Torrance et al. (2007) the observed effect size was smaller than expected, in Saddler and Graham (2005) it was larger than expected, as a result of the analysis the effect size in the first study was larger than comparable studies and in the latter study the effect size was smaller than comparable studies (see also Figure 1). According to this analysis, the results did not indicate a statistically significant difference if the studies were excluded (p = 0.16 for differences between 2 and 3 and df for the difference between 2). As a consequence, it was decided to continue these research and to employ the previously calculated model for future inquiry.

After that, moderator data was analysed to see whether the discrepancy between studies could be attributed to any one or more unique causes. If there were systematic variations in effect sizes between trials using an adequate control condition and those comparing multiple intervention conditions, we wanted to look for them. No research included a control group that received no additional training in any of the six intervention categories. Relative heterogeneity (QE = 220.37, df = 37, p.001) was not reduced significantly by the addition of control condition in the moderating variable (p-values ranging from .29 to .90). After that, the following variables were analysed as moderating factors: grade, intervention duration, technique for measuring writing quality (holistic versus analytical), number of writing assignments in posttest, and number of raters who rated the quality of the posttest measure. All these factors had no statistically significant effect on the total sample heterogeneity.

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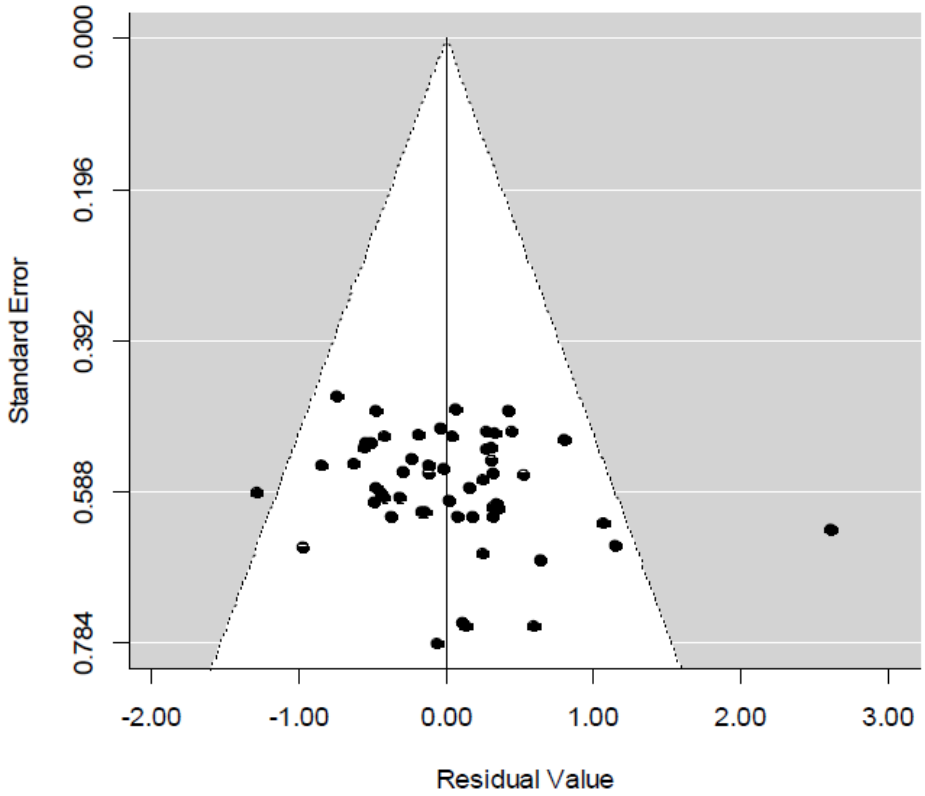

Figure 1: Funnel plot of final model.

Text structure instruction, process method, revision, and prewriting were all shown to have no significant differences in the following phase of the study (p-values ranging from .08 to .16). Remaining intervention types were compared to see how they differed. As a result, only categories with an impact size greater than five were included for this research. These categories include strategy training, peer help, assessment, and goal setting. Using a moderator analysis on the individual categories, grade, duration of intervention, type of writing quality evaluation (holistic or analytical), number of writing assignments in posttest, and number of raters rating the quality of posttest measure were considered as possible moderators.

Effect sizes in grade 6 (2.19) were consistently larger than those in grades 4 or 5, suggesting that grade may be an important mediator in strategy teaching. (0.59). Analytical text quality assessment trials were shown to have smaller impact sizes than studies that employed a holistic evaluation when compared to other types of trials (-0.86). Effect sizes were less (-0.11) for explanatory texts when genre was a significant mediator in the category evaluation.

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There is a lot of variation in peer support because of one large research with a tiny impact size. Goal-setting heterogeneity can be attributed to different situations.

The 95 percent confidence interval data in Table 3 demonstrate that even at the bottom bounds of the confidence interval, the effects of treatments that considerably enhance writing skill are remain overwhelmingly favourable.

In this section, we'll discuss the best ways to help elementary school pupils improve their writing.

According to new study, there have to be changes made to the way writing is taught in Dutch primary schools. Meta-analysis was conducted in order to identify effective instructional methods for teaching writing to students in grades 4 through 6. To arrive at this result, we computed the average impact sizes of 10 distinct types of treatments. In terms of impact sizes, the most successful interventions for increasing students' writing skills include goal setting, strategy training, text structure teaching, feedback, and peer help. These treatments were deemed to be the most effective by the post-hoc analysis. A recent review (Graham et al., 2012) found similar results to ours (Graham &Perin, 2007). This is despite the fact that we only studied kids in grades 4 to 6 who were enrolled in a typical school setting. In this example, statistical analysis supports our conclusions.

A key conclusion of our research is that establishing goals was by far the most helpful strategy. According to Schunk and Swartz (1993), all of these impact estimates stem from a single (1993) research, which compares diverse scenarios and numerous grades, as previously indicated. Thus, it is only possible to make speculative generalisations from these observations. Prior meta-analyses (Graham &Perin, 2007, Graham et al., 2012) found evidence that specifying product goals was beneficial, but these research were carried out on (partially) different populations of students (special needs learners, struggling writers, and slightly older students). Setting goals for students may help them improve their writing abilities, according to one study. Instruction in approach is the next most effective intervention. Teaching strategies is the most common type of intervention in our study, thus we can draw more reliable conclusions from it. One of the most extensively studied interventions is strategy teaching. However, Harris and Graham (1996)'s self-regulated strategy development (SRSD) approach to strategy education, or a variation of it, was the

focus of the majority of the research in this area. The SRSD approach has evolved as the "standard" in strategy education, which is not unexpected given the consistently large impact sizes revealed in research assessing SRSD. SRD has been proven to be exceptionally beneficial for all sorts of learners (strugglers with writing; learning challenged; average; and gifted) across a wide variety of grade levels by other research (grade 2 to 10). Another moderator analysis, which we ran in all categories with more than five effect sizes from various studies, found that in our sample, the (average) effect of strategy instruction appears to be significantly stronger in grade 6 than it is in either grade 4 or 5. Another argument is that students' lower level abilities have improved to the point where they can benefit from particular training in writing methods by sixth grade. Because of this, we find that impact sizes in this category are less in research where text quality is evaluated analytically, as compared to studies that adopt a holistic approach. Analytical assessments are commonly based on scoring rubrics. Using a scoring rubric is a way of determining how well an individual does based on a set of criteria and standards. A holistic test, on the other hand, is more generalizable to writing skill than an analytical exam since it is more task-specific (Schoonen, 2005; Rijlaarsdam et al., 2011). Analytical scores tend to be lower than holistic scores when analysing texts since all the different components of a text are analysed separately and then combined into a single final total score (Schoonen, 2005).

The second most effective intervention kind is teaching in text structure. The studies in this category are all of the same type. This category investigates the impact of explicit instruction of (parts of) text structure on student accomplishment in a variety of texts, including narrative, persuasive, and compare-and-contrast texts. In all of the research included in this category, students' writing skills improved significantly when text organisation was taught explicitly.

The pupils are given guidance from their peers once they have been taught about the structure of a book. Collaboration between students at various phases of the writing process as well as various types of interventions are all part of peer help. Using peer support is most successful when it's offered in a certain way with a specific goal in mind, as indicated in Table 2.

Comparatively, studies that focus just on cooperative writing (e.g., Puma et al. 2007) had less impact than studies that combine peer help with more specialised treatments, such as the

teaching of particular genre knowledge (Hoogeveen, 2013) or sentence combining (e.g. Puma et al. 2007). (Saddler & Graham, 2005). Students' writing skills can be improved by peer tutoring, according to the study by Yarrow and Topping (2001). This study found that instructors' writing scores improved more quickly than students'. Student learning may be enhanced when they are required to explain a topic in front of a group of others. The only way to truly grasp anything is to have first experienced it.

With just four impact sizes from two studies, feedback is one of the more restricted intervention categories. However, despite the fact that feedback tends to be effective, further study is needed to draw more definite conclusions, as feedback may be provided in a number of methods (for example, peer feedback vs teacher input) (e.g. product-focused vs. process-focused). The use of feedback in the classroom to improve students' writing abilities should be studied further.

The process approach to writing and the usage of grammar instruction have both negative impact sizes on the overall effect size of the writing process. The result that grammar instruction had a negative impact is in line with other meta-analyses that found the same thing (Graham &Perin, 2007; Graham et al., 2012; Hillocks, 1984). The quality of the material appears to be unaffected by paying attention to the correct structure of phrases. To a certain extent, this is because students may not be able to apply what they have learned in the classroom to real-world writing situations owing to a lack of transfer effects.

The procedure approach may have had a negative influence due to a variety of factors. Although it is a tiny intervention category, there are just three studies in this group, which makes it homogenous. You can compare one intervention type (in this example more effective) to the process approach as a control condition. This is the case in two of the three studies. Consequently, we anticipated that if we had used a 'pure' control group, the effect sizes would have been less than they were. A subsequent investigation employing the type of control condition as a moderator, on the other hand, was unable to support our hypothesis. There are various plausible explanations for this finding: However, it's also possible that our sample size is too tiny to identify any systematic variations, making it impossible to discover any changes at all. Beginning authors may find the process method overwhelming since it necessitates them working on too many things at the same time. Beginner writers may benefit

more from specialised writing instruction, such as instruction in text structure or technique. A (modest) beneficial effect of the process method was shown in the Graham and Perin (2007) meta-analysis of adolescent students. Using the process technique to teach writing to more experienced authors may be successful, but it may not be optimal for teaching writing to beginning authors, as previously noted.

The study has a number of limitations.

We can only speculate about the overall success of these intervention categories because several categories had minor effect sizes (e.g., 4 impact sizes). Even though we didn't include these categories in the research because we wanted to make the most of the available data, we did include them in the analysis to see whether they had any influence.

It was more challenging to understand the results of the study because of the large degree of variability between trials that could not be explained entirely by recognised variables. As a result of the inclusion of a significant number of small studies in our sample, our sample's heterogeneity is inflated. Large studies exhibit more variability inside the study and less across studies, but several small studies in a category lead to considerably more heterogeneity between studies, as seen in the picture. Differences across individual studies are typically the cause of variability in our sample's smaller categories, which is in line with earlier findings. For example, it's possible that the operationalization of the research differed due to variations in the materials that were used and the training that was given. Assignments ranged from a single piece of writing in one genre to many pieces of writing across several different genres. Students were expected to finish all of these pieces in class. Involvement might last anything from a single day to a whole calendar year. There were a number of issues with this study's data analysis, such as the inability to code for variables that weren't clearly stated. However, despite the fact that these characteristics might contribute to heterogeneity, they cannot be addressed meaningfully in a meta-analysis unless they are reported correctly.

4.3 Proposals for more research

According to our findings, there hasn't been much study on writing interventions for elementary school pupils, which is in keeping with earlier findings. We may conclude that more study is absolutely important in this field. In our meta-analysis, we found that sample sizes for some types of interventions were too small to make firm conclusions regarding their

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efficacy. In this field, further study is needed, in particular in the categories listed above. Research on the utility of goal setting, in particular, is essential because our findings imply that it may be extremely beneficial in improving writing. If Schunk and Swartz (1993)'s encouraging results can be replicated in additional studies, it would be beneficial to do so. Further research on prewriting activities such as feedback is needed here as well. Further research is needed to see if many highly effective treatments might lead to even better student performance. Does combining one highly successful strategy with another highly effective intervention result in a marginal gain in outcomes? In addition, new interventions and approaches should be created and tested.

34 percent of the studies in our sample utilise a posttest-only design, whereas 47 percent use the pretest-posttest design, in which the effect of an intervention is examined at the end of the intervention. It is, nevertheless, required to include a delayed posttest in order to verify claims regarding the effectiveness of an intervention. The posttest can be very similar to what was taught during the intervention, which might lead to an overestimation of the success of the intervention. Administering a delayed posttest might provide more information on the long-term effects of treatments on students' writing. In order to make conclusions regarding the'real' efficacy of therapy, delayed posttest data are needed. In intervention research, this isn't a common practise, which is a shame.

4.4 Instructional suggestions for use in the classroom

This meta-analysis gives useful information on what works in the teaching of writing. We were able to identify several possible tactics for teaching writing to kids in the upper elementary grades, but further research is needed to understand exactly what works and what doesn't. Because of this, we conclude that beginning writers would benefit most from a writing programme that focuses on goal-setting and strategy training as well as text structure education, feedback and peer interaction. We found that setting process goals, such as acquiring a certain skill, was really beneficial. Self-regulation skills were better taught when strategy instruction was incorporated into self-control training. Elementary students were shown to benefit most from specialised, targeted treatments, such as instruction in the application of procedures or the structure of a book. For example, we don't yet know what the optimal instructional programme for teaching composition skills is: what resources should be

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utilised, how much time students should devote to composing, how much practise students are expected to obtain, how we should assist students' writing processes, and so on. As a result, this research merely offers general concepts for teaching, rather than a prepackaged solution ready for use. You'll still need extensive classroom testing to find out what works.

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5

Writing as a Learning Activity: An Academic Study

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Abstract:

Research on writing as a learning activity has seen five major changes in recent years. In the last decade, meta-analyses have shown that writing's effects on learning are predictable and that a variety of variables mediate and modulate these effects. The second reason is that literature as a medium used to be assumed to be capable of generating thinking and education. A decade of study shows that writing to learn, according to the findings, is a self-regulated activity that depends on the writer's goals and approaches. A third movement, called Writing to Learn, emphasised the use of domain-general strategies to help students succeed in their studies (WTL). The WID movement, which emphasises the inclusion of genres that embody forms of reasoning particular to a certain subject, is reflected in a number of recent researches. To round things up, while WTL as a classroom activity was always at least somewhat social in nature, theoretical conceptions of it were largely solitary in focus. WTL has grown over the past two decades to embrace concepts and studies that involve social and psychological dynamics as well as individual distinctions. WTL research has traditionally focused on epistemic learning in schools, but it has lately widened its scope to include reflective learning in the workplace as well as other outputs and results from other domains, such as those from the workplace.

Keywords: Cognitive processes, research methods, writing, writing skills, writing to learn

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1 Introduction

The word "writing-to-learn" is not a phrase with a clear and unambiguous meaning despite its conciseness – or maybe because of it! Indeed, its two activities, each of which is conceptualised in a different way, are extremely far-reaching and difficult. Research into writing as a language production process and psychological activity, as well as an activity with a wide range of social and cultural functions and genres, has taken place during the past few decades. A wide range of psychological perspectives have examined learning on the other hand. A commonality between writing and learning is that they are both employed in academic and nonacademic settings: Outside of the classroom, students are writing and learning. In reality, the sentence "writing-to-learn" becomes even more difficult to interpret as a result of this dual "location" of writing. Even more so, this complexity increases enormously when the idea of "instrumentality" is expressly expressed, such as "writing as a tool for learning" (see Figure 1). These forms of writing can be used as "tools" for a variety of learning tasks.

Research into writing to learn shows that the two are intertwined, although the link is not symmetrical, as follows: In recent years, the value of writing has only expanded. To be sure, in recent decades, psychological research has heavily influenced how we view writing as a learning tool: as a mechanism and as a kind of active engagement in the learning process. Both cognitive and sociocultural approaches to writing may be found in these two important ideas, which are often at odds with one another (Boscolo, 2014). When it comes to influencing how people learn, writers have a remarkable capacity to do so, ranging from simple forms of learning (writing aids memory, for example) to their engagement with conceptual challenges in a wide range of academic disciplines. Throughout the course of this research, a major change has occurred from an individual process that is "useful" for any discipline to a fabric of processes that are tightly linked to certain disciplinary settings, as will be shown in the following pages. As far as writing is concerned, there isn't just one way to do it. Instead, it's a set of behaviours that, when encountered in a variety of contexts, might enhance one's ability to understand and reason.

In a way, writing has "integrated" learning into the writing process; hence, it has played a more prominent role. As a "means" or "tool" for learning, writing study in academic contexts

tends to overlap with non-academic research on writing. All except the most specialised forms of writing have a connection to education. As a creative endeavour as well as a cognitively taxing activity, writing needs both mental work and reflection as part of the learning process. As far as I can tell, writing is a lot like thinking. It involves brainstorming, organising, checking, editing, and so on (Bereiter & Scardamalia, 1987). Students who want to pursue a career in academic writing need to master the skills of expressing themselves clearly, selecting appropriate vocabulary, and organising their work. Particularly if the audience is totally virtual, they can develop the ability to be aware of (Olson, 2001, 2014). In order to communicate successfully, a writer must understand how to determine which lexical choices, coherence tactics, rhetorical manoeuvres, and assumptions about a potential reader's comprehension to utilise. The distinction between information telling and knowledge changing (Bereiter & Scardamalia, 1987) has had a considerable influence on the discussion on writing training, in addition to the contrast between beginning and mature writing styles (Bereiter & Scardamalia, 1987). Static vs dynamic approaches to using and reusing knowledge are more true contrasts. In the dynamic method, the writer transforms what he or she has learned through the usage of material with purpose, or by adopting a specific writing style.

2. The following summarises the study's goals and objectives:

What are the most recent advancements in the study of writing as a learning activity during the last few decades? Although "writing as a learning activity" is considered a prototype in the field of inquiry, we believe it to be an idea that has no fixed boundaries. Example of prototype research would be one in which the comparison between writing and non-text activities, such as non-compositional transcribing, is explicitly marked as "writing to learn" (e.g., Gingerich, Bugg & Doe et al.; 2014; Klein, Piacente-Cimini & Williams, 2007; Rivard, 2004; Spirgel & Delaney, online). On the other hand, this article only scratches the surface of the WTL research. In the literature on reading comprehension from a variety of sources, for example, the activity used to aid understanding is often writing, thus it cannot be ignored (Britt & Rouet, 2012; Wiley & Voss, 1999). Cooperative learning, computer-supported collaborative learning, and learning from primary sources in history all have study literatures that explore the impact of writing on learning (for example Dillenbourg, Järvelä, and Fischer,

2009; Johnson & Johnson, 1985; Van Drie & Van Boxtel, 2008). "writing to learn" has therefore been defined in this work as a wide idea.

A dialectical contrast of theory and research findings largely guided our selection of material for this study. For theory, we relied on well-known works including Bereiter and Scardamalia (1987), Britton (1982a), and Galbraith (1986). (1979). (1999). Prior literature reviews and meta-analyses in terms of empirical evidence have given us a method of indirectly addressing a vast quantity of previous research (e.g., Applebee, 1984; Graham & Hebert, 2011). For this reason, we have focused on empirical studies published in peer-reviewed journals and book chapters within the previous five years (2011-2015) in order to give a fair sample of current advancements (e.g., Martnez, Mateos, Martn, and Rijlaarsdam, 2015; Spirgel and Delaney, 2014). Among other things, we've paid particular attention to critical and dissident views (e.g., Siebert & Draper, 2008). Many different terms have been used to index recent studies on writing to learn, including the general terms "writing" and 'learning strategies,' as well as more specific terms like "argumentation," "journal writing," and "analogical encoding," as used by Demirbag & Gunel (2014) and Petko, Egger, and Graber (2014) respectively (Mason & Tornatora, 2014).

In the last few years, WTL research has centred on five different categories of problems. This review is divided into sections based on a single, overarching question: In order to better understand WTL, what sorts of research methods have been used? (2) What psychological theories and evidence have impacted the course of this study? (3) Learning via writing is facilitated by a variety of forms of writing. What is the role of social theories in the understanding of writing as a learning activity? Are you seeking for typical WTL study conditions and results? Each of these inclinations has several elements that we attempt to explore, as follows: How each new trend demonstrates both continuity and change; how each new trend indicates larger advancements in the research of writing; and how much each new trend has resulted in empirically validated assertions

Do not misunderstand that the purpose of this study is not to do a meta-analysis of empirical research findings. This would be redundant in light of the plethora of excellent meta-analyses that have just been published (Bangert Drowns et al., 2004; Graham & Hebert, 2011; Hebert, Gillespie & Graham, 2013). Rather, we sought to identify current research trends, that is,

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theoretical and empirical approaches that are newer than those that have been studied before. It has become increasingly common for researchers to focus on topics that are not only based on the scientific method. In addition to fresh empirical findings, there have been considerably less research undertaken to be able to draw conclusions about the reliability of effects or the average magnitude of affects.

