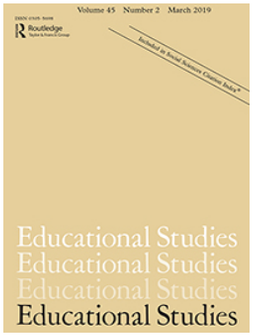

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How do self-efficacy beliefs for academic writing and collaboration and intrinsic motivation for academic writing and research develop during an undergraduate research project?

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ABSTRACT

Research skills are important for university graduates, but little is known about undergraduates' motivation for research. In this study, self-efficacy beliefs and intrinsic motivation for several research activities were measured three times during an undergraduate research project ($N = 147$ students). In order to promote self-efficacy for writing and collaboration, a collaboration script was developed and tested on half of the students. Twelve students were interviewed three times to gather in-depth information about motivational and self-efficacy beliefs. All measures except intrinsic motivation for research increased significantly during the project. Interview results suggest that enactive mastery and positive social interdependence promoted self-efficacy. Feelings of relatedness seemed to promote intrinsic motivation for writing. Lack of autonomy and low perceived relevance may explain why motivation for research remained stable. The script had no impact on self-efficacy beliefs. Relatedness, autonomy and positive social interdependence may boost motivation for research, but more evidence is needed.

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KEYWORDS
Self-determination theory; collaborative learning; undergraduate research; research-teaching nexus; academic writing

Introduction

It is recognised widely in higher education that research skills are important for university graduates (Rosenkranz, Wang, and Hu 2015) and that students should become actively involved in doing research (Brew 2003; Healey et al. 2010). However, little is known about how students' self-efficacy beliefs and intrinsic motivation for research develop over time as they do research. Doing research is a complex task that requires different skills, such as teamwork, critical thinking, academic writing and planning. For undergraduate students who have little experience with these skills, doing research can be challenging. To be

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successful, they should gain confidence in their ability to perform the complex tasks of doing research. This study investigates how undergraduate students' perceptions of self-efficacy for academic writing and collaboration, and intrinsic motivation for writing and conducting research developed over the course of a one-year research project.

Self-efficacy

A person's belief about his or her ability to complete a certain task successfully is called *self-efficacy* (Schunk 1991). Self-efficacy has been studied widely in higher education. Many studies have shown that self-efficacy beliefs relate positively to academic performance (Bartimote-Aufflick et al. 2016; Diseth, Danielsen, and Samdal 2012; Richardson, Abraham, and Bond 2012). This also accounts for self-efficacy beliefs about writing skills. Self-efficacy for writing relates positively with performance in both undergraduate students (Prat-Sala and Redford 2012; Zimmerman and Bandura 1994) and high school students (Pajares and Valiante 1999; Shell, Colvin, and Bruning 1995).

Bandura (1997) argues that people use four main sources of information to assess their own self-efficacy: enactive mastery, vicarious experience, social persuasion and one's physiological and emotional state. *Enactive mastery* is information from past experiences of performance. People who have experienced success on a particular task are more likely to feel competent in that task than people who lack this experience. *Vicarious experience* refers to learning through modelling and observation, that is observing a model perform a task in order to learn how to do the task. Learning through modelling and observation enhances self-efficacy most when the models are similar to the person observing the model. *Social persuasion* refers to coaching by (significant) others. Self-efficacy increases when others express their faith in the successful completion of the task at hand. The feedback should focus on acquirable skills, that is skills that the receiver can learn realistically. Modelling the desired behaviour or performance can help the receiver to develop those skills. Finally, the *physiological and emotional state* that a person experiences can affect self-efficacy beliefs. Negative physiological and emotional states, such as fatigue, pain and stress, reduce self-efficacy. Positive physiological states, such as feeling fit and relaxed, promote self-efficacy.

Intrinsic motivation

Self-efficacy correlates positively with other variables, such as intrinsic motivation (Bartimote-Aufflick et al. 2016). Intrinsic motivation means performing an activity because it is interesting or enjoyable (Ryan and Deci 2000a). A large body of research shows that intrinsic motivation correlates mildly positive with academic performance (Richardson, Abraham, and Bond 2012). For instance, Vansteenkiste et al. (2004) showed that students who were taught under conditions that stimulated intrinsic motivation attained better test results than students who were taught under conditions that stimulated extrinsic motivation (performing an activity to attain certain goals, see Ryan and Deci 2000a, 2000b).

Research on motivation for writing focusses largely on writing apprehension or anxiety. Writing apprehension correlates negatively with writing performance, but this relationship is weaker when self-efficacy is controlled (Pajares, Miller, and Johnson 1999; Pajares and Valiante 1999). Martinez, Kock, and Cass (2011) found a negative relationship between writing anxiety and self-efficacy beliefs about writing. These authors also found a mildly positive

relationship between "leisure writing", writing for fun, and self-efficacy for writing. Thus, it seems that self-efficacy beliefs and intrinsic motivation for writing are related positively. This positive relationship has also been found in other studies (McGeown et al. 2014; Williams and Williams 2010). Consistent with these findings, Bandura (1997) proposes that self-efficacy is an important drive for intrinsic motivation. People develop an "enduring interest in activities at which they feel efficacious and from which they derive self-satisfaction" (219).