In a wide range of methods, techniques and outcomes are evolving in a number of ways. Changes in WTL literature methodological methods will be the primary focus of this section. Questions to be answered include these: What alterations have been made to the research methods? Are we any the more convinced that writing is a valuable tool for students?

3. Disputes in the Beginning

Speculative yet firmly held views characterised early studies on the impact of writing on learning. According to historians and cross-cultural comparative studies, humanities authors have long made assumptions about the influence of writing and written content on the individual mind as well as civilizations (Donald, 1991; Goody & Watt, 1963; Ong, 1982). In a fascinating chapter by Murray, a huge number of experienced writers have testified to the benefits of writing for thinking and comprehending (1980).

There are a large number of writing instructors that believe this to be true, basing their assertions on theory or anecdotes or extrapolation from writing-related studies undertaken other than the WTL (Britton, 1982a; Emig, 1977). In the early days of WTL, chapters written by writing educators or subject-area educators who adopted these views and quoted Britton or Emig frequently appeared. This group of educators drew on a variety of theoretical frameworks in addition to drawing on their own practical classroom experiences (e.g., edited volumes by Gere, 1985; Thaiss 1986; Young & Fulwiler, 1986). Ethnographic studies of WTL in schools were also included of other study (e.g., Rosaen, 1989, 1990).

In the 1970s and 1980s, a slew of research used experimental methods to examine the relationship between writing and learning. For the most part, these studies examined the efficacy of two different sorts of writing exercises, such as an essay vs a response to a short-answer question or another activity requiring students to write a longer text. According to Applebee (1984), who reviewed this early study and found that there was insufficient

evidence that writing is connected with learning because of the small number of prior studies and inconsistent findings,

Another review of the empirical literature was done by Ackerman (1993), this time focused on both quantitative and qualitative data. Although writing advocates commonly claimed that writing was a unique way of learning, the effects of writing had seldom been compared to those of other media. He recognised this. Contrary to Britton (1982a) and others' predictions, journal writing did not always result in significantly more learning than other activities during most study; essay writing resulted in significantly greater learning than other activities during just half of the trials studied. Writing as a learning tool is "at best an argument that has yet to be made" according to Ackerman, who also agreed with Applebee (p. 335). The empirical literature may be better understood if we abandoned the idea that writing is necessarily linked to the acquisition of information, as well, according to his findings. There were a number of studies published around the same time that showed how students' interpretations of activities, such as thinking-aloud studies, text analyses, and case studies, shaped their writing in ways that researchers and teachers hadn't intended (Durst, 1987; Greene, 1993; Newell & Winograd, 1995; Penrose, 1992).

After this development, most of the WTL literature changed from a declarative tone to one that was more ambiguous and analytical by the century. Writing as a Learning Tool by Tynjälä, Mason, and Lonka (2001) is an excellent illustration of this trend in educational publication. Many chapters in this book used statistical approaches or systematic qualitative methods to experimentally test hypotheses or study issues concerning the influence of certain features of writing on learning (Boscolo & Mason, 2001). The rest of the decade saw a lot of WTL research focused on hypotheses about specific practises, and it continues today (e.g., Cantrell, Fusaro & Dougherty, 2000; Hand, Wallace & Yang, 2004; Klein, 2000, 2004; Rivard, 2004).

4. Recent Advances in the Writing to Learn Methodology

Throughout the last decade, experimental research has been taking place in a wide variety of environments. Some studies have found that writing has little or a limited impact on learning (Drabick, Weisberg, Paul, and Bubier, 2007; Gingerich et al., 2014; Yildiz, 2012), however the majority of studies have found that writing has a significant impact on learning (e.g.,

Linton et al., 2014; Spirgel & Delaney, online 2014; Yassin & Yong, 2013). Writers have researched the influence of writing on learning using various time scales, from the single writing activity to the full academic year (Correnti, Matsumura, Hamilton & Wang, 2012; Schumacher & Nash, 1991; Tomas & Richie, 2014).

As study methodologies have become more sophisticated, there is now more consensus on the benefits of writing for learning. It is notable that, although being a well-established technique, meta-analysis has only lately allowed for the systematic integration of numerous separate findings. Bangert-Drowns et al. (2004) did a review of previous trials and found that the majority of them compared writing-intensive study units to non-writing-intensive study units. According to the findings, writing had a small but noticeable impact on student achievement. As a result, the amount of these effects ranged from none to large, depending on the instructional context.

According to a recent meta-analysis by Graham and Hebert (2011) on the benefits of writing on reading, both average and poorer readers and writers benefit from writing when it comes to improving their reading comprehension. Prolonged writing (such as argumentative writing), summarising written work, collecting notes, and answering or creating inquiries are all examples of this style of writing. Reading comprehension in this cohort was improved by d =.37, which is in line with the efficacy of earlier treatments. More significant changes occurred in middle school compared to high school. Writing instruction (process writing, text structure, or paragraph/sentence construction) increased students' reading comprehension, although only half of the research met two-thirds of a quality criterion set. Writing more helped students' reading comprehension, although the quality of their work was uneven. Contrary to certain frequently held beliefs, further study found no evidence of variations in the effects of various types writing activities; see below for more information on this (Hebert, Gillespie & Graham, 2013). Each of these meta-analyses gave additional information, such as interaction effects, sampling and constraints.

Additional moderator factors discovered through meta-analysis have provided a more nuanced view of how writing affects learning and how it influences other variables. The magnitude of the effect on a dependent variable can be influenced by these variables (or vice versa). Students' educational level (Graham & Hebert, 2011); the frequency and duration of

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writing activities (Bangert-Drowns, et al., 2004); the type of discipline in which students write (Bangert-Drowns, et al., 2004); and methodological features such as the type of dependent measure (Bangert-Drowns, et al., 2004) have all been examined as moderator variables (Hebert et al., 2013).

Finding moderator factors can be aided by using analyses of variance and multivariate analysis of variance. Studies have shown that learning is affected by various types of interactions, such as the interaction between media (writing versus talk) and achievement level; the interaction between individual traits, such as level of self-monitoring, and the type of writing task; and the interaction between the writer's knowledge or achievement level, and the type of acti (Kieft, Rijlaarsdam, and van den Bergh, 2008).

Concerns have been raised concerning the procedure since moderator factors have been taken into consideration. There are studies in the WTL literature that utilise dependent measures similar to those used in writing therapy. Because writing interventions have a greater influence on treatment intrinsic measures than other measures (see Hebert et al., 2013 for additional information), they are a matter for concern (Hebert et al., 2013; Linton, Pangle, Wyatt, Powell & Sherwood, 2014).

This is the third big methodological development that has occurred in recent years. Mediating variables (in this case, writing) influence the dependent variable when they are influenced by an independent variable (in this case, writing) (here, learning). Mediating factors are depicted in WTL theories of "active substances" Textual analysis and verbal think-alouds are among the strategies used to acquire information on mediating factors. A number of researchers studied comparable factors in the 1980s and 1990s (Durst, 1987; McCrindle & Christensen, 1995; Newell & Winograd, 1995). These characteristics, however, were not tested statistically to see if they had a role in the association. As a result, route analysis has been used in recent years in order to achieve this aim (e.g. Glogger, Schwonke, Holzäpfel, Nückles & Renkl, 2012). This has been accomplished through methods such as route analysis (e.g. Petko, Egger, Graber, and Wäschle, 2014; Wäschle & Nückles 2015). These findings bolstered the hypothesis that WTL is mediated by elements such as cognitive processes. It will be discussed in further detail in the section on psychological processes in WTL later on in this chapter.

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Psychological processes are undergoing three major shifts: from writing as an agent to self-regulation and more. As opposed to the what, this part will focus on how WTL affects psychological processes. We'll begin by looking at three current study trends: What is WTL's psychological make-up like? Does learning new things benefit from the use of elaborative cognitive processes? Is there a function for spontaneous cognitive processes in the learning process?

5. Written text as a causal agent in social science research of the 1970s and 1980s is examined in this section

Students' learning was attributed to a variety of cognitive processes that were supposed to be facilitated by text in early writing across the curriculum. A substantial impression was made on both the United Kingdom and the United States by the work of James Britton (1972/1982a, 1982b). According to him, most of the writer's knowledge is initially implicit before it is explicitly stated in the text. There are times when a writer doesn't know how a sentence will end up. Because writing permits information to be shaped "at the point of utterance," the syntax and semantics of language may be used to great advantage. According to Britton, the Vygotskian idea of "inner speech," which is similar to expressive writing in that it is a discourse addressed at oneself, has a theoretical relationship to expressive writing.

In line with this strategy, Britton campaigned for a rise in the use of expressive writing in the schools. An extensive research done in British schools provided the basis for this guidance (Britton, Burgess, Martin, McLeod, & Rosen, 1975). However, the goal of this experiment was to show that transactional writing is more widespread in schools than expressive writing. We did not investigate whether or not spontaneous cognitive processes are induced by expressive writing, nor did we investigate whether or not they benefit learning in general. In the 1980s, Britton's advise on writing expressively was extensively used in curricular literature, despite lack of evidence to back his statements (e.g., see volumes by Fulwiler & Young, 1982; Gere, 1985; Thaiss, 1986;). Freewriting, inkshedding, and the writing of informal essays were all part of this tendency toward expressive drafting, as were other related practises (Elbow, 1973, 1981; Murray, 1980; Thompson, 1990). For the sake of this discussion, let's focus on how this idea predicted that the act of writing would automatically lead to increased knowledge, with the writer needing just to write.

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Emig's notion was yet another early one that linked writing to learning (1977). When she published "Writing as a Mode of Learning" a fundamental study that was extensively recognised, she defined the aspects of writing that, in her opinion, "uniquely" linked to learning processes. Writing, for example, "create generative conceptual groupings that are both synthetic and analytic," to generate "establishes clear and systematic conceptual groupings through the use of lexical, syntactic, and rhetorical devices" (p. 128). A more metaphorical interpretation may be to claim agency was given to the text rather than the author in this approach.

6. In the 1980s and 1990s, the writer acted as a strategic agent.

The early 1980s saw the emergence of the notion of writing as a methodical, problem-solving strategy popularised by the work of Hayes and Flower (1980). (Flower & Hayes, 1981a, 1981b; Hayes and Flower, 1980; for a review, see Alamargot & Chanquoy, 2001). Cognitive theories claim that the writer has a high degree of control over the writing process, and this control is based on the writer's intentions as well as their knowledge, techniques and judgements. Writing therefore has a direct impact on learning (Hayes, 2012; Kellogg, 2008; McCutchen et al., 2008). Written text as a medium does not have any intrinsic learning properties according to the cognitive perspective; rather, the precise methods employed by writers to perform tasks are vitally crucial to the learning process.. Since learning while writing demands complicated objectives, complex techniques, and knowledge about writing, all of which are often linked with more experienced and talented writers according to cognition, one topic in cognitive tradition has been (see Klein, 1999 for a review). Influential cognitive theories such as those proposed by Bereiter and Scardamalia (1987) argue that the fundamental difference between authors who create new knowledge via their writing and those who merely recount what they already know about a subject matter. When learning to write for the first time, most people engage in knowledge-telling tasks that need them to draw on a variety of sources, including current events and genre-specific material, in order to retrieve the next idea from long-term memory, which is then transformed into text. Writing experts participate in a process of knowledge transformation based on the dialectical interaction between the text's rhetorical message and its knowledge content, which leads in the text's knowledge content being restructured and re-elaborated.

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These new cognitive theories were established in opposition to Britton's idea that spontaneity in writing is a crucial prerequisite for learning. To put it another way, Applebee's (1984) evaluation of WTL was in line with the new cognitive theories. Using the Craik and Lockhart (1972; Craik & Tulving, 1975) depth of processing theory, Applebee argued that writing helps to learning to the degree that the writer elaborates links between concepts. Using these findings as evidence, Applebee came to the conclusion that various types of writing activities have different effects on learning; for example, summarising may cause the writer to recall a wide range of content, while analytical essay writing may cause the writer to gain a deeper understanding of the specific relationships that are the focus of the text. They show the connections between scholars' theories about the psychological processes they believe are responsible for learning and the genres they recommend reading.

7. Learning Environment Mediating Processes

"does writing induce learning?" is a better question, in Klein's (1999) view, rather than "by what cognitive processes does writing effect learning?" Applebee (1984) and Ackerman (1996) received mixed reviews (1993). To put it another way, what mental processes let us tell the difference between writing that helps us learn and writing that doesn't? According to his research, he found four distinct WTL ideas in the prior literature: These assumptions were based on processes that lay somewhere in between the two extremes of spontaneousness and greater planning and complexity. According to the theory of shaping at the time of speech, the spontaneous end of the spectrum, the hypothesis was situated (Britton, 1982b; cf., Elbow, 1981; Galbraith, 2009). Following this was the concept that writing is a way for people to externalise their thoughts so that they may analyse, evaluate, and alter them. Backward searching was the second-complicated hypothesis (Young & Sullivan, 1984). The third sort of theory, genre theory, posits that distinct text genres facilitate the formation of specific kinds of connections between concepts. – (Applebee, 1984). According to the idea of backward search, the transformation of information happens during the search process if objectives and subgoals are established (Bereiter & Scardamalia, 1987). It was Klein's opinion that each concept was supported by some research, but that none of them could be proven conclusively at the time.

Recently, there has been a rise in the study of how writing and learning go hand-in-hand, particularly since the turn of the century. One of the most common assumptions in WTL research is that writing in different genres elicits different types of reasoning, which in turn leads to different levels of learning (Applebee, 1984; Wiley & Voss, 1996, 1999). In this study, two seemingly contradicting but logically consistent findings emerged.

However, assignments in a variety of genres don't always produce learning results that are appropriate for the subject matter. According to Britton, expressive writing does not have a larger effect on learning than other forms of writing (for reviews and meta-analyses, see Ackerman, 1993; Graham & Hebert, 2011; Stotsky, 1995). In recent years, the genre of argumentation has become increasingly popular as a means of promoting critical thinking and learning. When it comes to thinking or learning, research has shown that argumentation contributes more than other forms of writing do (e.g., Langer and Applebee, 1987, Chapter 6, 8; Wiley and Voss, 1999). This disparity in genre effects, on the other hand, has not been replicated by other studies (Langer & Applebee, 1987, Chapter 7). According to a recent meta-analysis, the majority of measures did not show any differences in reading comprehension between the following pairs of writing activities: extended writing (often argumentation) and answering questions; summary and answering questions; summary and taking notes; and extended writing (often argumentation) and taking notes (Hebert, Gillespie & Graham, 2013). However, only on measures that require prolonged writing did extended writing beat question answering; whereas summary outperformed question answering on those measures that require free recall.

On the other hand, path analysis and related approaches have demonstrated the relevance of genre-appropriate thinking in the learning process. Klein and Kirkpatrick (2010) found that students' genre expertise had an impact on the quality of their texts, which in turn predicted the quality of their learning results (cf., Klein & Samuels, 2010). Following the findings of Klein, Piacente-Cimini, and Williams (2012), it was discovered that students' learning was improved when they utilised more comparable writing movements (such as comparing and contrasting parts of the source and the target) (2007). Greater utilisation of cognitive processes in text has been linked to improved learning outcomes in learning protocols according to Glogger, Holzäpfel, Schwonke, Nückles and Renkl (2009) (similar to learning

journals). Many other researchers (Glogger et al. 2012; Klein 2000, 2004; Wäschle, Gebhardt et al. 2015) have found that students learn more when texts involve cognitive operations more frequently.

It's not clear what may be done to reconcile these disparate findings on the influence of genre on learning. There are other explanations for the differences in the effects of genre writing, such as that they occur primarily inside the genre. Wiley and Voss (1999) and Gil et al. (2010) discovered that there is little diversity between genres in their effects on learning, as indicated by their findings. However, disparities between students who use genre-appropriate reasoning operations and those who don't seem to be as persistent within a specific genre as the differences between students who don't use genre-appropriate reasoning operations. An educational genre's influence on student learning will often be determined by the student's ability to grasp and apply concepts taught within that genre.

8. Writing to Learn: Self-Regulation in the Writing Process

Research on the function of self-regulation in writing processes during learning has made tremendous progress over the last decade. An individual is said to be engaged in "Self-regulation" when he or she is able to see and control his or her own psychological processes. We've seen that early theories of textual mediation gave the text medium the most of the agency, whereas cognitive theories of WTL give the writer the bulk of that agency. The empirical evidence substantially supports the latter viewpoint. This meta-analysis included metacognitive writing prompts, which ask students to reflect on their own learning, as a major mediating variable, as previously indicated by Bangert-Drown et al. (2004). The "metacognitive writing activities" (goal setting, organising, assessing, and changing) observed in another study by Klein, Boman, and Prince (2007) contributed a separate variance to learning, independent of more fundamental operations such as generating ideas and transcribing text. It was shown that metacognitive methods such as verifying understanding contributed much more to learning than cognitive activities such as extending information (see also Glogger et al., 2012; Nückles et al., 2009; Petko et al., 2014).

In order to increase the utility of writing as a learning tool, researchers have discovered that students may be taught metacognitive abilities. Teachers and students alike should take note. Research on the cognitive strategy teaching approach known as Self-Regulated Strategy

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Development has been the most in-depth (SRSD; Graham, McKeown, Kiuhara & Harris, 2012; Harris & Graham, 1996). Since its inception, SRSD's primary research focus has been on improving writing abilities. Both the teaching of writing skills and self-regulation methods, in which students set objectives and monitor their writing process, contribute to the quality of written work produced by students, according to evidence (Graham et al., 2012). Research has been moving away from utilising strategy education to learn to write and toward using writing strategy teaching to learn to write for over a decade (see MacArthur, 2014 for a review). When it comes to teaching writing strategies, Martnez, Mateos and Martn and Rijlaarsdam (2015) employed a range of methods, including SRSD (e.g. Martnez, Mateos, Martn, and Rijlaarsdam, 2015).

Literature, science, and the arts have all been studied in terms of the impact that writing strategy instruction has on learning, as has the impact of writing strategy instruction on the development of writing skills (Boscolo & Carotti; Kieft, Rijlaardam & van den Bergh; Lewis & Ferretti 2009, 2011; Wong, Kuperis, Jamieson, Keller, and Cull-Hewitt, 2002). (De La Paz & Felton, 2010; Martinez et al., 2015). With the use of strategy training, teachers have seen improvements in their students' writing and learning in tasks like discourse synthesis (Britt & Rouet 2012; Gelati, Galvan, and Boscolo 2014; Martnez et al. 2015; Martnez et al. 2016). Hübner, Nückles and Renkl (2010) found that teaching cognitive operations and teaching metacognitive (self-regulation) operations both contributed significantly to learning while writing (Berthold, Nückles and Renkl, 2007; Hübner, Nückles and Renkl, 2010). The same can be said for learning protocols (which are related to learning journals).

We'll return to strategy teaching in the following section, when we analyse the change from discipline-specific approaches to WTL. Meanwhile, research utilising strategy training has found it to have a significant and frequently considerable influence on the learning process when it comes to the writing process. According to recent studies, students who struggle academically or have learning disabilities benefit from self-regulation training (e.g., Ferretti, MacArthur, & Okolo, 2001; Taylor, Therrien, Kaldenberg, Watt, Chanlen, & Hand, 2012; Wong et al., 2002). At the same time, a study of secondary teachers in the United States indicated that most instructors do not employ strategy teaching to enhance writing for

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learning, indicating that this is an area of professional development that should be prioritised for teachers.

The study of psychological processes has also seen some recent advancements. There has been a substantial amount of study into the role of spontaneous processes in learning, as well as the necessity of self-regulatory behaviours. WTL theory pioneered by Galbraith (1992, 1999, 2009) links learning to spontaneous writing processes rather than structured teaching (Galbraith, 1992). (Elbow, 1973, 1981). Using the existing parallel distributed processing architecture, he has devised an efficient and effective model for knowledge building. Writing activities focused on rhetorical preparation are more beneficial for students who are high self-monitors, according to Galbraith's indirect study, whereas drafting activities, which encourage spontaneous writing, are more effective for students who are low self-monitors (Galbraith, 1998). For further information, see Ong (2013).

Finally, applying Cognitive Load Theory to WTL is a relatively new method. As of this writing, it's still in its infancy. Writing and learning via writing require a healthy supply of working memory (e.g., Galbraith, Ford, Walker & Ford, 2005). When it comes to designing instruction to reduce extraneous working memory load, cognitive load theory focuses on principles for reducing inefficient instructional methods and maintaining at an optimal level intrinsic working memory load, which directly concerns the relationships that are critical to schema formation (Sweller, Ayres, & Kalyuga, 2011). It was originally developed to help students understand math and other subjects characterised by algorithmic problem solving. According to a recent study, the notion of cognitive load has recently been expanded to domains that are less computational, such as written writing (Schworm & Renkl, 2007; Si & Kim, 2011; Zhu & Zhang, 2005). For this study, it will be interesting to discover if any of the impacts of writing on cognitive load are equally applicable to the influence of writing on learning. According to Klein and Ehrhardt (2013), April, Klein, Haug and Arcon (2015, August), and Nückles, Hübner, Dümer and Renkl (2010), low cognitive load conditions benefit writers with a low level of knowledge while those with a high level of knowledge are either less advantaged or even disadvantaged by low cognitive load conditions. Another discovery was the reversal of expertise.

The genre of writing is always evolving, and students should be aware of current developments in the field. Writing for the Learning (WTL) focuses on a second major trend: what kinds of writing activities or genres of writing activities might contribute to learning? What is the connection between disciplines and genres in World of Tomorrow Literature?

9. Early Writing to Learn: Domain-Neutral Writing as a Step One

Britton, as previously mentioned, was a major writer who advocated for the use of journaling to express one's emotions through writing. Similar to this approach was one that had pupils begin with freewriting before moving on to draught and revise their work into a formal text (e.g., Britton, 1982b; Elbow, 1981). The argumentative (or "analytical") essay or subject was deemed to be the most appropriate at the time since it elicited the most in-depth consideration (Langer, & Applebee, 1987; Stotsky, 1995). These views all held that writing in a certain genre would lead to a greater understanding of a wide range of things. A "domain-general" or "discipline-neutral" point of view will be used in this study.

It's important to remember that genres like "journal" and "essay" have their roots in the humanities, and many of the early proponents of "writing across the curriculum" were humanities-trained instructors or professors. Writing to Learn (1988's) original title, "How to Write and Think Clearly About Any Subject at All," wonderfully captured the concept of Zinsser's famous book. "excellent writing" in this book is defined as a higher quality for humanities and popular nonfiction in science and social sciences. According to Zinsser in analysing the chapter "Crochets and Convictions," good written communication relies heavily on brevity, avoiding jargon, and proper organisation. "Reduce your discipline—whatever it may be—to a logical series of clearly considered statements," he writes in the book. As a result of this, you'll be able to explain it to others and to yourself. " Your topic matter knowledge will be tested to see whether you've been exaggerating (p. 198).

10. A Context for Change in Discipline-Based Writing

In the meantime, the "WID" (writing in the disciplines) movement was placing pressure on discipline-neutral writing approaches. A notable early publication on the issue was Bazerman's (1981) research, "What Written Knowledge Does: Three Examples of Academic Discourse," One from each of the domains of sociology, biology, and literary criticism were examined in the study. There were differences in subject matter and audience expectations

across the three books, according to Bazerman's analysis. He also pointed out differences in style and authorship. The fact that he uncovered major discrepancies in the conceptions of evidence and arguments held by each academic profession is perhaps the most crucial finding for people who write to learn. In Hartman's (1978) review of Wordsworth's poem "Blessing the Torrent," for example, the reviewer used his own writing to create an aesthetic state of mind in the reader that would allow them to appreciate Wordsworth's poetry, "Blessing the Torrent." For example, Bazerman said that each text "[i]n mediating between reality, literature, the audience, and one's own self, each text appears to be making a new kind of play in each game." by mediating between reality, literature, the audience, and one's own self. (1981,(Also see Myers, 1985, p. 46.)) In contrast to social theories of writing, such as sociocultural theory, which proposed that each genre has historically evolved under the influence of specific institutional structures and disciplinary cultures, this belief was consistent with the belief that the nature of writing is specific to each discipline... (Bazerman, 1988; Olson, 1994; Russell, 1997). There is a comprehensive summary of writing and rhetoric in different academic fields provided by Bazerman and colleagues (Bazerman and colleagues, 2006). (2005).

11. Understanding and Using Writing Concepts Specific to Each Academic Field

For educational purposes, WID research has advocated for shifting from a domain-general view of writing that is applied across the curriculum to a more domain-specific view of writing as an educational activity (Bazerman et al., 2005; Russell, 1997). During the 1990s, many collegiate writing educators and academics began to clearly regard writing as a practise that is interwoven with disciplinary communication, inquiry, and argumentation. In addition, they viewed disciplinary instructors as collaborators in the development of pedagogy and research as well (e.g., Monroe, 2002; Walvoord, Hunt, Dowling, McMahon, Slacker & Udel, 1997). When Carter (2007) collected data on educational outcomes at a prominent public institution, for example, he published his findings in 2007. According to his research, the intended outcomes of writing may be divided into four "meta-genres," with a number of disciplines utilising more than one of these categories.

It was about a decade ago when WTL research in elementary and secondary schools began shifting toward more discipline-specific genres and practises. Several studies have looked

into the Science Writing Heuristic (SWH; Akkus, Gunel & Hand, 2007; Benus, Yarker, Hand, & Norton-Meier, 2013; Keys, Hand, Prain & Collins, 1999; Hand, Wallance & Yang, 2004). According to this theory, professional science is a group of researchers who share their findings primarily through the written word. Students in elementary and secondary courses alike are encouraged to form similar communities via the use of the SWH. Students participate in a variety of activities as part of an inquiry process, including small group discussion, hands-on inquiry, large group discussion, and reading. In this method, writing activities for individuals and groups are intertwined and help to link the many phases. Students follow a framework that resembles a scientific study report when they are writing, and this template emphasises argumentation concepts significantly. Small and large-scale group activities are used for peer collaboration and assessment as well as a specific emphasis on providing explanations and testing them using evidence. The approach is similar to that of traditional discipline research.

When it comes to writing as a learning tool, both Olson (2001) and Nelson (2001) explore it. Given the importance of disciplines and professions in shaping one's own literacy and learning, it is clear that this phenomena is domain-specific. In the early 2000s, the application of domain-specific approaches in elementary and secondary WTL was still unusual. In studies, the use of discipline-neutral practises such as note-taking and essay writing (Cantrell, Fusaro, and Dougherty, 2000; Klein, 2000), portfolio building and maintenance (Linnakylä, 2001), and the use of technology in writing (Hartley & Tynjälä, 2001) remained significant.

It has been a decade since the trend toward WTL specialisation began. Writing in elementary and secondary schools as well as research in psychology are now being affected by this trend. Prior to this, we examined how strategy training has played a big role in the previous decade, pointing out that the majority of this was discipline-specific. According to a recent study by MacArthur (2014), research has been undertaken in the fields of science, history, and literature on cognitive strategy training in writing at the elementary and secondary school levels. Since the early 2000s, research on WTL in history has grown more discipline-specific in its approach (De La Paz, 2005; De La Paz and Felton, 2010; Ferretti, MacArthur & Okolo, 2001; Wiley, Steffens, Britt, and Griffin, 2014; van Drie, van Boxtel & Braaksma, 2014). Researchers drew on studies in which experts in the field of history debated contentious

topics to develop this method (Seixas, 1993; Wineburg, 2001). Students may then utilise these resources to help them write on a disputed topic after researchers have completed their study and compiled a collection of primary source articles. During this course, students were taught how to critically analyse historical sources and utilise them as evidence in their arguments (De La Paz, 2005; De La Paz and Felton, 2010; Ferretti et al., 2001; Wiley et al., 2014; Van Drie et al., 2014). Using a Self-Regulated Technique Development method to teaching argument writing, De La Paz and Felton (2010) ran a research in which they taught students a multi-step strategy for critically examining historical sources (De La Paz & Graham, 1997). WTL cognitive strategy education has had favourable impacts in the past, but the number of research and methodologies utilised are limited, according to MacArthur (2014), who asks for additional replication of these findings.

In the 2000s, writing educators in the literary studies area developed long-term, discipline-specific, cognitive strategy approaches to writing (Boscolo & Carotti, 2003; Lewis & Ferretti, 2009, 2011). When Lewis and Ferretti (2009) looked at how literary critics utilise methods (topoi) to understand texts, they came up with one of the most discipline-specific approaches. (1991) (Fahnestock & Secor, Secondary school students' performance was significantly improved as a result of the researchers' use of these topoi into reading and writing approaches. The reader might study MacArthur's book to acquire a comprehensive review of strategy training in literature studies (2014).

During the same time period as WTL has developed more specialised methodologies, progress has also been made in the closely linked subdiscipline of topic area literacy instruction. Many scholars are now questioning the long-held belief that instruction in general reading comprehension techniques and non-field-specific journal writing are sufficient preparation for students to succeed in a given subject area's literacy requirements. A content analysis of significant content literacy tools in math teaching was undertaken by Siebert and Draper (2008) in their study. There is a lack of understanding of the specific character of arithmetic in terms of representations, reading methods and conceptual substance, as well as textual representations and texts in these sources even when they claim to be about math. According to the researchers, psychologists and academics in the field of literacy have affected subject area literacy tools more frequently than disciplinary educators. Text and

literacy should be defined more broadly to encompass disciplines like mathematics, according to Siebert and Draper. In recent years, there have been a number of recommendations for teaching pupils to read, think, and write in certain secondary school fields like math and science (Moje, 2008; Shanahan & Shanahan, 2008).

12. The WAC vs. WID divide has significant drawbacks when it comes to writing for learning.

Here, we explain a shift in the WTL literature from the more domain-neutral Writing Across the Curriculum (WAC) approach to the more domain-specific Writing in the Disciplines (WID) approach. While McLeod and Maimon (2000) refuted the "myth" that writing throughout the curriculum is incompatible with writing inside disciplines, our interpretation of these patterns differs significantly. Writing and disciplinary educators collaborated from the inception of WAC, according to the authors. This collaboration facilitated the development of disciplinary learning and reasoning abilities, they said.

It's also worth noting that current WTL practises comprise both discipline-specific and discipline-neutral strategies, the usefulness of which has been amply demonstrated in recent years. Many fields can benefit from the use of a reflective diary entry (also known as the learning technique) as an example. According to several research papers (Bangert-Drowns et al., 2004, Hübner, Nückles and Renkl, 2010; Nückle-Hubles and Renkl 2009; Uzoglu 2014), writing in this genre is an effective way to improve one's writing skills. McNeill and Krajcik (2009) investigated the role of domain-specific and domain-general argumentation in science, concluding that each contributes to learning in a distinct manner (cf., Mason & Boscolo, 2001).

To make matters more complicated, WTL uses a WAC/WID distinction. In recent years, research in this field has become increasingly discipline specific, although there is a sense in which it has evolved not toward writing in the disciplines, but rather toward reading in the disciplines.. When researchers teach students how to read and interpret documents in a specific discipline, the student's critical interpretation is used as a basis for an essay that is written using a discipline-neutral argument strategy (such as persuasive writing) that is based on the student's critical interpretation (e.g., De La Paz & Felton, 2010). It is possible that educational and developmental considerations were taken into account due to the fact that

this form of writing is essentially discipline-neutral. Graduate and professional school students who are writing in their fields of specialisation have a reasonable objective of generating texts that are similar to those produced by experts. For students at the primary and secondary levels, the experience is less real because their primary goal is to gain a fundamental understanding of the discipline's knowledge and methodology. A "school genre," is a phrase used to describe a type of writing that has a primary aim and structure in mind when it comes to educational writing. Elementary and secondary students might benefit from writing in the school genre, even if the end output may differ from professional writing in the same discipline (Bazerman, 2009; Berkentotter & Huckin, 1993).

13. Discourse Synthesis is a technique for synthesising discourse.

A writer can develop a new piece of writing by integrating and synthesising information from several sources. Writing from sources, or discourse synthesis, is known as this (Mateos et al., 2014; Segev-Miller, 2007; Spivey, 1997). As students combine various sources to generate one piece of writing, different study literatures such as argumentation and reading comprehension from multiple texts are intertwined with discourse synthesis research (Britt & Rouet, 2012; Wiley & Voss, 1996). Spivey (1997) found that authors must select, link, and arrange content from a number of sources to create a new work. For the construction to work, authors must take apart and reassemble numerous source texts in order to produce a structure that is distinct from any of the source texts (Boscolo, 1996; Segev-Miller, 2007). Authors must create an intertext model consisting of intertext predicates that logically connect elements of two or more texts in order to achieve this goal (Britt & Rouet, 2012). An iterative process of analysing materials and developing a final draught of the essay is necessary for this to occur (Mateos et al., 2008). Self-control is required because this is a deliberate activity (Britt & Rouet, 2012; Mateos et al., 2008). (Segev-Miller, 2007; Smeets and Solé, 2008; Britt and Rouet, 2012) Writing from sources assignments require students to develop a conceptual model of the writing process that they will use to synthesise their sources.

Discourse synthesis appears at first glance to be both a teaching and a learning process.

Discourse synthesis leads to a unique integration of knowledge that may go beyond what is offered by the sources themselves as their final product (Segev-Miller, 2007; Martnez et al., under consideration). Mateos and colleagues discovered that teaching students how to apply a

discourse synthesis technique may improve both their writing and their conceptual learning (Mateos et al. 2014; see also Britt and Rouet (2012), Gelati and colleagues (2014), Reynolds and Perin (2009); Mateos and colleagues (2014)). How to teach sixth-year students how to write from sources using the following steps: analyse each source, generate a concept map for each source, assemble a concept map that integrates the different sources and write a piece. Modeling, writing together, and then individual writing were all part of strategy development instruction. There were substantial differences between instructional and control groups when it came to complexity of writing processes, quality of text, content transformation and topic knowledge acquisition.

There is some evidence to suggest that genres such as argumentation and explanation, which necessitate an integrated product that is distinct from the source texts in terms of genre, are more effective at improving student learning than tasks in which the integrated product is the same genre as the source texts (Britt and Rouet, 2012; Cerdán and Vidal-Abarca, 2008; Wiley and Vos 1996, 1999). Previously, we stated that there is no clear scientific agreement on this topic, as we have shown. Researchers have found in the past that both summarization and discourse synthesis, which do not require that the sources be transformed into a new genre, require integrative work and lead to participants developing conceptual knowledge (Gelati et al. 2014; Martinez et al, 2015).

Many people, including those who work in argument writing, have debated the difference between persuasion and deliberation. As an alternative to persuasive argumentation (i.e. disputation), deliberative argumentation (conversation or exploration) has been suggested as a means for authors to study different statements and arrive at reasoned conclusions. Although there has been a lot of talk about this, there hasn't been any research done to see if written discussion and deliberation have different effects on learning. While there are significant distinctions between the effects of oral and written persuasion and deliberative goals on speech, they are also convoluted (e.g., Nussbaum & Kardash, 2005). While deliberative peer discourse had the greatest impact on later writing and learning, it was observed that disputatious peer talk had no influence on these outcomes. Felton et al. (2009) agreed. According to the results of another study, the form of reasoning and past writing success have more complicated relationships (Felton et al., 2009).

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14. Combining Text and Other Media

Recent approaches in the study of genre and WTL have focused on the diversity of literacies. Before, it was common to contrast the supposed powers of written language with other media's weakened or divergent capabilities, particularly visual ones (Emig, 1977; McLuhan, 1962; Ong, 1982). A consequence of this has been that until recently, "writing to learn" was conceived of primarily in terms of the creation of written material. A consideration of the value of discussion in connection to writing might occasionally moderate this approach, though (see Klein, 1999 for a review). It was during this time period, notably in the humanities and social sciences, that the primacy of text for thinking and learning was increasingly challenged. Studies of cross-cultural communication demonstrate that writing and speech have many of the same qualities as well as a wide range of functions that are heavily impacted by their respective cultural settings (Biber & Vasquez, 2008; Scribner & Cole, 1981; Street, 1984).

It was stated by semioticians that many aspects of culture may be viewed as sign systems that are similar to those used by people when communicating. Scholars in several domains have discussed the ramifications of adopting a semiotic perspective on thinking and learning (Smagorinsky, 1995; Suhor, 1984; Unsworth, 2011). For example, they found that a range of representational kinds are crucial to the acquisition of knowledge in numerous professions and school subjects such as the study of science (Kress, Jewitt, Ogborn & Tsatsarelis, 2001; Smagorinsky, 1995). This vast spectrum of media has been studied extensively under the banner of "New Literacies" or "Multiliteracies" (Baker, 2010; Leu, Kinzer, Coiro, & Cammack, 2004). It was found that fine arts departments were predominantly concerned with non-written outputs and performances when Carter (2007a) performed a study project on university departmental writing results. To keep up with the growing recognition in educational discourse of the wide range of sign systems in use throughout the world, writing to learn expanded into various media forms in the 2000s. Smagorinsky (1995) defines "composing throughout the curriculum" as a notion that includes "electronic writing across the curriculum," which is another way of saying "composing throughout the curriculum" (see volume by Reiss, Selfe & Young, 1998).

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According to a number of recent studies, children learn more from activities that require them to create multimodal representations than they do from activities in which they are just required to write (Demirbag & Gunel, 2014; Leopold & Leutner, 2012; Leopold, Sumfleth and Leutner, 2013). Developing multimodal representations is predicted to be a focus of future research. Experiments on the consequences of students developing products that combine text and nontextual media, such PowerPoint slides, equations and graphs, were conducted by Hand and his colleagues. Students' creations that combine text and nontext media, such as equations and graphs, have been empirically compared to the impact of various combinations and sequences of these representations on science learning (e.g., Gunel, Hand & Gunduz, 2006; Hand, Gunel & Ulu, 2009; McDermott & Hand, 2013).

15. As a result of this transformation, we're seeing an increase in the use of the social-cognitive system.

Earlier in this part, we reviewed how the idea of causal agency in writing has evolved from the textual medium to the individual writer. In the next section, we'll look at the writer in relation to a larger social and technical context, including current study trends.

As early as the 1970s and 1980s, social aspects of writing to learn were only sketchily discussed.

So far, what we've understood about learning via writing is that internal psychological processes, which were activated either by the text as a medium (Britton, 1982b; Emig, 1977), or the strategies that the writer deployed (Britton, 1982a), were assumed to be responsible (Bereiter & Scardamalia, 1987). Journal writing, a type of content that was mostly written by the individual writer for his or her own personal delight and growth, was paired with an emphasis on individual and internal attention (volumes edited by Gere, 1985; Thaiss, 1986; Young & Fulwiler, 1986). On the other side, WTL's success was supported by social activities like community gardening. There was a lot of interaction between the students and their teachers, as well as with their peers (Elbow, 1981; Langer & Applebee, 1987; Rosaen, 1989, 1990; Thompson, 1990). In contrast, little attention was paid to the social aspects of WTL in this early research.

Moving toward social theories is a trend in the writing profession.

Since the 1980s, social theories have become increasingly prominent in academic writing, and this trend has maintained to this day (Nystrand, 2006; Prior, 2006; Russell, 2013a). In addition to Cultural and Historical Activity Theory (Engestrm, 2009), there are additional versions of historical activity theory (Russell, 1997). In addition to distributed cognition and situational cognition, two other theories have been offered in the past (Carter, 2007; Englert, Mariage & Dunsmore, 2006; Haas & Witte, 2001; Klein & Leacock, 2012). These theories, although being unique, share overlapping subsets of the following concepts: A variety of tools and techniques are employed in writing practises, which are taught and learned through experience. Each writing practise is specific to a particular social context and text genre. Many written texts are the result of multiple contributors, including authors, reviewers, and editors. Writing practises use a variety of tools and techniques. a. Greetings

Authors such as Prior, 2006; Starke-Meyering & Paré, 2011 have discussed the rise of social theories of writing and claimed or implied that cognitive theories were inadequate because they did not address social, historical and political aspects of writing, while acknowledging the contributions of cognitive theories. Social theories of writing have been offered as a replacement for cognitive theories of writing, with mixed results. The social theory of writing has advanced significantly during the 1980s and is expected to continue to do so in the future, according to most experts. It is our opinion that this new story is inaccurate in three important respects. Cognitive theories are backed by extensive empirical evidence; second, their influence on theoretical work and empirical study has been evident throughout the years; third, the "social" theories are each made of a combination of both social and cognitive components.

16. Studying to Become a Professional Writer: A Social Aspect

If you want to learn more about social theories of writing, Nardi (1996) has an excellent comparative examination of these ideas. As an alternative, we will focus on the recent connections between social theories of writing and research on WTL, which will be examined in great detail. " When it comes to sociocultural theory, it's perhaps the most frequently referred to in reference to WTL. For example, Nelson and Olson (2001), Tynjälä et al. (2001), and Tynjälä et al. (2001) have all mentioned Writing as a Tool for Learning as a key

effect (2001). Individuals may access literate organisations and their personal awareness of linguistic and argumentative forms is affected by literacy, according to Olson (2001). "these individual processes always have a social and cultural background" they wrote in reference to Vygotsky's work in Tynjälä and colleagues' (2001) allusion to his work (p. 14). According to Bazerman's (2009) sociocultural theory, a learner can use a genre to rebuild information by employing it as a perspective on knowledge and as a vehicle for communication. This is based on Vygotskian sociocultural theory.

It is a sociocultural idea called activity theory that has informed contemporary thinking about WTL. Engestr•m and Russell (2009) describe this object-oriented theory as one in which writing is conceptualised as an interaction between tools, the subject (in the sense of an agent), rules or norms, objectives/reasons and division of labour and community. Russell (2009; 2013a; 2013b) is a disciple of Miller when it comes to viewing genre as a kind of social action (1984). Bakhtin, 1986 (cf. Thus, each genre is viewed as having a specific social function that can be described and routineized as a form of tool-mediated behaviour. An environment of trust may then be created to help students learn about their disciplines (Bazerman, 2009; Russell, 1997; 2013b).

The term "distributed cognition" (also known as "distributed cognition theory") has been used to characterise the social aspects of WTL (Klein & Leacock, 2012; Newell, 2006). Complex human behaviours, such as thinking, can theoretically be modelled as a system made up of several individuals and a variety of internal and external symbolic representations, all of which are dispersed throughout both time and space. Organization, dissemination of information, and transparency of decisions are examples of external representations (Hutchins, 1995; Zhang & Patel, 2006). The authorship of academic textbooks has been cited as an example of distributed cognition (Cronin, 2004; Zhang & Norman, 1994). In professional research, for example, writing is used to develop knowledge in a distributed network of writers, reviewers, and editors. Distributed cognition has been used to characterise writing and knowledge creation in academic and professional writing, as well as writing and knowledge construction in general (Freedman & Smart, 1997; Klein, 2014; Newell, 2006; Rivers, 2011). It has been shown that professional written communication is highly collaborative and is mediated by both older texts and technology advancements (Beaufort,

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2008; Haas & Witte, 2001). Research conducted by Hewitt and Scardamalia (1998) and Mason (1998) indicated that dispersed cognition influenced their understanding of computer-supported collaborative writing.

In accordance with the hypothesis of'situated cognition,' complex mental processes are learned by engagement in the environment in which they are practised (Brown, Collins & Duguid, 1989; Robbins & Aydede, 2009). Carter and colleagues (Carter Ferzli and Wiebe, 2004; 2007) investigated laboratory report writing as an interpretation of experiments. They tested LabWrite, a programme that helped scientists write lab reports and explain their findings. A wide range of internal cognitive processes and other behaviours that incorporated context into thinking and learning were affected by this intervention, the researchers found. Students' learning results improved when they went back to their readings and attended lectures.

17. Social practises in the writing process are discussed in section 5.4.

In WAC and WTL teaching practises, there has been a well-established scholarly and professional literature for a long time now (e.g., Nystrand et. al, 2001). Because of the vast number of people involved and the employment of cultural instruments to mediate these activities, we may classify them as social and cultural practises. First generation WAC programmes were oriented on individual students' cognitive growth; however, the second generation of WAC programmes progressively turned toward learning as a social process that involved cooperation, an audience, and a social environment (Childers, Gere, and Young, 1994). To further understand these processes, we'll look at some of the research currently being done in this area.

Instructing and facilitating are not the same thing; they are two separate activities. In the sections above, there are several allusions to the role of facilitation and teaching in the WTL process (e.g., De La Paz & Felton, 2010; Martinez et al., 2015). Social support has been shown to have an impact on cognition in several research (e.g. Carter et al. 2004; Roelle, Krüger & Jansen, 2012; Wong et al. 2002). (e.g., Carter et al., 2002).

Collaboration. Writing tasks like "academic controversy" were employed in the early research on cooperative and collaborative learning to test ideas (Johnson & Johnson, 1985). Review of research on cooperative learning (not specifically on writing) indicated that group

objectives and individual responsibility, where each student is held accountable for the collective goal, were both significant moderators of learning (see Johnson & Johnson, 2002 for a meta-analysis). Many forms of WTL activities have included cooperation, including considerable study into the Science Writing Heuristic during the last two decades (Hand, Wallace & Yang, 2004). The social support that comes from a readership is particularly crucial for new authors (Chen, Hand & McDowell, 2013; Gunel, Hand & McDermott, 2009).

Some recent qualitative study has examined the ways in which students might learn more successfully when they collaborate while writing (Klein 2014; Milian 2005; Nykopp, Marttunen and Laurinen, 2014). An ongoing theme has been that students commonly fill in gaps in one another's sentences, often by building on one another's ideas. However, the study by Felton et al. (2009) indicated that group thinking followed by writing resulted in learning that was significantly more successful than solo writing. Collaborative writing was proven to be far more successful than individual writing. In order to better understand the influence of collaborative writing on learning, further experimental studies are required.

Using a computer for collaborative learning is supported. When it comes to theories of how people learn, computer-supported collaborative learning has traditionally been excluded from consideration. However, writing has not always been the dominant manner of interaction on CSCL systems (Dillenbourg et al., 2009; Stahl, Koschmann & Suthers, 2006). As a result of their knowledge transforming model of writing, Bereiter and Scardamalia created Knowledge Forum (formerly known as Computer Supported Intentional Learning Environment), an innovative CSCL platform (Bereiter & Scardamalia, 1987; Chuy, Scardamalia & Bereiter, 2012). In CSCL platforms, argumentation is a frequent genre that allows students to engage in critical thinking, challenge one other's ideas, and re-construct their understanding (Chen & She, 2012; Yeh & She, 2010; Chen & She, 2012). For further information, see Choi, Hand and Norton-Meier (2014).

Many other elements of writing and learning have been affected by computers, including CSCL. Carlson and colleagues (2008) used a platform to measure the ability of engineering students to analyse peer assignments and found positive results. While the writer is working on a piece of writing, the computer can act as a teacher, providing scaffolding to aid learning (Schwonke et al., 2006). He describes this as yet another role for computing in the WTL that

was developed with the help of the content management system MyCase (Fisher, 2007). An advisory board was formed by students in the field of telecommunication. The system used email and other business technology to encourage and promote writing. Video-recorded characters supported the writers by offering information and difficulties. As a result of this activity, students were able to respond and critique materials in a more realistic context.

It is common for CSCL platforms and techniques to include numerous features in a single package. When it comes to learning, hands-on investigation, argumentation training, small-group discussions, report writing and audience response are all incorporated into a single learning experience in an argument-driven inquiry (Sampson et al., 2013; cf., Chen & She, 2012; Syh-Jong, 2007). CSCL treatments that can be broken down into discrete variables for testing would be excellent. The effects of medium (for example, blogs versus paper and pencil) and prompting (for example, prompting against no prompting) may be separated using a 2 x 2 design in a recent research (cognitive and metacognitive prompts versus no prompts). Even more interesting, they found that students in the prompted condition learned more than students who were not prompted at all in both mediums; yet, students who were prompted at all learned more than students who were not prompted at all in both unprompted circumstances (Petko, Egger & Graber, 2014; cf., Braaksma, Rijlaarsdam & Janssen, 2007).

The phrase "critical pedagogy" refers to the practise of instructing students with a critical eye. As a kind of critical social activity, writing has inspired the work of certain authors (Kostouli, 2009; Luke 2012; Russell, 2013b). However, according to Russell (2013b), university-level WAC has created a platform for critiquing the very fields that have benefitted from this authority. Additionally, topic area teachers have used writing assignments at the elementary and secondary levels to encourage students to think critically about society and the world around them (Christensen, 1999; Comber, Thomson & Wells, 2001; Huang, 2011). Critical pedagogy and writing to learn have long been seen as distinct fields of study. On the other hand, writing assignments in this tradition may include important subject area reasoning as well as conceptual information. For instance, in one intriguing study, young children wrote letters as a kind of social action to raise awareness about social injustice (Vasquez, 2014). Students had to understand and think critically about a wide range of topics in order to complete the letter-writing assignments. Students' conceptual understanding should be tested

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in order to get more accurate results from previous critical literacy research. In the future, further research on WTL should be conducted using a critical pedagogy paradigm.

18. The terms "epistemic learning" and "reflective learning" are synonyms for "writing to learn."

As noted at the opening of this paper, the significance of writing in the acquisition and organisation of information has been emphasised in school settings, but the authors claim that the relationship between learning and writing has remained murky. It is true that WTL serves a purpose apart from its epistemic value. When it comes to studying and writing, it isn't just academics that are involved. There was a higher focus on the function of writing in the workplace by Leijten, Van Waes, Schriver, and Hayes (2014) than there was on writing in the classroom (Leijten et al., 2014; Schriver et al., 2012). Writing-to-learn may be viewed in a different light in professional contexts, when writing is used as a means of self-reflection and improvement.

When it comes to research on how people think and how they learn (e.g., Kolb 1984; Schön 1983), the term "reflection" is often used, but it has been largely overlooked in the field of psychology. A person's relationship with oneself or herself is characterised as a kind of implicit monologue in which a person might construct a tentative balance between his or her successes, failures, doubts, and concerns, as well as plan future activities, and this is what reflection is in actuality. Reflecting is a metacognitive practise that involves the activation of both ideas and emotions over the course of the reflection process. "Reflective writing" refers to writing that is meant to elicit reflection in students, as evidenced by several studies in vocational education (such as Ortoleva and Bétrancourt, 2015). Emotional responses can be channelled and dealt with more successfully via the act of writing about them (e.g., Hoover, 1994; Kember, 2001; Kember, McKay, Sinclair, & Wong, 2008; Wade & Yarbrough, 1996). Metacognitive functions, such as analytical thinking, problem solving, and decision-making, can all be aided by the act of writing. Higher-order thinking skills are used by professionals, for example, during critical reflection processes, to review and evaluate their experiences. Procedures like this connect theoretical notions to practical implementation. Writing activities in today's health-care systems are increasingly related with reflective processes (Breuer, Newman, & Newman, in press).

Both epistemic and reflective writing have parallels and differences that may be explored. Digital writing tools like wikis, blogs, and electronic portfolios are examples of non-traditional forms of writing that are becoming increasingly prevalent. A wiki may be appropriate for instructors from the same subject to exchange and discuss their ideas on how to teach a certain topic or assess students' learning. An apprentice's specialisation may be used to teach them how to use a number of formats and media to help guide their reflection on their apprenticeship experience, assess proficiency, and select appropriate learning assignments (Cattaneo & Boldrini, in press).

A second component of the study focuses on the link between epistemic and reflective writing. Despite their differences, they are not incomparably separate from one another. As a student-writer, increasing one's proficiency in a discipline may increase one's awareness of writing as a learning tool and one's own role in learning itself. Reflective writing is an important part of developing professional competence, but understanding its relevance also enhances a person's self-image and sense of agency in the workplace (Kurunsaari et al., in press). As a researcher, writing is an essential part of your job, which means that it has a positive influence on your educational and professional development. In this case, writing is a tool for increasing self-awareness as a researcher. WTL for undergraduate students combines the two main meanings of writing as an educational tool: a student utilises WTL to study, and through writing, the student considers his or her identity as a future researcher

Phenomenographic research by Kurunsaari, Tynjälä, and Piirainen (Kurunsaari, Tynjälä, and Piirainen, in press) examined how students use reflective writing as a tool for learning throughout their undergraduate studies. After their first year of university, the students began filming themselves in classrooms and labs as well as at practical training places. In order to put their knowledge into practise, they chose settings where they could practise patient evaluation, training, and counselling. Students were encouraged to write in a reflective manner in order to increase their awareness of the many aspects of gaining certain talents. It wasn't necessary for students to write in a certain genre; rather, the goal encouraged them to think about their ideas, reflect on them, and then express them in writing. We polled the graduating class about their experiences with reflective writing, and the results were made public. In the interviews, writing emerged as a valuable tool in four descriptive categories: 1)

writing as a meaningless pastime; 2) writing as a tool for deeper knowledge; 3) writing as a tool for self-reflection; and 4) writing as a tool for professional growth.. Individuals were divided into four distinct groups based on these criteria: how they intended to use their writing; what they were reflecting on; what they were feeling; and how important their writing was to their professional growth. The lower categories did not include any traits from the higher categories, and vice versa. Hierarchical relationships existed between the categories, with each higher category including elements from the lower ones.

The students who thought writing was pointless also realised that it didn't contribute to their professional growth. Students in the second category saw reflective writing as a tool for increasing their learning, despite the fact that they admitted that they didn't enjoy writing at first. That's why the third type of students thought that their writing job necessitated a comprehensive understanding of not just their own behaviours but also their interactions with others. As a result, pupils felt that writing helped them develop as persons in addition to honing their thinking abilities. In contrast to those in the preceding groups, people who completed the survey questions in this category had good sentiments regarding reflective writing right out of the gate. An effective approach for both self-reflection and the development of professional competence and identity, reflective writing was found in the fourth category, is described as a (as opposed to the first three). Reflection on students' encounters with patients and members of the professional community was more prevalent in the students' reflecting process. Students were able to better comprehend and work together with customers, colleges, and multi-professional workplaces because of this programme. Because of this, the importance of writing shifted from increasing one's personal growth to enhancing one's social development as a member of a community. Consequently Pupils shared their sentiments of inspiration and motivation with one another.

As a last point,

Five recent patterns in WTL research have caught our attention, and we feel they are significant. The first phase in this process has been the application of more sophisticated analytical tools to critically examine beliefs and practises. Initially, WTL research was based on theoretical statements and one-off experiments that produced a wide range of inconsistent and inconclusive results.. Researchers have been using meta-analyses for more than a decade

to objectively combine the data of several studies. In addition, a meta-analysis has been conducted to identify the instructional elements and student characteristics that have a moderating influence on writing's learning effects. Route analysis has been used in conjunction with other research to explore the psychological processes and text elements that mediate the effects of writing on learning. Because of this, most researchers believe that writing has a major impact on learning, with effects ranging from moderate to large in size. However, the magnitude of these effects can be amplified depending on the amount to which moderator variables are utilised.

As an example, in the early days of cognitive psychology, some authors claimed that learning while writing was the result of spontaneous cognitive processes, which was at odds with current research on psychological processes. Cognitive theories that portray WTL as dependent on the intentions and methods of the writer, rather than other models, have been backed by research conducted in the last decade. Learning benefits from both task-focused cognitive processes and self-regulatory processes that focus on the writer's own perceptions. In recent years, students have been taught how to use writing as a learning tool through cognitive strategy training.

The third WTL research trend focuses on the types of writing activities students engage in. This view was commonly held by those who advocated Writing Across the Curriculum: that expressive (journal) writing and the argumentative essay were significant across disciplines. There has been an explosion of study in the last decade on the usefulness of teaching students cognitive reading and writing strategies that are specific to fields like science, history, and fiction. Metacognitive journal writing and discourse synthesis, two genres that are not directly tied to a certain field, have been shown to have a significant impact on student learning. Furthermore, a related trend has been the development of multimedia products that combine written texts with visual representations, such as animations, rather than relying exclusively on the written word.

Theorizing about WTL's social features has become the fourth trend to emerge. In the beginning, WTL was viewed primarily through the lens of psychology. There has been an explosion in the WTL literature in the last ten years of theories relating to social and activity contexts and situated and distributed cognitions. Writing teaching and facilitation; audience

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and audience response; cooperation; computer-supported collaborative writing; and other computer applications have all been studied empirically. Computer-supported collaborative writing, audience and audience response, and other computer applications are included in this category. Additional experimental research is needed to analyse the impacts of individual components in greater depth, as this study has mostly comprised of multi-faceted design trials or qualitative investigations.

The numerous sorts of learning that may be achieved via writing have been the focus of the sixth inclination. Research into WTL began with an emphasis on epistemic writing, which included familiarising oneself with the principles and reasoning of several academic topics, with the most common of these being physics, history, mathematics, and literature. However, writing in the workplace might serve as a learning opportunity. As a result of this, reflective writing has also come to the fore. It's not just about learning new facts; it's about developing a professional identity as well.

Writing-to-learn research has, without a doubt, focused primarily on the epistemic function of writing, while the reflective aspect has been examined qualitatively, in terms of personal experience, with results that are intriguing but difficult to generalise. With the trends described in this article, it's not hard to imagine how writing might develop into a more fruitful tool for learning and knowledge creation in the future. Read on to learn more about these trends. Educating people about their own personal capabilities, both inside and outside of the classroom, is another possible goal that is often overlooked when thinking about the second, lesser-known instrumentality of writing. Future academics may have a tough time analysing the roles of writing in the context of a specific concept of learning.

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6

The Effect of Handwriting vs. Keyboard Writing on the Learners' Reception of Words: Challenges and Benefits

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Abstract:

In this study, we were interested in determining how writing mode affects word memory and recognition. Handwriting using a pen on paper, typing on a regular laptop keyboard, and typing on an iPad touch keyboard were chosen as the three writing modes. Using a completely counterbalanced and in-subjects experimental design, 36 women ranging in age from 19 to 54 participated. Participants were asked to jot down words that were read aloud to them in each of the three writing modes using a wordlist paradigm. By handwriting, on a keyboard, and on an iPad virtual keyboard, we assessed our participants' verbal recall and recognition abilities. For the purposes of this study, the data were analysed using non-parametric statistics. This study's findings show that writing modality has an overall effect, and further analyses show that participants had much stronger free recall of words written in the handwriting condition than words written in either of the keyboard conditions. The writing mode had no influence on recognition in this circumstance. According to the results shown in the graph below, handwriting may have certain cognitive advantages over writing on a computer keyboard when it comes to word recall components. Findings are investigated for their educational and cognitive value in this study.

Keywords: Handwriting; keyboard writing; ergonomics of writing; word memory; cognition; educational implications of digitization embodied

1. Introduction

1.1 Background and motivation

Unlike other animals, humans are able to communicate through the written word (Preiss & Sternberg, 2005; van der Weel, 2011; Wolf, 2007). An inscription method has existed since the 4th millennium BC, when writing was developed, and it has always been done with the help of some form of item or technology, and it has always left a physical mark. Following the invention of the printing press by Johannes Gutenberg in 1440, manual inscriptions were replaced by mechanical typewriting. As digital writing devices take the place of mechanical writing instruments as the primary means of communication, handwriting is being disregarded even more frequently. It's a tendency that's also seen in the early stages of writing education (see, for example, Genlott&Grönlund, 2013; Trageton, 2003) that kids are learning to write by typing on virtual touch-screen keyboards or regular computer/laptop keyboards alongside traditional handwriting. In terms of the individual, cognitive, educational, and social implications of such a shift, we still don't know everything there is to know (Kiefer &Trumpp, 2012; Mangen, 2013; Mangen&Velay, 2010, 2014; Velay&Longcamp, 2013).

A variety of practical, pedagogical, and cognitive questions about writing are raised as a result of the marginalisation of handwriting. Putting our thoughts down on paper is a cognitive technology par excellence, according to Margaret Wilson (2008, p. 382): "For purposes of embodied cognition, this last example is perhaps most interesting not so much in terms of its archival functions [...] but for its functions in serving as an external memory device during ongoing cognitive processing [...]." Formalized (Wilson, 2008, p. 382) and formalised (Wilson, 2008, p. 382) formalised (Wilson, 2008, p. 382) formalised (Wilson, 2008, p. 382) formalised (Wilson, 2008, p. 382) Consider the following questions in light of this: Is there a role for digital writing tools in supporting and enhancing cognition? Does putting things down on a computer rather than by hand have an effect on our ability to recall what we have written? Does it matter if we type on an iPad with a virtual touch keyboard or a real keyboard on a laptop when it comes to memory performance? Some researchers (Chandler, 1992; Hensher, 2012; Keim, 2013, and McCullough 1996) have claimed that writing by hand is more stimulating to the mind than writing on the keyboard is. It is not yet

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clear how and to what degree such gaps occur, as well as what the cognitive and educational consequences of such variances would be.

A study in cognitive neuroscience comparing handwriting and keyboard writing (Longcamp et al., 2008; Longcamp, Boucard, Gilhodes, &Velay, 2006; Longcamp, Tanskanen, & Hari, 2006; Wamain, Tallet, Zanone&Longcamp, 2012) as well as the "embodied cognition" research paradigm (Calvo &Gomila, 2008) inspired this experiment. I According to this study, whether or not the words are written down by hand or typed in using a laptop keyboard has an impact on how well they are remembered.

Additional information is given on the haptics and the ergonomics of writing instruments.

As a result of the current digital revolution, writing is being explored as a cognitive and sensory-motor activity. Writing on a computer keyboard requires a change in the haptics of handwriting, or the combination of our fingers and hands' active movement and our bodies' (passive) feeling of touch when we write, according to Mangen and Velay (2010). While there are physiological and ergonomic differences between handwriting and keyboarding, there also exist cognitive and phenomenological differences that must be taken into account. While we use both hands to type on a computer keyboard or touch screen, handwriting is among the most lateralized of physiological activities, with just a few people capable of writing with both hands at the same time. Handwriting can be a challenge for new writers since they have to use all their cognitive resources to generate individual letters instead of focusing on the text. As a result of this automation, cognitive resources are freed up to focus on the substance of a document (Feder &Majnemer, 2007). When it comes to writing, there is a distinct difference in the synchronisation of physical effort and visual attention between the two modes. You may find the page I'm talking about here: Inexperienced touch typists, on the other hand, are more likely to focus their visual attention on the keyboard than than the words they're typing on the computer screen (Johansson, Wengelin, Johansson, &Holmqvist, 2010). Our attention tends to focus on the tip of the pen while we are writing by hand since that's where the traces of the letters appear to come from While visual attention and sensorimotor activity are synchronised and continuous while writing by hand (Mangen, 2013), they are not when writing by keyboard. As a result, the process of inputting text using a keyboard is conceptually and physically distinct from the act of inputting text by hand (Mangen, 2013).

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Handwriting on paper necessitates a greater degree of precision and dexterity than writing digitally, according to the majority of experts (Mangen&Velay, 2014). Instead than relying on a computer keyboard, handwriting provides a more controlled and supervised translation of the writer's message. With handwriting, we seldom construct or apply an incorrect character (in relation to the intended letter and, assuming proper grammar skills are available, words), although technical errors are widespread with keyboard writing due to variations in motor control and coordination. Using digital tools to create text has resulted in an increasingly distant link between the physical, sensory-motor input of the writing process and the resulting audiovisual output (the written text itself) (Mangen&Velay, 2014).

A study that compares the cognitive and educational benefits of handwriting against typing has not been conducted, despite the above-mentioned technological inequalities. There is an impression that writing is primarily a mental activity based on current writing research (e.g. Alamargot and Chanquoy, 2001, 2012; Berninger, 2012; MacArthur, Graham and Fitzgerald, 2006; Torrance et al., 2012; Van Waes, Leijten, and Neuwirth, 2006; Van Waes et al., 2007; Van Waes et al., 2006). I There are three main processes in the writing process, according to Flower and Hayes (1981), who established the most frequently used cognitively-oriented writing model. These are: planning (creating an outline and defining goals), translating (creating text) and revising (i.e., text reading and editing). According to a recent empirical study (Olive &Passerault, 2012), written composition is a visuospatial activity in which working memory's visuospatial processes play an important role (Olive &Passerault, 2012).

In the digital age, writing has become more of a sensory-motor, tool-mediated activity that requires the dexterous use of writing implements (e.g., pens, pencils, keyboards, digital styluses) and writing surfaces (e.g., paper, computer screens) as well as a variety of writing surfaces (e.g., computer screens) (e.g., paper, cardboard, screens). It is possible that the diverse ergonomic and tactile affordances of these writing implements, as well as the writing surfaces, may have an influence on cognitive elements at different levels of abstraction. An examination of ergonomic elements of writing is therefore important, and the embodied cognition paradigm may be particularly beneficial for this.

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2. The theoretical framework

2.1 Embodiment of thought

Embodied cognition theory suggests that switching from handwriting to keyboard writing will have effects on a wide range of cognitive processes, from basic perceptuo-motor processing all the way up to higher level thought processes (Kiefer &Trumpp, 2012; Mangen, 2013; Mangen&Velay, 2010). Cognition is thought to originate not just in the brain (Fodor, 1983) or in a symbolic processing unit (Clark, 1997, 2008), but also in the nervous system's sensory and motor systems, a theory that has gained popularity in cognitive research in recent years (Calvo &Gomila, 2008). As a result of this concept of "embodied cognition," it may be said that the processes of sensory perception (such as sight or sound) as well as motor activity and mental processing are more closely linked and interdependent than previously thought. Embodiment theories have gained increasing empirical support in recent years, based on behavioural and neuroscientific studies (see Kiefer &Barsalou, 2011) that show how cognition is based on the reinstatement of both external and internal perceptions as well as bodily actions that produce simulations of previous experiences (Kiefer &Trumpp, 2012).

Under the phrase "embodied cognition," a wide range of theoretical contributions from several fields can be combined. The motor theories of perception are the most important cluster of theories for this paper's goals. First postulated by Liberman et al. (Liberman & Mattingly, 1985), motor theories of perception claim we cognitively duplicate movement and activities even when we see (or just hear, or only touch) something. Research in cognitive neuroscience and neurophysiology shows that when people are shown pictures of instruments that need certain movements (e.g., a hammer, scissors, a pen), the brain's motor regions (e.g., premotor and parietal areas; Broca's area) are active (Chao & Martin, 2000), There are many ways in which motor theories of perception can be used to support the idea that human cognition is "sandwiched" between perception (the input from our environment to our minds) and action (the output from our minds to the external environment), demonstrating the existence of underpinning motor-perceptual links.

When it comes to embodied cognition, this is perhaps the area where the most functional links between action and perception have been shown and where the notion is clearest (Velay&Longcamp, 2013). To the extent that alphabetic characters may be linked to specific

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handwriting motions even though they aren't physical objects, we can assume that motor-perceptual links play a role in their representation. It is necessary to create a graphic shape that is as comparable to the visual model as feasible in order to do these tasks. Handwriting actions are therefore linked to constant spatial information about a specific letter. Goodnow and Levine (1973) used the term "grammar of action" to describe the rigorous geographical and temporal limits that they imposed on their subjects (Velay&Longcamp, 2013).

Such mental simulations of movement are particularly important for the present experiment since everything written by hand leaves a record of movement, which makes them highly relevant. A "imprint of action," is what Longcamp et al. (2006) call a handwritten script, and they point out that, despite the wide range of handwriting styles, we can typically recognise it: It has been shown in a number of psychophysical investigations that the perceptual system can accurately derive production-related information from the visual trace [...]. Researchers including Tanskanen and Longcamp (2006) In the work of Longcamp, Tanskanen, and collaborators (2006) In the perception of handwritten traces, this data shows that we use information about the implicit motor principles involved in handwriting, supporting the idea that we do so.

In a nutshell, the kinesthetic processes involved in handwriting are distinct from the kinesthetic processes involved in typing on a keyboard. As a result, it is fair to expect that the continued marginalisation of handwriting will have major cognitive, educational, and cultural repercussions on an individual and society level.

2.2 Handwriting and keyboard writing; relationship to word memory

Writers must evaluate visual, proprioceptive (i.e., haptic/kinesthetic), and tactile information at the same time, according to studies on writing and drawing in neuroscience, and graphonomics specifically (Fogassi&Gallese, 2004). Learning the shape of each letter and honing one's graphomotor talents (the movement that results in the letter's shape) are critical to improving one's handwriting (Van Galen, 1991). There are clear neural network activation pattern similarities between seeing, reading, and writing letters in different languages and writing systems, for example, comparing logosyllabic systems (e.g., Chinese), Japanese ideograms, and alphabet systems, among others (Kato et al., 1999; Longcamp, Anton, Roth, &Velay, 2003, 2005; Van Galen, 1991). Brain imaging techniques have shown that neural

networks can be differentially activated by the processing of different writing systems: logosyllabic writing systems appear to activate very distinct parts of the frontal and temporal areas of the brain, particularly regions involved in what is known as motor perception (Chen, Fu, Iversen, Smith, & Matthews, 2002).

Handwriting, in particular, relies heavily on the motor component, according to this study (Longcamp, Tanskanen, et al., 2006; Velay&Longcamp, 2013). To back up this argument, there are studies in the field of neurology showing that Letter memorization may be assisted by the movement of the hand when writing, according to certain studies. For example, in Japanese schools, children are sometimes taught to memorise kanji characters by repeatedly writing them by hand (Naka & Naoi, 1995). When writing difficult letters, many Japanese adults describe doing so with their finger in the air to help them recognise and remember their meaning. As a matter of fact, the Japanese call this phenomenon "kuusho" (Japanese for "kuusho") (Cibulka, 2013; Sasaki, 1987). Additionally, students' ability to retain graphic forms is facilitated when they are taught in handwriting (Naka & Naoi, 1995).

There are a range of purposes and contexts to which we write during the day. We write in order to remember something essential, which is one of writing's most crucial roles (e.g., shopping lists; note taking during reading or lectures; post-it notes). We should do more research on how writing affects our memories in light of how important writing is. Researchers employed the respondents' own handwritten notes to test the impact of writing modality on verbal memory for their own written content (i.e, writing with a pen on paper, typing with a laptop keyboard, or using a virtual touch-screen keyboard).

When it comes to chores like drafting grocery lists, taking notes during meetings, and reading for school or work, people are increasingly using tablets and smartphones instead of traditional desktops and laptops. The tactile and haptic feedback provided by touch-screen (or virtual) keyboards sets them apart from standard computer and laptop keyboards in several ways. A computer keyboard's tactile and haptic feedback is more noticeable than that of a touch-screen keyboard's, which is limited to the (optional) slight vibration enabled by force feedback and, in addition, does not allow the user to feel any tactile borders (or edges) between individual keys. This is more of a point of emphasis. Within-subject design was employed to boost ecological validity of the study by employing three different writing

modes for each participant. With a ballpoint pen and paper or an iPad's touch screen keyboard, these included handwriting and typing.

Numerous researches have examined how writing method (both handwriting and typing) affects elements of memory retention, identification, and recall, particularly in the field of neurology Memory for letters learnt by handwriting and keyboard writing were compared in two behavioural tests, one for toddlers and one for adults (Longcamp et al. 2005). (Longcamp, Zerbato-Poudou, &Velay, 2006). (Longcamp, Boucard, and et al., 2006). Both studies found that those who learned to write by hand subsequently had greater memory and visual recognition than those who learned to write on a keyboard. For the first time, fMRI results from Longcamp et al. (2008) showed that processing handwritten and typed characters' orientation did not depend on the same brain regions as in earlier studies. Many areas of the brain involved in visualising and executing actions, such as the left Broca's area and the bilateral inferior parietal lobules (IPLs), were more active in the handwriting condition than in the other conditions (Longcamp et al., 2008). It's likely that the sensory-motor actions involved in writing by hand lead to the ultimate recall of the character's form and/or orientation (Longcamp, Tanskanen, et al., 2006; Mangen&Velay, 2010).

Every one of these findings has something to do with the ability to recall single letters or character combinations. Single-letter memory may have limited ecological value for many everyday writing activities connected to functional memory or learning outcomes, and this may be the case at all levels of development. Only Smoker and colleagues (2009) have taken this line of investigation a step further by investigating possible links between writing modes and word-level memory. An experiment in which participants were asked to recall and recognise words that had either been written down by hand or typed on a computer keyboard was published in Smoker et al(2009) .'s Journal of Experimental Psychology: General. For the purpose of this investigation, the researchers conducted a between-subjects experiment in which 61 people participated. Handwriting on paper and typing on a standard computer keyboard were the two writing modes, with the keyboard condition being a regular computer keyboard. On a printout (in the case of handwriting) and on the left hand side of a computer screen (in the case of computer use), participants in both situations saw identical words (taken from the sixth grade Florida Comprehensive Assessment Test (FCAT)). Using paper

or a computer, participants were instructed to copy the words exactly as they were listed, writing them down next to the originals. The assignment had no time limit, and the logbook recorded every minute of time spent on it. A distractor task was assigned to participants after the display of the stimuli. As soon as the distractor task was done, the participants were encouraged to write down on a blank sheet of paper as many words as they could remember in order to show their memory. It wasn't long after they completed the memory exam that the participants were asked to complete an FCAT vocabulary recognition problem. A five-minute time limit was also imposed on the recognition exercise.

The effect of writing medium on the identification test was substantial in a research conducted by Smoker and colleagues (2009), which indicated that memory on the recall task was close to significance in favour of handwritten words. Study results show that people are more likely to recall the meaning of words if they have written them down by hand rather than typing them in, according to Smoker et al.

An important part of the current study is a direct replication of Smoker and coworkers' work, although the design is completely counterbalanced within participants. Using a mechanical laptop keyboard and a virtual touch keyboard, we test whether individuals can better recall words written as part of lists when they are written by hand rather than typed. To test these two possibilities, a new experiment has been set up.

H1: “Our first hypothesis was that superior free recall of words written by hand would be observed when compared to words written on a physical laptop keyboard and words written on a virtual keyboard on an Apple iPad.”

H2: “We also anticipated that results on the word recognition test would differ depending on the writing modality used, more specifically, that participants would recognise more words if they had written them by hand rather than using a computer or iPad keyboard to type them in.”

3. Method

3.1 Ethical standards

Participants were required to sign an informed permission form before participating in the study, which was authorised by the Norwegian Social Science Data Services (NSD).

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3.2 Participant and design factors

There were three writing conditions in the current study, and each participant was allocated to one of them. Students and teachers from a medium-sized Norwegian university participated in the study, which had 36 female participants. It was critical that all participants were fluent in Norwegian. According to the research, all of the participants had normal eyesight and hearing as well as no issues reading or writing. Thirteen people described themselves as "touch-typists," while three described themselves as "left-handed." When 36 individuals were utilised in a repeated measures design with three conditions, the power to detect a medium effect size (f = 0.25) was 0.9, according to a power analysis. Age, education, conventional keyboard typing speed (words per minute), keyboard experience (years), and touchscreen experience (years) are all shown here. Table 1 shows the results.

Table 1. Demographics, writing experience and writing skill

	Mean (SD)	Max, min	Median
Age	25.22 (7.98)	54, 18	22
Education	15.81 (2.70)	22, 12	15
Years of experience with keyboards	12.97 (6.19)	35, 4	12
Years of experience with touchscreens	0.89 (1.04)	3, 0	1
Age when started with keyboard writing	12.25 (5.32)	23, 3	12
Keyboard words per minute	61.00 (21.12)	118, 26	59

3.3 Instruments

We employed a word list paradigm to examine the influence of writing mode on a core cognitive outcome. Cognitive psychologists have long utilised word list learning to study episodic verbal memory (Tulving, 2002), a sort of verbal, consciously accessible memory for elements connected with events. To assess episodic verbal memory, we used word list learning in this study (Mayes & Roberts, 2001). Each step in the process of recalling what has been encoded and stored is regarded to be a separate component of the overall process of recalling previously learned knowledge (Mayes & Roberts, 2001). A larger demand is placed on attentional resources when subjects are asked to recollect the contents of a previously learned/encoded and stored word list than when subjects are presented previously learned

words and asked if they were old or new (Naveh- Benjamin, Craik, Guez, & Dori, 1998). When it comes to retrieval and recognition, the tactics used during encoding might have a varied effect (Tulving & Thomson, 1973). Consequently, the retrieval processes on memory as they relate to list-learning throughout various forms of writing were evaluated in this study by evaluations of both word recognition and free recall.

There were three word lists used for the listening-to-writing exercise. It had 28 words, all of which had a similar semantic context and were divided into three unique semantic groups. Action verbs (for example, "paint"), animals (for example, "dog"), and food were the three main subjects of the lists (for example, "avocado"). We identified a similar number of items with one, two, and three syllables in each category on each of the word lists. There was a 6-second delay between each word captured digitally and processed, resulting in each list lasting around three minutes in length (see below). A full picture was created by including all 28 target words and their corresponding distractor words on each recognition checklist. There was no rhyme or reason as to the sequence in which the items on the checklist appeared.

Technically-oriented gear

On a Dell laptop with Windows 7, a set of KOSS SB/45 headphones were used to record each of the three-word lists and play them again. Apple's first-generation iPad running IOS 4 and its notepad software with the default font type and size were used to build a touch technology keyboard. Dell laptop with a full-size keyboard was utilised for the physical keyboard condition, with participants writing in Notepad in Windows XP with the window maximised and Lucida Console 10 point typeface as the default typeface. For the handwriting test, an A4 notebook and a normal blue ballpoint pen were used. An in-built microphone was attached to a digital video camera, which was mounted on a tripod, for each session's video recording. This made it possible to evaluate the recall sessions in the future.

Procedures

During the experiment, participants were required to enter a list of words using handwriting, a real laptop keyboard, and an iPad virtual touch keyboard, all of which were dissimilar from one another in every way possible. Before the session began, each participant received a set of headphones to wear throughout the event. Upon entering the room, they were informed that they would be hearing a series of phrases read out loud. Participants were told to jot

down each word as soon as they heard it, one word at a time, as soon as they heard it. In each of the three scenarios, the same approach was taken. After completing the job of writing down all of the items on a given list, participants were informed that they would be asked to recall as many words as possible. Although participants were advised that they may use any approach to organise written words to increase memory and recall, such as establishing line breaks between each new word or organising words into columns or clusters while writing, they were also informed that they were free to do so.

Participants were instructed to scribble down the words that were read aloud to them while wearing headphones, then a second set of words was played back to them. Participant word lists were then put aside and participants were instantly asked to recollect as many words from the list as possible. To ensure accuracy, after each listening-writing session, participants were asked to check their written lists for the presence of the target and distractor terms. A lab assistant read aloud a set of target and distractor words for the recognition exam. There was a radical reversal of how writing strategies and word lists were provided across all disciplines.

When using a physical keyboard and writing by hand, participants should sit comfortably in front of the laptop and notepad. It was up to the iPad participants to choose whether or not to hold or place the tablet on a desk in front of them while they were doing the experiment. Participants were told to say aloud any and all words that came to mind as part of the free recall condition. As soon as they thought they could recall no more, the participants contacted the researcher and they were given an infinite amount of time to do so. People who recalled what they said and how they said it, as well as any interruptions to their mental process, were documented (words not in the list).

To test whether or not a participant recognised the words on a list of targets and distractor words, the experimenter read the list aloud to each participant. Participants were then asked to indicate whether or not each word in the list was one they had written down. To finish the task, the participant had to go through the process again for the other two writing technology conditions.

A speed typing exam (available at http://norwegian-speedtest.10-fast-fingers.com) was used to measure the participants' keyboard writing speed and whether or not they were touch

typists after they completed all three conditions. The participants were also asked to indicate how many years they had spent using keyboards and touch-screen devices in order to better understand their writing abilities.

Analysis

Using a signal detection technique to evaluate discrimination performance, the d' (d-prime) measure of recognition memory performance was produced by balancing the percentage of recognition hits and false positives according to the proportion of recognition hits and erroneous positives (Macmillan & Creelman, 2005).

We were able to assess if the data were normally distributed by doing the Kolmogorov-Smirnov test on a single sample. The following variables deviated statistically significantly from normalcy based on the Kolmogorov-Smirnov test: Handwriting data was negatively skewed, whereas data from the keyboard exhibited a flattened distribution and data from the Pad condition was right-skewed (p=.001; skewness: 0.721). When it came to recognition, the data from the Pad condition was right-skewed (p=.001; skewness: 0.721). Nonparametric statistics were utilised throughout the investigation as a consequence.

The omnibus analyses of differences between rankings in the groups for free recall and recognition were evaluated using Friedman's related samples analysis of variance. Planned follow-up samples were compared with related samples in each group using the Wilcoxon statistical test. Z-scores and the square root of N, as specified in Rosenthal (1991), were used to determine effect sizes (r) as published in Rosenthal (1991). (1991). We used a non-parametric Spearman rank-order correlation analysis to examine the relationship between a number of different performance metrics, such as memory, typing speed, keyboard usage experience, and the use of touch-screen technology. Mann-Whitney U tests were also employed to examine if there were any differences in memory performance between touch-typists and non-touch-typists. The data was analysed with the help of the SPSS 22 statistical software tool.

4. Results

“In Table 2 , we show descriptive statistics for free recall and recognition in the three different writing modalities:”

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Table 2: Performance

	Free recall		Recognition (d′)	
	Mean (*sd*)	Median	Mean (*sd*)	Median
Handwriting	15.33 (*4.67*)	15.0	2.91 (*0.56*)	3.04
Keyboard	13.89 (*3.64*)	13.0	2.78 (*0.51*)	2.79
iPad	13.64 (*4.54*)	12.5	2.67 (*0.78*)	2.72

sd: standard deviation;
d′: d-prime

The only statistically significant omnibus group difference was seen for free recall (p.049). Free recall was considerably better in the handwriting condition than in both the keyboard (p =.024, r =.37) and iPad (p =.050, r =.32) conditions, as well as in the iPad condition. According to our calculations, both of these impact sizes (r) are of medium importance (Cohen, 1988). A lack of statistical significance and a lack of indication of a potential trend toward significance were observed by researchers in their study.

Spearman rank order correlation analyses were used to assess if keyboard or touch technology skill/experience was linked to the free recall effect. Memory for lists produced on the iPad touch screen and years of experience with touch displays (rho =.329, p =.005) were shown to have a positive connection (rho =.329). There was no correlation between years of keyboard experience, writing speed, or age at which one first learned keyboard writing (rho = -.049, p =.785), and recall for lists produced on the standard keyboard. Neither touch-typists nor non-touch typists (N = 23) showed any difference in the ability to remember words input on the keyboard (Mann-Whitney U = 138, p =.721).

5. Discussion

Writing by hand is linked to better free recall of written content compared to text generated by traditional keyboards on computers and virtual keyboard devices, such as those found on iPads. The study's hypothesis 1 (H1) is supported by this finding. No differences in word recognition ability were seen between writing techniques, contradicting our second hypothesis (H2) on recognition memory. So our findings are incompatible with the fundamental idea that keyboard writing (whether on a virtual or traditional keyboard) diminishes or worsens memory for the material that is typed. However, our findings imply

that handwriting may have certain cognitive benefits that are not totally preserved when writing on a computer for aspects of word memory. It is impossible to provide a definitive explanation for the observed pattern because the study was exploratory in nature; however, drawing on relevant empirical and theoretical research on similar aspects of writing, the following speculations are offered in an attempt to shed some light on our findings. As a result, they might serve as a starting point for further studies.

However, our findings only partially duplicated those of Smoker et al. (2009), who indicated that writing mode influences episodic memory. When it comes to writing mode, however, there were only statistically significant impacts on recognition and memory in the Smoker trial. Furthermore, years of expertise with touch screens were linked to better memory recall on the iPad, but competence and experience with traditional keyboards were not linked to greater memory recall for word lists generated on conventional keyboards. Participants' level of automaticity, albeit solely in the touch keyboard input mode, may have had a role in the outcomes based on the positive connection between lists generated on the iPad touch keyboard and years of familiarity with touch keyboards. According to our findings, several participants in our study had less than a year of experience writing on virtual keyboards while having at least four years of experience writing on conventional keyboards. It's likely that the lack of experience with virtual keyboards contributed to this conclusion, to put it another way. It is possible that participants' expertise with touch keyboard writing allowed them to rehearse (orally; quietly) prior words throughout the trial, explaining why there was an impact of experience in the touch screen keyboard condition but not in the traditional keyboard condition A touch keyboard has no tactile feedback to help distinguish between distinct keys, unlike a regular keyboard, which has tactile feedback to help distinguish between keys. Force feedback is another common feature of touch keyboards (in the form of vibration). Knowledge of and experience with a virtual keyboard that offers force feedback may contribute more to automaticity of skill and, as a consequence, reduced cognitive load than knowledge of and experience with a normal physical keyboard, according to the research on cognitive burden.

The results of this study should be taken with a grain of salt; more empirical research comparing the cognitive consequences of different keyboards will assist in better

understanding the possible impact of haptic and tactile affordances on sensorimotor and cognitive processes while writing. Aiming to better understand the processes at work, future studies in writing should look to untangle the precise correlations between various components of cognitive processing, such as cognitive load, sensorimotor affordances of the input mode (i.e. writing modality).

Even while our results do not support H2, there are several possible explanations for our findings that participants were able to recall more words written by hand on paper than those typed on a laptop or iPad keyboard. One possible explanation is because writing by hand requires a different set of sensorimotor/graphomotor processes than writing on a keyboard. There must be a graphomotoric process of creating the shape of each letter from scratch while writing by hand in order to finish a phrase. This process is known as graphomotorics. Handwriting may have allowed for a more comprehensive encoding of the words into long-term memory, which may have resulted in an enhanced free recall as measured by the free recall test in our experiment. Smoker et al. (Smoker et al., 2009) observed that participants in the handwritten condition performed better than participants in the keyboard writing condition, and this finding is comparable in some ways. Using one-way ANOVA to see if memory was better for handwriting or typing, Smoker et al. (2009) found that memory on a recall task approached significance for handwritten words where the present study found a significant difference between writing modalities in favour of handwriting on the free recall measure and no significant difference for recognition (see their table 1 for details). Combined, these studies suggest that the embodied character of handwriting can boost memory in a number of different ways. When words are formed by hand, a stronger memory trace may be underpinned and contribute to better recall due to the kinesthesia contained in the sensorimotor process. But this does not explain why there was no difference in recognition performance between handwritten and keyboard writing in the current study.

Writing by hand differs from writing on a keyboard in the relationship and combination of sensorimotor input (i.e., the [physical] act of writing) with the visual feedback that results from this input. This may be one further explanation for the higher free recall of words written by hand on paper. When writing by hand on paper (or any other material substrate), the point of inscription, which is the tip of the pen on the substrate's surface, is typically the

focus of visual attention. Handwriting leaves a "imprint of action" or spatial-temporal continuity between sensory and motor action and (audio) visual output (Longcamp, Tanskanen, et al., 2006). Such an integration of spatial and temporal information in both location and time is likely to lead to increased cognitive processing, which will ultimately improve elements of memory and recall. Writing on a keyboard, writers may vary between focusing their visual attention on the keyboard (and, therefore obtaining visual information from the characters on keys) and focusing their visual attention on the screen, depending on their level of automaticity or proficiency. Because their visual attention is mostly focused on the computer screen, which is a different area from their "motor area" it is likely that they are proficient keyboard writers (i.e., the keyboard). Keyboard writers may receive visual feedback about their haptic and tactile input that differs from the feedback provided while writing with a pen and paper in terms of kind and level of detail. Cognitive tests may demonstrate a deterioration in the solid mental representation of letters and words as a result. Nevertheless, it's conceivable that separating the sensory input's visual manifestation (the screen) from its motor domain (the keyboard) leads to less spatial information rivalry between the two areas, resulting in a better mental representation of the input. There is no reason to believe that these possibilities can explain why the benefit of handwriting was shown solely when it came to free recall rather than word recognition ability.

The usage of colour is another potential consideration from an aesthetic standpoint. While typing, keyboard writers' visual attention is divided between the text they are creating and the keyboard they are using. Keyboards distinguish between "motor region" (or input area) and "visual presentation area" where letters are shown from a visual-spatial point of view; the keyboard has both) (the screen; or output area). There are less visual and sensory inputs about the writer's writing process while utilising a keyboard, which may result in less accurate mental representation of the text being typed. When writing on a computer rather than a pen and paper, some experts believe that this separation causes the writer to interact with the written text less and as a result, they have a lower visual memory of the word.

Individuals differ in how long they spend staring at the keyboard as they write. When writing, some people pay more attention to the keyboard than the words on the page because they have undergone touch-typing instruction or because they regularly switch between gazing at

the keyboard and the computer screen when they are proficient at typing. We discovered that being a self-described "touch typist" has no impact on the ability to retain information. Our findings become less consistent with visual feedback as an explanation. In future investigations, eye movement tracking might be employed to determine the impact of visual information on memory and retention. This would be a good way to explain things.

Last but not least, it is important to keep in mind that the current experiment participants were adults with previous writing experience in both languages. Most of them were taught to write by hand rather than via the use of a computer. Some schools are now using digital tools instead of or in addition to conventional handwriting instruction in order to teach students how to write. More and more youngsters are writing on their computers rather of writing with a pencil and paper outside of school. It's possible that having participants who were "keyboard-first" authors in a study like the one under discussion might have yielded different results. Some intriguing discoveries have been discovered in Chinese studies of children despite the fact that research on this area is still scarce, particularly in terms of longitudinal studies of children whose language and writing system are comparable to those of the current study (i.e Norwegian). Rather than learning to read and write in the traditional logographic style, Chinese schoolchildren are increasingly using pinyin-based electronic devices. With the exception of the visual qualities of logographic Chinese letters, Pinyin is a system that connects phonemes with English alphabetic symbols. Chinese children's capacity to learn to read would be harmed, according to Tan et al. (2013). Authors evaluated primary school students in three Chinese cities to see if they were able to read Chinese characters using a pinyin input technique and observed that the overall incidence rate of severe reading difficulty looked to be substantially greater than previously reported. Using digital writing tools in conjunction with the pinyin input technique appears to have a significant negative impact on Chinese children's reading performance: The interference with Chinese reading acquisition, which is characterised by fine-grained analysis of visual features of characters, pinyin typing appears to be damaging in itself. Children's reading skills increase when they practise handwriting, though. A study by Tan and coworkers (2013, p. 1122) The capacity of Chinese youngsters to recognise characters will almost certainly be harmed more by the use of a keyboard than by studying an alphabetic language. This is due to the fact that the former necessitates a more complex and detailed visual-spatial mapping and more repetitions than

the latter. The question of whether replacing keyboard writing for handwriting for children whose linguistic system is alphabetic rather than logographic is an important one to examine.

6. Conclusion, constraints, and future outlooks are all addressed in this section.

The following are some of the study's shortcomings. If a ceiling effect is to blame for the absence of changes in recognition conditions, it is plausible that this is so. An even greater negative skewness of -1.02 indicates that this ceiling effect was particularly prominent in the handwriting condition, suggesting that true differences in recognition across the three recognition modalities may have been concealed by this effect. Using non-parametric statistics further weakens the statistical ability to discover actual differences since the ceiling effect covers such differences and reduces their significance. A drawback of the study is that only the encoding conditions were changed in terms of modality. Since the encoding and retrieval circumstances were not compatible, we did not explore the encoding specificity principle, but rather evaluated all memory performance using an oral report (i.e. no oral recital of the stimuli). As a result, the research doesn't look at how different modalities connected with encoding affect memory or recognition. Our findings might have been influenced by the use of visual feedback, such as looking at a growing list of words written down and memorising them. We may reasonably assume that participants in the two keyboard writing conditions had more time to memorise their lists than participants in the handwriting condition while writing in the two keyboard writing conditions... (where the writing process takes longer, hence leaving less time for visual memorization of written words). Because we didn't account for "time on task," this is something we'll look at more in future studies. The participants in this study were also adults with prior experience in both written and oral formative forms of written and spoken communication. Therefore, our findings do not necessarily apply to children and novice writers, nor do they apply to handwriting or keyboard writing in general. For this experiment, we don't know if it would have been different if the participants had learnt to write on a keyboard instead of by hand. Because various writing forms have varied affordances in this regard, our study has another possible flaw: that we didn't control for spatial organisation when respondents wrote down the lists. However, just one person ordered words geographically according to their semantic significance when writing. Every other person only wrote one word per line. For this reason,

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it is plausible that working memory effects may have been present when all recall procedures were completed within a few hours of encoding.

As the writing process becomes more digital, it is important to recognise the importance of writing devices and the substrates on which they are written in the act of writing (e.g., paper vs. screens). Even while writing requires delicate finger and hand motions that are intertwined with attention, perception, and cognitive processes, it is also a tool-mediated talent. There are major differences between writing by hand and typing on an electronic keyboard when it comes to sensory motor and kinesthetic awareness. Results from this study show that it is crucial to analyse the function of sensorimotor and kinesthetic processes involved in writing since these processes differ considerably between handwriting and keyboard writing. Subjects were able to recall more words that they had written by hand when compared to both the iPad touch and laptop keyboard conditions. This study shows that different technologies may alter cognitive results in different ways when it comes to writing, as seen here.

In order to better understand how digital technology affects writing's cognitive components, further empirical study is needed. Material and ergonomic elements such as the interaction between sensorimotor execution and psychological processes, as well as the cognitive outcomes of distinct writing modalities are critical to consider when building writing technologies, according to our findings. The better performance in the handwriting condition in this study is not attributable to the fact that people had grown up learning to write with a pen and paper rather than a computer keyboard, according to the findings of this study. To determine whether or not this is a generational issue, or whether something more basic, less time-limited, and age-specific is at play, there is a need for further empirical research, particularly longitudinal research including children and young people.

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7

Perceiving Genre with Special Reference to the Academic Writing

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Abstract:

This study uses innovative computational rhetorical analysis tools to investigate the use of citations in a corpus of academic articles. As a result of genre theory, our study uses graph-theoretic diagrams to extract and amplify expected patterns of repeated moves that are linked with stable academic writing genres. There is evidence to suggest that our computational strategy is as good as qualitative researchers who code by hand, such as Karatsolis and colleagues, in properly detecting and classifying citation movements (this issue). Pairwise comparisons of advisor and advisee texts reveal further applications for automated computational analysis as formative feedback in a mentoring scenario.

Keywords: Citation, computational rhetoric, rhetorical moves, text processing

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1. The Challenges of Learning Academic Genres That Are "Always Customized." 2.

Academic writing has a strange contradictory aspect that, when studied, explains why so many of us who aren't experienced writers have trouble finishing our projects, as pointed out in Pare's (2015) work on academic genres. Most importantly, the ability to create certain sorts of messages on a recurrent basis is available for certain types of texts. According to RGT, however, every occurrence of a certain academic genre has a "always custom" aspect, which undermines the concept that stable textual patterns will form as a result of recurrence. Pare. With Bakhtin mentioned, Pare shows that while the conditions under which some texts appear and recur may be generally stable, the precise conditions as well as the uniqueness of each writer enable or require that each text be distinct from the others. In the first paragraph, there is no indentation of the material.

By implying a certain distance between the genre, which is typically used in rhetorical genre theory to signify the social actions from which textual regularities emerge, and a genre instance, which is the single text that emerges from the distinctive social exigencies associated with a particular genre, RGT anticipates this "always custom" nature of genres. Learning and teaching are made more difficult by the fact that there is a wide range of variation within the same genre. Advisors and advisees also have challenges because of this. To be able to write in a new genre, you'll need more than simply grammatical accuracy. To be effective, it must be able to execute all of the genre-specific rhetorical manoeuvres flawlessly. Consequently, the meanings of the terms may alter significantly from time to time.

When it comes to RGT, maybe the most important lesson is that the repetitious texts we assign or analyse are simply the centre of much larger trajectories of stereotyped activity (A-91). When textual conventions are seen as a part of and in some cases a part of social relations by Pare's reading, this can be extended by pointing out that where there are repetitions at the textual level, these can be understood as signals shared by author and reader about the social activity (genre) with which they are cooperating. There is a wide range of information that is repeated, from whole chapters to only a few sentences. That being said, it's not just as simple as saying the phrases over and over again. A comparison of the same

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author's work in two different contexts may reveal that she has changed the wording but has produced a recognisable (albeit customised) example of the genre in both cases.

For this reason, it can be incredibly difficult for students to identify the "genre signals" that are connected with a certain type of writing in order to generate an example of a genre. It's possible that as instructors, we're making things more difficult for our students if we don't urge them to write about the kinds of situations and texts that are necessary in the larger discipline or community that they're hoping to join.

2. Analyzing Academic Writer Citation Patterns for Genre Signals

Using computational methodologies, we evaluate the possibility of creating a supportive environment for advisor-advisee mentoring in the area of academic writing and report our findings in this work. Pare's concern area is one that we aim to investigate and offer content that will benefit both learners and those assisting them in their endeavours. There are two key analytic passes that make up our approach: First, the texts in the corpus are treated as strings by text-processing algorithms, which means that they are no longer treated as individual words but rather as lists of words. Analytical methods such as word frequency and adjacency can be used when we approach the text in this manner. This is a huge step forward in the recognition of the importance of words in transmitting critical information.

We are seeking to find genre signals, which are often repeats of words or word combinations, that correlate to essential structural components, such as those that we may ask human raters to identify in a qualitative examination of text in the first pass. Repetitive social action (RGT) holds that generic expressions are fundamentally instances of repeated social action and that, in general, genre stability as indicated by regularised textual form arises from habitual responses to recurring social exigencies. During the first analytic pass, we are guided by RGT (Miller, 1994). As stated by Schryer (1993),

A more basic coding system than human raters would use is the result of our initial analytic run, yet it can sometimes provide results that are comparable to those produced by human raters themselves. Do you know how to go about accomplishing this? Often, it is because we uncover a consistent structure that might serve as a signal for a larger framework or a more subtle "rhetorical move" in the future (Swales, 1990). By recognising instances of propositional hedging, the endeavour to adjust claims to fit the weight of existing information

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that is so distinctive of scientific thinking, we can consistently define speech sections of various lengths as "science" or "not science" as we have shown (Swales, 2014). If a human reader would arrive to the same conclusion, it would not have done so by reading the same context signals or focused on similar details as a Hedge-o-Matic (Omizo& Hart-Davidson, in press). To put it another way, it's looking for a "key protein" in the complex molecular structure of scientific discourse. As long as the protein concentration is high enough, it can make a determination. Consistency in scientific discourse, not in the conventional textual sense, but rather in the manner Bakhtin (2010) conceptualises "speech genres" may be linked to Hedge-success. o's (see Bakhtin, 2010). Propositional hedging is essential to scientific discourse, and neglecting to use it is tantamount to breaking the social contract.

However, a second analytical step beyond the first text analysis is necessary for the Hedge-o-Matic to provide the results it produces. A graph is a collection of nodes that are connected by connections between nodes in this second stage of transformation. When we turn text into a graph, we open up a whole new set of analytical possibilities. There are more than just words on the graph now; there are also edges, which show the connections between those words. It is possible to understand not just the features of individual nodes, but also how they interact with each other and the overall structure of a network, using graph analysis tools. So, for example, it is possible to evaluate whether a particular phrase has a hedge move, but the Hedge-o-Matic also has the ability to identify hedges which are near a major statement in terms of the graph as well as its semantic content

The way we prepare the texts for analysis has a considerable influence on the results of both analytical passes. For these manoeuvres to work, interpretative work has to be done, guided by both the broad theories of genre and more particular ideas or hunches about the kinds of structures we seek to identify, isolate, or enhance. As an example of rhetorical structure theorization, the act of preparing texts for analysis can be viewed as a sort of pre-analysis. Instead of writing an exegesis from the beginning to the end, analytical "recipes" for discovering interesting rhetorical manoeuvres are being created. Consequently, we go into considerable detail about how we do our analysis here. It is not enough to just share our approaches with people who may find them beneficial; rather, we do so in the same way that we would in other sorts of rhetorical reasoning about texts.

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Searching for Citation Moves in the First Analytic Pass

Using Karatsolis's qualitative coding method in this case with human raters to provide a computer analysis of the data is just too complex and intricate. As soon as possible, we had to devise a more clear plan. It was our goal to find out what kind of signals would be present in the corpus that could perhaps explain the perception of citation kinds by humans. Here, we'll explain in further detail how we came up with an alternative qualitative coding system.

Analytical techniques like those of our colleagues were developed to focus on more than one word or lexical item at once. Swales' (1990) idea of "rhetorical motions," commonly considered as significant patterns of speech within a specific genre or discourse community and performing crucial signalling roles, is what we were seeking for. Additionally, a text's rhetorical gestures reveal something about its position as an attempt by a given audience, in this case, readers of academic research papers, to respond to a recognisable type of urgency. A frequent example of this is the assertion of a claim, which is usually a new assertion of fact. To ensure that readers understand the author's unique perspectives and contributions, claims of truth are scrutinised carefully. ... Statements that explain evidence and hedges that qualify assertions based on the quality of the evidence are prevalent in science writing. We may see this in the form of textual regularity, which is a result of Miller (1984) and others' conception of genres as a sort of social activity that grows more stable through time and as genres become more stable.

Citation patterns are commonly blamed for part of this signalling activity, according to widespread consensus (Geisler, 1994; Prior, 2013). One of the most notable differences between our approach and that of our peers is that we are interested in developing assistive technology for both authors and text readers. Because of the speed and accuracy of these technologies, more junior members of a field may be able to learn from and collaborate with more senior members of the same subject.

Using the following questions as a guide, we began our data exploration:

What follows are some of the questions answered:

Classification patterns in citation moves that contribute to genre stability can we uncover evidence of? And can these patterns be accurately and consistently identified with the writing

cohorts from which samples are derived (for example, experienced authors vs more inexperienced ones)? B.

b. Is it possible to create categories that will allow us to compare Karatsolis' findings with our own?

c. Is it possible to create analytic data that, if accurate, may benefit the advisor/advisee dyad for reasons such as academic mentorship or other comparable objectives?

Creating a Simplified Citation Analysis Coding Scheme

Since the beginning of citation analysis as a scientific field, there have been several proposals for qualitative citation classification schemes. Schemas that helped speed up search and retrieval might also be considered rhetorical in nature because of their intent to convince. By way of illustration, Moravcsik and Murugesan (1975, p. 3) have devised the following four-part taxonomy of in-text citations: (for an empirical application of the following categories see Cano, 1989). 1 Using six categories of in-text citation categorization, Chubin and Moitra (1975) propose a revised version of the Moravcsik and Murugesan (1975) typology in an attempt to measure the influence of a scientific paper on the growth of a discipline (in this case, high energy physics). The Chubin and Moitra (1975) method lays forth guidelines for how a research paper's claims and conclusions interact with the broader body of knowledge. Rules for academic writing may include the reference of relevant material that is crucial to the comprehension of the present piece and the denial of rival ideas in the subject of scholarship 2

There are two forms of in-text citation: communicative incentive systems and rhetorical ones. to acknowledge the intellectual property of the field in which they're employed, in-text citations can be used in this scenario (see Kaplan, 1965). The use of in-text citations as a rhetorical strategy to promote acceptance of the cited work is known as rhetorical citation. The value of a reference to the referring newspaper may be measured by categorising it into one of nine categories proposed by White and Wang (1997). A mix of in-text citation content description and/or a rhetorical manoeuvre can be used to describe this. For example, White and Wang (1997) defined the Analogy/Contrast/Comparison category, which suggests an act of interpretation in which the referenced authors compare and contrast their work with another. When a referring article uses data from another research source, the category of Data

shows that the material was sourced from another source. 3 For the categorization of in-text citations to be successful, it must be handled as a supervised machine learning problem, which means it must be solved using a set of training data. Also discussed are 12 functions for labelling in-text citations based on the contrastive use of references by the referring publication and the positive or neutral valence of the reference's use by the referring work (p. 104-105). Textual components, such as parts of speech and metadiscursive phrases, were incorporated into their training data as well as their classification algorithms in order to enhance their classification methods.

The results of our investigation led us to classify in-text citations into four distinct categories: extractions, groupings, author(s) as actors, and non-citations. Extractions: A large part is due to our initial exploration of data from the Springer Open Journal archive, which is constrained by Harvard-style citation rules and Springer Open mark-up templates used in the presentation of research articles, and which we discovered during our initial exploration of data from the Springer Open Journal archive. Springer Open Access journals were screened for 505 research papers to create our categorization method. All of these publications are peer-reviewed and adhere to academic genre standards, such as the IMRaD format, which is often used to structure scientific and social science journals (see Christensen and Kawakami, 2009; Hannick and Flanigan, 2013; Salager-Meyer, 1994). The article's meta-data (authors' names, publication dates, affiliations, and document object index) were scraped from the original source document, as were the article's entire text without pictures and the works cited list. Using the Springer OpenAccess filtering tool, only articles classified as "Research Article" were taken into account for this exploratory study.

This benchmarking project has two objectives in mind. We ran a series of experiments to see if our categories could account for every potential sentence type that may be found in an academic research publication without the requirement for subject expertise. A corpus of 505 research articles from Spring OpenAccess served as the basis for this study. By using this corpus, we could optimise the syntactic and argumentative signals that each sentence in a research article could provide for computation, while also reducing the likelihood of overlap or ambiguity between categories and the requirement for domain-specific knowledge of sampled journals. Moravcsik and Murugesan (1975) show how domain knowledge may be

employed in a coding situation involving the type 3 category, development of juxtaposition. While a non-expert might be able to tell that "Our study builds upon the work X" or "Our study varies from X in the following respects" without metadiscursive clues, a decision between evolutionary and juxtaposition may be more difficult in the absence of metadiscursive signals." Because Moravcsik and Murugesan (1975) and Cano (1998) both use type 1 perfunctory citations, it's important to have a solid grasp of the subject area before making such use of the citations consistently (1989). Because the inclusion of a reference might be interpreted as rewarding a colleague while still being considered as rhetorically fitting to the argument, the reward system proposed by Cozzens (1989) may induce conceptual ambiguity This research and most other computer techniques lack an interview, which is necessary to hypothesise about the writer's intents because of the idea of reward. Most other computational approaches also need us to move above the lexical level (similar concerns are raised in Teufel et al., 2006).

Second, we were able to create a sentence parser that automatically distinguished between citational and non-citational sentences and then sorted these phrases into more specific categories based on lexical information using the Springer Open Access corpus. We didn't utilise our sentence parser to code the sentences from Karatsolis' data, but we expect that it will be useful in the future for other applications that need processing of bigger volumes of text.

The "shallow analyzer" method provided by Marcu et al. motivated us to build a lexically-driven yet rhetorically informed coding system (1997). Pre-marked cue phrases with specific grammatical functions and rhetorical applications were gathered by Marcu (1997) in an effort to scan natural language texts for their rhetorical purpose. Cue phrase "Although," for example, can be used to break up the text, but it can also be used to make concessions because of the limited use of it in English. To make an argument more compelling, it is common to use a trigger phrase like "yet" (Marcu 1997 p. 101). (Marcu, 1997, p. 101; Marcu, 1997) Our coding approach considers all four citation types to be relevant in their lexical differences, even when phrases like "despite the fact that" and "despite the fact that" help to delimit the alternative rhetorical readings of a sentence. Even in the lack of further context or intertextual information about the author, the presence or absence of an author's name in a

phrase is regarded to have significance within the sentence itself. With our coding system having limits, we feel that classifying citations into four categories can give important information on academic writing citation practises, as well as a horizon line between material from mentors and those of their protégés. First, we'll go through the requirements and rhetorical contributions to the subject for category 1.

4.1 Extractions

Excerpts include in-text citations that provide a concept from another source without explicitly referencing that source. A parenthetical reference is a frequent example of a paraphrased idea from a source that is attributed to the source. Kemner et al. (2015) claim that stress and diathesis interactions are prevalent explanations for psychopathology's emergence (Monroe and Simons [1991]). Using conventional citational parentheticals to emphasise the material from Monroe and Simons' piece is no longer the preferred method of underlining their work as active agents in the study of contemporary research. Motives for making this shift include wanting to build one's own voice as a specialist in a certain topic or developing one's own personal style (e.g. a choice to describe conclusions as facts rather than narrating research as a process). According to Swales (1981) and Swales (1982), the reference of Extraction falls within the category of "non-integral citations" (2014). There are two ways to credit a referenced author in these citations: in parentheses or as a number index.

4.2 Groupings

An example of this type of grouping is the phrase "in-text citation phrases that include three or more sources within a parenthesis or brackets" The following from Kemmer et al. (2015) serves as an example:

Of particular note, several studies have found that having previously experienced depression or another mood illness to be an important risk factor for future recurrences of those conditions (Judd et al. [2008]; Keller et al. [1983]; Perlis et al. [2006]). The in-text reference from Kemner, et al. (2015) is categorised as Grouping in this case study because it refers to three sources that have uncovered evidence that significant life events/difficulties affect the emergence of unipolar depression and bipolar diseases. "Parenthetical plonking," or "nods all around to past scholars," is what Swales (2014) refers to as "Grouping," a rhetorical strategy he employs (p. 135). On the other hand, "plonking" or "grouping" strategies are viewed as

attempts to synthesise a range of individual findings that are consistent around a larger issue. We feel that this method, used by researchers such as Kemner et al. (2015), acts as a condensed literature review since it allows them to exhibit their knowledge of important sources while also showing their connection to a broader network of academics studying mood disorders. There is another example that may assist to understand their thesis more clearly provided by Kemner and his colleagues (2015):

Also found in earlier research by Bender and Alloy (2011; Hunt, et al., 1992) and Kessing et al. (1998), however it was proposed that these occurrences may be linked to the syndrome itself (Bender and Alloy [2011]; Kessing et al. [98], [2004]). (Hunt et al. [1992]; Kessing et al. [1998], [2004]). Researchers have found that (Kessing et al. [2004]).

The authors of this specific study are looking at the history of studies that are comparable to their own and that both confirm and differ from their own findings. Leighton (2014), for example, utilised what we term a Grouping in-text citation to gloss whole fields of research through parallel references in the Journal of Evolutionary Education and Outreach.

Since the dawn of time, scientists in all fields have been concerned with the protection of public assets (Hardin [1998]; Boyd et al [2003]; Bowles [2006]).

As previously indicated, the parenthetical list is supposed to reflect an overall theme or concern with each reference in the list. This list is used to find current research in relation to a certain group of academics within the field of study, which is how the Grouping categories obtain their grammatical grouping of sources in a parenthetical list. Swales and Najjar's "construct a research space" (CARs) strategy might support such a shift (1987). For producing research article openers, Swales and Najjar (1987) established a four-step process. A research article's introduction typically includes four sections: (Move 1) signalling to the reader the importance of this research; (Move 2) summarising relevant prior work in the field; (Move 3) indicating an insufficiency in prior work; and (4) explaining how the present study will address current gaps of knowledge (1987, p 178- 179). Swales and Najjar's moves 2 and 3 may be considered a way of "creating research space." in our study's Grouping category by conveying information to the reader in one sentence.

Extractions and groupings are both considered non-integral citations in Swales' (1990) definition since their basic ideas overlap considerably. Extinct ideas can be identified in the

author's argument by looking for proof in a parenthetical line that includes a summation of study and several references. The ratio of summarization in the argument is one of the distinctions in rhetorical value. A single line from one or two sources indicates that the source has been less filtered or homogenised, emphasising what particular agents are saying in relation to the present piece's theme. More than one source is needed to make a single statement on the present article's subject matter, whereas a single source is needed to make a statement about a single subject matter. Another approach to distinguish between extraction and grouping is to see them as actions of enrolment. Every citation is, in the end, a way to collect data from a variety of sources. When evaluating enrolling for our purposes, we look at how prominent it is in the context of the phrase. Three or more sources included in parenthetical notes demonstrates a wide breadth of interest in a given subject and shows the present writers' current effort in learning about other voices in the area. If you use an Extractions in-text citation instead, you'll have more room to draw attention to your engagement in the source material.

The Author as an Actor (or Authors) (s)

To use the term "actor" in an in-text citation, the author of a piece of cited research must either be the subject or object of the sentence in which they are cited, the subject or object of subordination in which they appear, the source of a direct quotation, or the subject of a possessive contraction linking the author's name to a piece of cited research. In-Text Citations Author(s) and Actant(s) A date of publication reference in parenthesis or a bracketed number reference in brackets must accompany these in-text citations. This citation style, which Swales coined the term for, might be seen as a more condensed form of the "integral citation" style, which was originally characterised as (1990). This syntactic pattern is used by Thompson and Ye (1991) in their research of so-called "canonical" citational forms, which contains the proper name of the author followed by a year in parentheses or brackets, which functions as either the subject or the object of the phrase.

No date of publication or pronoun attributions are taken into account in the Authors as Actor category. "They further contend that," for example, is not recognised as an Author(s) as Actant(s) citation by this coding approach; instead, the sentence pattern is classed as a non-citation. "I" and "us" pronouns are used in extractions, which appear to be full citations,

although they are not. "(see Smith, 2007)," would not be categorised as an Author(s) as an Actant(s) citation type since the source is subordinated inside the sentence by a parenthesis. On the other hand, the "see" author suggestion is incorporated into the text's main argument and is classed as an Author(s) as Actant phrase (s).

This example from Keown-Stoneman et al. (2015) shows a circumstance in which the author of a work that is being referenced becomes the subject of the sentence: ""

Among this high-risk group, Duffy et al. ([2010]) hypothesised that some psychopathological signs may be precursors to the onset of bipolar disorder.

"Duffy et al." is the subject of a sentence when it refers to a theory concerning the likely causes of bipolar disorder that they "proposed" In this perspective, Keown-Stoneman et al. (2015)'s research space includes a diegetic dimension in which the referenced authors act or are acted upon at the sentence level.

In Keown-Stoneman et al. (2015), an example of an Author as Actors in-text citation can be found, where the referenced author is the subject of the predicate.

Detailed information on the collecting processes is available in Duffy and colleagues ([2007]).

Authors Keown-Stoneman et al. (2015), for example, indicate that more study has been written about by Duffy et al., meaning that Duffy et al. has carried out their own investigation. For example, "Duffy et al. ([2007]) provide a more extensive description of these procedures," becomes "Duffy et al. ([2007]) offer a more detailed description of these approaches." in the passive voice citation above.

Example: A statement from Correa-Bahnsen-et al. (2015), wherein each author is a subordinate clause, provides as an instance of in-text citation in which the named authors appear as subordinate clause objects:

Afterwards, we looked at the results of a cost-sensitive logistic regression (CSLR), which was calculated according to the literature's default parameters (Correa Bahnsen et al [2014a]).

When Correa Bahnsen, et al. (2015) allude to an article in which they provided methodologies for a cost-sensitive logistic regression, they are referring to a previous paper in which Correa Bahnsen, et al. were successful in their endeavours. As a result of journal

markup, the parenthesis are disregarded in this example, and the listed authors are assumed to be the object of preposition "in" in the following phrase.

According to Thompson and Ye, the use of an author's name in conjunction with a reporting verb like "display," "confirm," or "give" is an act of interpretation (1991). The writer's attitude toward the given information is shown through these actions of interpretation. The orientation may be used as a reward mechanism to recognise the achievements of the cited author, or it may be used as a punishment mechanism if there is agreement or disagreement between opinions or facts (Charles, 2006 p. 322). According to Paul (2000), naming the author(s) of a reference is a reflection of the source's significance in the field. There are two options, according to Paul, if there is no number or parenthetical reference: (p. 199). Authors' names serve as a convenient cue for readers to focus their attention on a certain passage. Their works, Thompson and Ye (1991), Paul (2000) and Charles (2006) are all built around a core of assessment that serves as the basis for their nomination instances. There are a lot more textual features involved in these evaluations than our coding technique can handle. It is important to analyse the type of reporting verb employed in a favourable, negative, or neutral assessment (Thompson and Ye, 1991 p. 372). The polarised valences of "oppose" and "agree" would be inverted in the citations "We oppose Smith (2000)" and "We agree with Smith's (2001) findings." Our coding method, on the other hand, only takes into account how a verb functions in relation to a given author, rather than the type of verb. Do you think our curiosity was sparked because we were introduced to specific practitioners in the area by referring to an author as a topic or object of an activity? Authors can then use this rhetorical move in both a positive and a negative way, thereby affirming or extending related work while also complicating or challenging it. This results in an entirely different kind of engagement with the source material than is possible with the Extraction or Grouping citation types.

4.4 Non-citations

This category is for sentences that don't fit into the Extraction, Grouping, or Authors As Actants citations. As an example, attributions that use a pronoun in place of the named agent and do not contain a parenthetical date or a parenthetical with the name and date or a bracketed numeric reference fall under this category.

Following our coding method, it is logical to assume that typical attribution activity, especially if it is an extension or enlargement of an earlier attribution, is classified as non-citations by our categories. Due to limitations in the shallow parsing tool and an effort to eliminate subjective coding decisions, this elision was made. Citational incursion, in which writers are signalling their compliance with research standards and signalling additional arguments, is the sort of behaviour we are seeking to capture using shallow parsing and network graphs. For example, a nod, a rounded sweep of the hand, or a pointing motion are all examples of rhetorical gestures in the style of Gilbert Austin or Francoise DelSarte, respectively.

Analytic Pass 2: Seeing Citations in Graphs as Essential Structures

Using citation coding scheme decisions, we have constructed a network graph structure that uses the numerical codes 0-no citation, 1-extraction, 2-grouping and 3-author as a node list of [0, 1, 2, 3]. As a result, the graph of the network consists just of these four nodes. To distinguish one node from the one directly adjacent to it, lines are placed between them. The original order of the source text dictates the node sequence. Here's an example from Lemieux (2015), which has been labelled as follows in our SpringerOpen investigation:

Digital images that include spatial information are commonly known as geotagged shots in the digital photography business. There are a number of techniques to geotag a photo, some of which are manual and others of which are automated. (1) Digital cameras with GPS built-in or connected to the camera allow for automatic geotagging. Some camera manufacturers, such as Casio, Olympus, and Nikon (Valli and Hannay [2010]), also provide devices that have a built-in GPS receiver. 1)

[(0-1), (1-0), (0-1)] is how the edge connections between the phrases would look with citation tags. Since all the tags point in the same direction, we may think of the previous set of edges as a path that links 0 and 1 and 0. The likelihood is that each graph will have nodes that link to themselves (or to other nodes in the same class) in order to avoid establishing differences between various phrases and to represent each sentence as a class (e.g. 0-0). Graph representation creates the idea that nodes with the same class assignment are identical, despite the fact that this is not the case. Many edges are created between nodes due to this oversight, resulting in an arrangement that is almost identical to the annotations in the

original text. Self-looping links the nodes in this network structure, giving it both direction and a plethora of edges. Although there are self-loops and repeated edges that appear to be present, the graph structure is an Eulerian path, in which each vertex has an equal number of incoming and outgoing connections, except for the vertex at either end of the path. This graph structure is equivalent to a network graph in which each node has a class value and an individual identification number. It would be possible to tell one node and edge apart from the rest in this circumstance. Given the importance we placed on preserving sentence order as it appears in natural language texts (in English), we chose an Eulerian route network graph structure as the basis for our data model. We can keep track of the text's citational and non-citational motions by modelling it as an Eulerian route. Using an Eulerian route, we will be able to extract elements that authors use by default, such as dividing material into parts with a beginning, middle, and end, among other things. As a result of the text-to-graph structure, a computational operation may be applied to an array of coding decisions. Network structures may be studied using these approaches to extract attributes that can be used to develop a model that compares advisor and advisee texts. Text-to-graph structural elements are explained in the next section, along with why this feature was used in the context of a rhetorical research on how to include citations into the text.

Indicators Based on Graph Data

According to the network adjacency matrix, the citation nodes' eigenvalues

This feature includes the eigenvalues of the graph's three different sorts of citation nodes (i.e., 1, 2, 3). If you want to know the number of nodes in your graph, you need to take the greatest eigenvector value and multiply it by that number. Known as the eigenvalue, this highest value of an eigenvector serves as a measure of the matrix's fundamental properties. We utilise these eigenvalues as a baseline for comparison in our study of adviser and advisee texts since they pertain to significant structural elements of the graph. Because they contain self-loops, asymmetric adjacency matrices are common in our graph architectures. Consequently, adjacency matrices will typically contain values that are unduly biassed toward edges between non-citational nodes (0-0 or sentences without in-text citations that follow other sentences without in-text citations).

We only save the eigenvalues of the adjacency matrix that govern citational nodes when graphing advisor and advisee texts since the citational practises of advisors and advisees are our major focus (1, 2, 3). It's no secret that advisor and advisee writings rely heavily on non-citational phrases. This is due to the general character of academic writing. A high Eigenvalues or Eigenvalues with substantial effect on the nature of the network isn't surprising because the 0-node vector has high Eigenvalues or Eigenvalues. That is why our focus is on how to utilise citations strategically rather than how to use them liberally across a whole text.

It is possible for a subgraph's size to vary.

With this feature, nodes with an inbound or outbound link to 1, 2, or 3 other nodes are removed from the graph altogether. At the spots where deletions have occurred, the Eulerian trace has been split. To reassemble the Eulerian trail with the following path, for example, it would be necessary to eliminate all of the 1-citational edges. This would result in three separate sequences or subgraphs: 0-0-0-0-0; 0-0-0-0; 0-0-2. This characteristic is similar to that of "network robustness" (Albert and colleagues, 2000), which is a measure of how well a network can withstand node deletion while still preserving its connectivity. Although Albert et al(2000study)'s on network robustness is applicable to the sorts of graph topologies developed in this study, it is not immediately transferrable. It is of particular importance to compare the responses of exponential and scale-free networks to attacks and node malfunctions, respectively, as Albert et al. (2000) have shown in their study. Scale-free networks have a network architecture characterised by a limited number of essential nodes with many edges and a large prevalence of nodes with a smaller number of edges. A powerlaw distribution is only marginally supported when the nodes of our graph structure are typical of classes 0, 1, 2, and 3 in the Springer Open Access corpus and advisor and advisee texts. Similar arguments may be stated in favour of using the lognormal distribution over a powerlaw distribution. As a result, the Eulerian pathways we used in our study lack the same robustness as those found by Albert and colleagues (2000; see also Albert, et al., 2000).

Second, Albert et al (2000) investigates websites on the World Wide Web, rather than typical webpages, as nodes in a vast directed network. There are no citational and non-citational sentences inside a single article, but the sequence in which the words are presented is what

makes the difference. Espan.com could be linked by a group of regional sports websites, but these sites are free to develop additional relationships with other websites and benefit from fresh incoming links. Because nodes in our network topologies reflect separate sentences in a text, the order in which they appear is predefined. A scale-free or exponential network's connection may suffer if a node is deleted at random, but data from a deleted node may still reach another via alternate channels, raising doubts about the applicability of Albert and colleagues' (2000) concept of network resilience. In the Eulerian routes we are using as models for citational practises, every single node or edge deletion will result in a short in the network. As a matter of fact, on an Eulerian route, because each node has only one incoming and one outgoing edge, each node delivers the same amount of connectivity (with the exception of the very first and very last nodes in the path). Eliminating any node or edge will prevent data from travelling through the network in a way comparable to but at a different place than it would otherwise because of the lack of redundancy and other paths. As a result, our graphical representations of networks do not match the resilience or disruption concepts for scale-free or lognormally distributed networks.

The size range of the subgraphs created by the deletion of edges that contain a citational node and the number of edges that are eliminated are used to assess the robustness of the method. For each subgraph, the size is divided into quartiles, with the first and third quartiles being used to measure the subgraph's size. A subgraph fragment's usual size is used here as a way to estimate the degree of disruption caused by the deletion of citational edges or the relative size of the Eulerian network components that citational edges help to link. We use the interquartile range of sizes instead of the mean of sizes to adjust for the overall skewness of subgraph sizes. This indicates that citational types are less common and more broadly dispersed in a text's subgraphs with a bigger interquartile size range than smaller interquartile size ranges. There are smaller pieces after removing the edges of citational types, which indicates that the kind of citation is more common in the text and has closer connections to other citational types.

6.3 A thorough examination of the distribution and placement of citational edges is provided.

This feature's objective is to account for the network graph's citational edge positions. The network graph sequence is broken down into the following percentile ranges in this manner. For example, in a network series or research article, 0-30 represents the beginning; 30-75 represents the middle; and 75-100 represents the conclusion of the sequence or research article. Percentile ranges of citations are recorded for each kind and then divided by the total number of citations in the section to get the relative frequency per section for that section. According to Cano's research, which was repeated using this feature extraction approach, citations are an effective research tool (1989). Even though research articles allow authors to insert citations at any point in the text (and frequently do), research by Cano (1989), Voos and Dagaev (1976), and Ding, et al. (2013) (see also Tang and Safer, 2008) has found that citations in scientific research articles are primarily located early in the document—in the Introduction, Literature Review, and Methods sections. When Hu, Chen, and Liu (2013) studied the Journal of Infometrics' 2013 corpus, they found that more than half of the in-text citations occurred in the first 30 percent of each article, based on their findings (p. 891). According to Paul's research on the literature on chaos theory, half of the citations come in the article's introduction section, which is also where the majority of the research is done. 6 Using 505 research publications from the SpringerOpen database as a benchmark, a similar concentration of citations was found. We found that 46.8% of citational edges appeared in the first 30% of our network sequence, which is substantial. 7 Consequently, this feature serves as an indicator of how well a writer adheres to the genre's citational practises. As a general rule, a larger concentration of citations should be seen near the beginning of the network. On the other side, the absence of such a density might indicate a departure from the genre standard. Furthermore, the areas where citations for Extraction, Grouping, or Author(s) as Actant(s) kinds cluster within a text may offer further information about the precise general limitations put on each type of citation.

6.4 Edge reciprocity

In a loop of edges, two vertices in a directed graph exhibit reciprocity if and only if: There are nodes in the network that point back to each other, and so on (Newman, 2010 p. 204).

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Each node in our Eulerian route represents a different sentence in the original text, therefore they are all distinct from one another. When we talk about reciprocity, we're talking to node classes that are related to one another in the graph's linear arrangement. A reciprocal arrangement for nodes in classes 0 and 1 would be the arrangement of their nodes in the order of 0-1-0. It is possible to represent the degree of edge reciprocity as a percentage of the total number of edges. Non-citational node classes that link to one another in the network produce the same kinds of edges that citational node classes did. Due to the huge number of non-citational nodes connecting to one other, this is the case. As a result, the edge type 0-0 is eliminated. Each of the remaining edge reciprocity permutations may now be represented by a single value thanks to this technique (see Figure 1).

Edge Type
(1-1)
(1,2) and (2,1)
(1,3) and (3,1)
(2,2)
(2,3) and (3,2)
(3,3)

Figure 1: Edge Reciprocity Types.

Author(s) and Actor(s) as Actor(s) are cited in the text in such a way that they tend to inform one another, and this feature may be employed for this purpose. Conventional discourse would lead us to believe that there is more reciprocity between the various sorts of extraction and grouping than there actually is. Both the Extraction and the Grouping citation types would be utilised to extract concepts from the source they are citing in this scenario. Extraction and Grouping citations are more completely incorporated into the argument's style and construction, and are supplied as pure information rather as citations, as Voloshinov points out in his essay. It would be more accurate to classify author (or author(s)) quotations as "reported" rather than "quasi-direct" speech, because they place an emphasis on the "what"

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rather than the "what" and the "how" of what is being said or done (Voloshinov 1973, p. 117). (Voloshinov 1973, p. 119). By using terms coined by Latour and Woolgar (1976), the distinction between "extraction," "grouping," and "author(s) as actant(s)" can better be described as one of "facticity," where parenthetical references draw less attention to other research efforts than the clausal incorporation of an author's name, making the sentence appear more factual on the surface (p. 80-81). Extraction or Grouping moves may be more convenient because the goal of a reference is to give uncontroversial information or acknowledge that comparable work exists, omitting the need to offer context or qualification both philosophically and aesthetically, as stated by Cozzens (1989). (see Cozzens 1989, p. 443). To back this up, we looked at the SpringerOpen database, which comprises over 500 peer-reviewed papers. Nodes engaged in extraction had the highest mean edge reciprocity scores (1-1). Mean Edge Reciprocity Score for Extraction and Grouping is second only to Extraction and Grouping in terms of average score (1-2, 2-1). Following closely behind is the link between Extraction and Authors acting as Actants, which has the third highest mean edge reciprocity score (1-3, 3-1).

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The above features are aggregated into an array in the order shown in Figure 2:

Figure 2: Graph Feature Array.

Feature
Adjacency Matrix Eigenvalue Extraction
Adjacency Matrix Eigenvalue Grouping
Adjacency Matrix Eigenvalue Author(s) as Actant(s)
Subgraph size (per quartile range) Extraction
Subgraph size (per quartile range) Grouping
Subgraph size (per quartile range) Author(s) as Actant(s)
Extraction Edge location (0-30 percentile)
Extraction Edge location (30-75 percentile)
Extraction Edge location (75-100 percentile)
Grouping Edge location (0-30 percentile)
Grouping Edge location (30-75 percentile)
Grouping Edge location (75-100 percentile)
Author(s) as Actant(s) Edge location (0-30 percentile)
Author(s) as Actant(s) Edge location (30-75 percentile)
Author(s) as Actant(s) Edge location (75-100 percentile)
(1-1) Edge reciprocity
(1,2) and (2,1) Edge reciprocity
(1,3) and (3,1) edge reciprocity
(2,2) edge reciprocity
(2,3) and (3,2) edge reciprocity
(3,3) edge reciprocity

The graph feature values tabulated in the array are then used to calculate the Euclidean distance between network graphs.

7. Discussion: Citation Moves Appear Stable Enough to Reliably Locate & Classify

Our two analytic passes will be discussed in detail before we return to our three framing questions. This research is still in its infancy, and more work need to be done to determine whether or not the findings can be relied upon. To begin, we should point out that our corpus was rather small by big data or text analysis standards. In addition, the writings do not

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adequately depict the phenomena researched. We chose to call this study exploratory rather than confirmatory or even descriptive for the following reasons:

The results we've seen thus far are encouraging, and we feel that greater investigation into this topic is needed. The citational patterns observed by Karatsolis are matched by our findings of genre signals (this issue). It will be necessary in the future to conduct more extensive investigations to draw more reliable results. Our exploratory study ideas, on the other hand, yielded fruitful outcomes.

Are there classifiable patterns in citation changes that contribute to genre stability and possibly explain the similarities and differences in the writing cohorts from which the samples are collected (for example, more experienced writers vs. less experienced authors)? If so, what are they? The first question looks to have an affirmative response. For this study, we looked at articles from the Karatsolis dataset from two different groups of advisers and advisees. The cohorts include chemistry advisor and advisee textbooks, as well as materials science advisor and advisee texts. Using Karatsolis' original comments and our own developed coding system from the first analytic run, we manually identified citation patterns. Figures 3 and 4 show the distance matrices used to illustrate the network graphs in this section.

	CA_1	CA_2	CA_3	CAE_1	CAE_2	CAE_3
CA_1	0	5.990	3.147	2.808	7.663	4.082
CA_2	5.990	0	3.352	4.046	9.107	3.796
CA_3	3.147	3.352	0	1.050	8.288	1.761
CAE_1	2.808	4.046	1.050	0	8.005	2.439
CAE_2	7.663	9.107	8.288	8.005	0	9.738
CAE_3	4.082	3.796	1.761	2.439	9.738	0

Figure 3: Pairwise similarity scores for chemistry cohort.

Three textbooks, CA 1, CA 2, and CA 3, are written by one professor who leads the chemical group. In the chemical cohort, one advisee has written three texts: CAEs 1–2 and 3–4. The distances between the samples are shown in Figure 3 (as shown).

the following texts are written by an advisor in the material science cohort: A, B, C, D, E, and F One, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen, fourteen Data from the material science cohort is depicted on Figure 4.

Using this method, we feel we have achieved what we set out to do: provide an easy way to compare texts between and within cohorts. What do these apparent differences show, then?

	MA_1	MA_2	MA_3	MA_4	MAE_1	MAE_2	MAE_3	MAE_4
MA_1	0	48.569	7.262	6.497	7.251	4.982	7.079	5.346
MA_2	48.568	0	46.261	46.793	47.671	48.389	46.77	47.948
MA_3	7.262	46.261	0	2.274	3.114	3.493	2.117	2.999
MA_4	6.497	46.793	2.274	0	1.7789	2.303	1.360	1.718
MAE_1	7.251	47.671	3.114	1.779	0	2.764	1.584	2.307
MAE_2	4.982	48.389	3.493	2.303	2.764	0	2.851	1.033
MAE_3	7.079	46.767	2.117	1.360	1.584	2.851	0	2.173
MAE_4	5.346	47.948	2.999	1.718	2.307	1.033	2.173	0

Figure 4: Pairwise similarity scores for material science cohort.

2) Can we develop classifiable categories to produce comparisons that correspond with Karatsolis' results?

According on the facts, the answer to this question appears to be a little more qualified yes. To get a sense of where we are, we may look at the average similarity ratings of the writings written by different writers. The chemistry advisor's texts (CA 1, CA 2, and CA 3) have an average pairwise distance of 4.163 points on the chemistry advisor's text distance scale. CAE 1, CAE 2, and CAE 3 texts have an average pairwise distance of 6.72700061 characters (in hexadecimal notation). The material science advisor's texts (MA 1, MA 2, MA 3, and MA 4) had an average pairwise distance of 26.276. In general, the material science advisor's writings are separated by an average of 2.119 points in pairwise distance. Comparing texts by different authors, it appears that the average pairwise distances follow certain predictable patterns. We would predict less variance in citation patterns in the more novice advisee texts compared to the more experienced advisor texts because (1) advisees are less experienced authors than advisors, and (2) less experienced writers frequently have less opportunity to perform in a

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range of genres. Greater experienced writers have more freedom in terms of their writing styles than less experienced authors (see Berkenkotter and Huckin, 1995, p. 117-144). As a result, we may predict that the citation habits of advisees will become more regular over time. The chemistry cohort advisee exemplifies this. Extraction citations are often used by the chemical adviser in the texts sampled. Extraction citations are also heavily emphasised in the first third of articles in chemical advisee manuals. Author(s) as Actant(s) citation is commonly used towards the conclusion of a document, particularly in the final third of the publication, while presenting the results of a research or experiment. It is consistent with the IMaRD framework of a scientific research report, and it is also consistent with the chemical advisee's efforts. Consequently, the article's technical content, which occurs early on in the paper, is meant to be more descriptive in nature. Because of this, it is more common for citations to be excerpts meant to set precedence for an approach quickly. There should be a greater emphasis on previous research in the final discussion section in order to properly interpret the findings and emphasise their relevance in relation to other studies in the area.

As can be seen from the high frequency of non-citation moves and the prominence given to citational moves in the first third of articles, there is even greater uniformity across members of this cohort. Using citational motions to build a research space (in the Swales sense) and then adding new work to this rhetorical stance is common, according to the material science adviser.

Advisor texts will also be more varied because of their higher status since advisers have (1) more disciplinary writing skills; (2) better access to a wider range of literary forms; and(3) more freedom to break from convention. In a dramatic way, this may be seen in the texts for material science advisors. The adviser and advisee textbooks in material science do not have anything like the MA 2 text. In our coding method, MA 2's text suggests a total of four citations, which is a low quantity. As in MAE 4, the total number of citational movements in MAE 2 is 9 (MAE 4 = 32 vs. MA 2 = 54), which is similar to the number in MAE 4. Only the first quarter of the series has the MA 2 citational changes, which is noteworthy. A higher number of these citational moves are spread out among the different texts in MA 1, MA 2, and MA 4, suggesting that these texts are more heavily dependent on these moves to build an argument and illustrate conclusions than other texts. It's easy to see in the MA 2's text that the

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focus is on explaining the findings of an experiment on nanoparticle motion. Our macro-evaluation is bolstered by this. The first sentence of the text has a Grouping citation, which shows this:

There are a broad variety of unexpected behaviours that may be seen when it comes to nanoparticles made from inorganic materials (1-3) It is the goal of MA 2's research to at least theoretically confirm traditional knowledge of nanoparticles. In this case, it is reasonable to expect that less citational labour will be required. While MAE 4 aims to challenge the status quo, as stated in the following goal statement:

We provide here a method for producing parallel carbon fibres and extended, ordered networks of multiwalled nanotubes that may be utilised to form layered multiple connections using a modified CVD methodology built from our carbon nanotube growth strategy.

Taken along with MA 2 text's extreme pairwise distance figure, we can observe that the material science advisor and advisee text samples are quite near. Figure 4 shows that the MAE 1 and MA 4 texts are quite close in Euclidean distance.

The contrasts that Karatsolis points out between advisors and advisees in the texts, on the other hand, do give some useful targets for differentiating between the two. One of the most notable variations is the way in which the sources are evaluated. Citations that include references can be found here. The first was submitted by a chemical advisee (CAE 2), while the second was submitted by a chemical advisor (CA 2). Keep an eye out for the advisee's use of evaluative language in her sentence:

Advise: Long and Norrish31 (-136 + 25 kcal mol-1) got a measurement that is more in line with the computation than any of the others reported by Cox and Pilcher31.

Advisor

The proportional-derivative and minimal variance adaptive controls were employed by Meline and colleagues (3) to get around the learning periods of adaptive controllers.

Aside from the fact that the advisor's use of quotation marks is more descriptive, he also describes the authors' work as "close to issue resolution" rather than "better" or "more accurate". Even if both texts follow the same pattern of elaboration, words like "really" and

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"better" jump out in the advisee's text because they are plausible indications that are typically lacking in the advisor's writing.

This is one of just a few changes that can be clearly seen at the sentence level. After coding and comparing hundreds of sentences across a large number of texts, the majority of the differences become apparent (as demonstrated by the distances shown above). To put it another way: When two writings are similar, it is not merely because they utilise the same set of vocabulary to describe the same subject matter. Instead, the entire texts are constructed in a way similar to the snippets at the macro level.

An analysis of macro structure at this level may help to discover areas where a writer is producing a work that is significantly different from other writers. The text produced by the chemical advisee is markedly different from the texts written by all of the other authors, both advisors and advisees, in the similarity scores table above. Accordingly, we might guess that the writer is unfamiliar with some part of citation practises in their field of study.

Due to Berkenkotter and Huckin's (1995) findings, writers commonly utilise citational procedures to highlight the newness of their findings in their scientific writings. The macro-perspective offered by the graph analytic may assist reduce the breadth of research subjects to a more defined range of options. Before moving on to the rest of the texts in a cohort, researchers can identify the outlier text, analyse the text's important parts, and gain a broad idea of what deviations to look for before further investigation.

The most important feature of our strategy is not that we can exactly reproduce each human-coded judgement using a methodology like Karatsolis', but rather that we can. Advisers and their advisees may benefit from focusing on a specific set of rhetorical techniques (e.g. citations and their utilisation) to better improve awareness of the need for more targeted readings, comments and revisions. Automatic analysis can help teachers and tutors better grasp the rhetorical strategies that beginning writers might apply and whether or not these strategies are reflective of the types of strategies employed in a specific field.

When it comes to helping students with their academic writing or making professional selections, can we come up with analytical results that if they are correct, would be beneficial to the advisor/advisee dyad?

We'll have to wait and see, but we're cautiously hopeful based on what we've seen thus far. With Karatsolis' observation that advisees supply substantially more detail than advisers, we may see opportunities to detect them and highlight them during the writing and editing processes.

One of the most intriguing possibilities we see is a connection between citation categories and Karatsolis' findings. If, for example, we wanted to uncover patterns of more or less elaboration around citations, we may categorise citations according to the author as the actant category (i.e. author as actant moves mean there are more likely to be elaboration). This is an example from one of the chemical engineering texts that the advisee is studying:

Researchers Felinger and Guiochon [20] showed that optimising the experimental settings in displacement systems may be accomplished using a simplex technique that had been slightly adjusted. Their results, however, are confined to materials in the stationary phase with particle sizes ranging from 5 to 20 microns since they utilised the equilibrium-dispersive model.

In the face of such a drastic shift, there are two compelling reasons to expect further explanation from the author. Furthermore, the selection of an author as the active citation type is more time consuming (compared to the selection of an Extraction or non-integral citation type), and it indicates that the researcher wishes to engage more directly with the specific works of other researchers, as Paul (2000) argues (p. 2000). Because of this, it is reasonable to expect that the author's capacity to compose a whole sentence will frequently be exceeded when he or she publicly displays this level of participation. Actant citational types like author, then, may point to additional in-depth text mining work done on a larger corpus, which would help corroborate these predictions.

A baseline of fidelity between advisor and advisee writings may be established by comparing the distances between advisor and advisee writings, we believe, which might shed insight on how advisees are learning about citation practises and how advisors are modelling citation practises. Genre convention mastery is and will be a moving target. Citational motions may be required for publication, but they may also be required in an overly strict manner, which may lead to inconclusive results or hamper the development of new ideas. The network graph measurements offered by our team may be utilised to automate the selection of a suitable

general baseline for citational alterations among academic mentoring ties. Using a pairwise metric can serve as a global indicator that an advisee is maintaining the proper citation patterns necessary for field recognition and the preservation of that advisee's scholarly voice after an advisor has established a qualitative judgement about the acquisition of disciplinary writing codes. Aside from the ability to track citations in various academic contexts, such as academic journals, dissertations, and academic books, we also want to be able to track the emergence of new fields through the usage of citations in the future.

Notes

1. The four-part citation coding technique proposed by Moravcsik and Murugesan (1975) contains the following:

a. conceptual (the citation refers to a theory or concept) or operational (the citation refers to a method or procedure) (citation references a method)

b. organic (essential for understanding the current or cited paper's content) or perfunctory citation (acknowledgement of previous work)

c. evolutionary or juxtapositional (current paper builds on previous work) (current works provides an alternative to referenced work)

d. affirmative (the current study confirms the work of the referred work) or negative (the current publication refutes the work of the referenced work) (current paper challenges or critiques referenced work)

2. Essential basic (citation is integral to the content of the referenced article) b. essential subsidiary (referenced work or findings are integral to understanding the referenced work but not related to the content of the referring paper) c. supplementary (referenced work or findings are integral to understanding the referenced work but not related to the content of the referring paper) d. supplementary (referenced work or findings are integral to understanding the referenced work but not related to the content of the referring paper) (references provide additional, independent information)

d. insignificant (references included with interpretation)

e. partial negation (references that the referring article disagrees with in part)

f. total negation (references that the referring article rejects outright).

3. See Cronin 1984, pp. 35-49, for a discussion of citation classification taxonomies.

4. Teufel et al. (2006)'s study expands on previous categorization attempts aimed at automatically diagnosing the content of research articles by extracting information about the rhetorical status of phrases. The assignment of rhetorical status on a sentence-by-sentence basis may enable better automatic text summarization (Teufel and Moens, 2002) and more informative citation indexing (Teufel 2006).

5. The text processing technique used in the Springer OpenAccess research database to categorise citational and non-citational sentences is based on the use of predefined regular expression criteria. http://ryan- omizo.com/2016/01/11/finding-genre-signals-in-academic-writing-benchmarking-method/

6. In Paul's (2000) study, location is likewise used as an operant citational attribute.

7. In the next 30-75 percentile, 30.2 percent of citations emerge; in the final 75-100 percentile, 22.6 percent of citations appear.

8. We use sci-kit learn's pairwise distance metrics algorithm for this study (see Pedregosa et al. (2011) and scikitlearn's module documentation at http://scikit-learn.org/stable/modules/generated/sklearn.metrics.pairwise.pairwise distances.html).

9. Swales (1990, p. 213) proposes that models be presented in "caricature" format, which "simplifies and distorts" genre features in order to acclimate students to the rhetorical demands of academic writing. This attenuation process is seen as a way to limit the variety of student writing.

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