According to Ryan and Deci's Self-Determination Theory (SDT), there are three important innate drives for intrinsic motivation: a psychological need for competence, autonomy, and relatedness. While performing a task, people need to feel *competent* to complete the task successfully. Feelings of competence can be stimulated by offering challenging (but feasible) tasks and giving positive feedback. People also need to feel *autonomous*. They need to experience an "internal locus of control", a sense that they are in control over their own actions. Therefore, feelings of autonomy can be enhanced by giving people control over their own actions. Finally, people have an intrinsic need to be related to (significant) others. This need for *relatedness* enhances intrinsic motivation when people feel valued by others with whom they feel connected (Ryan and Deci 2000a, 2000b).

Self-efficacy and intrinsic motivation in undergraduate research

Although self-efficacy and intrinsic motivation have been studied widely in the context of higher education, less is known about these concepts within the specific context of undergraduate research projects. Undergraduate research projects often resemble an authentic research setting, in which students participate in realistic research activities (Brew 2003; Healey and Jenkins 2009). Conducting research requires a set of complex skills and learning in an authentic environment can help students to acquire these complex skills (Van Merriënboer and Kirschner 2013).

Some previous studies have shown that participation in research projects increases feelings of self-efficacy for doing research (Sadler et al. 2010). Kardash (2000) found that, after completing a research internship, undergraduates felt significantly more competent in research skills like formulating hypotheses, designing experiments and writing research papers. Undergraduates who participated in research have also reported that their team work skills improved (Hunter, Laursen, and Seymour 2007).

Little, yet some research has been done to students' intrinsic motivation for research. Rosenkranz, Wang, and Hu (2015) studied students' motivation for research through a cross-sectional design with surveys and interviews in a five-year medical programme. They used Ryan and Deci's (2000a, 2000b) three innate drives for intrinsic motivation, competence, autonomy and relatedness, as a framework to analyse the results. With regard to feelings of autonomy, students reported that time constraints, the bureaucracy of doing research and the poor financial rewards demotivated them for doing research. Regarding feelings of competence, they reported that new research experiences improved their confidence in doing research. Concerning relatedness, role models (experts who could show that research can be combined with clinical work) turned out to have a strong positive effect on motivation for doing research. Teamwork and a sense that research contributes to scientific knowledge and clinical practice also motivated students to do research. Conducting research for career purposes only, and the image of research as a lonely job, was seen as demotivating. The authors concluded that intrinsic motivation for doing research was related mainly to feelings

of competence (through research experience) and relatedness (contributing to the scientific and medical community).

Collaboration scripts

As mentioned before, teamwork is an important aspect of research. Therefore, undergraduate research projects should focus on collaboration skills as well. In the context of undergraduate education, students may not always collaborate effectively without specific guidance (Dillenbourg and Hong 2008). Another problem is that social loafing, a tendency to work less in a group than one would do as an individual (Karau and Williams 1993), can occur when individuals in a group cannot identify their own contribution to the group process (Gagné and Zuckerman 1999). Furthermore, without explicit instructions on how to collaborate student collaboration does not always lead to an effective co-construction of knowledge (Chan 2001; Mercer 1996).

To solve these problems, a wide variety of *collaboration scripts* have been developed over the years (van Dijk, Gijlers, and Weinberger 2014; Dillenbourg and Tchounikine 2007; Kollar et al. 2014). These scripts contain step-by-step procedures for structuring the collaborative process. Many scripts have been developed over the years for a variety of purposes, such as promoting the quality of small group discussion (King, Staffieri, and Adelgais 1998), promoting the quality of argumentation (Stegmann, Weinberger, and Fischer 2007; Toulmin 1958; Weinberger, Stegmann, and Fischer 2010), developing team skills (Thomas 2013) and improving the quality of the collaboratively written products (Lowry, Curtis, and Lowry 2004). Collaboration scripts are often based on the theory of social interdependence (Johnson, Johnson, and Smith 2007) which states that cooperation occurs when there is a state of *positive social interdependence* between group members. Positive interdependence means that individuals in a group feel that they can only reach their own goals when their group members reach their goals as well. This creates an incentive for helping each other attain the goals, so every group member should make an effort if the group wants to succeed.

For the present study, a collaboration script was developed to help students organise their collaborative writing process. The script was written to promote *positive role interdependence*, a situation in which each group member is assigned a specific role and in which the group succeeds only when every group member succeeds in playing his or her role (Roseth, Johnson, and Johnson 2008). The division of roles was introduced as well so as to discourage social loafing and encourage co-construction. Because the script aimed at facilitating both the writing and the collaborative process, it was expected to promote self-efficacy beliefs for collaboration and academic writing. The script was provided to half of the students, so a comparison could be made with students who did not receive the script.

Research questions

Little research has been done to self-efficacy and intrinsic motivation for research within the context of undergraduate research. There is particularly little research to how self-efficacy and intrinsic motivation for research develop over time while students gain their first research experiences. This calls for a longitudinal single cohort approach. This study aimed at filling this gap by following a cohort of students during one year, while they were working in groups on an undergraduate research project. Half of the students received the collaboration script

in order to test its' effect on self-efficacy beliefs about collaboration and writing. We expected that the script would raise self-efficacy beliefs for writing and collaboration, because it was developed to facilitate the collaborative writing process. Self-efficacy beliefs for research were not investigated because students had no prior experience with doing research in an authentic research context. Therefore, we did not expect students to have substantiated self-efficacy beliefs about doing research at the beginning of the course. In contrast, we did expect them to have substantiated self-efficacy beliefs about collaboration, because they had collaborated before in previous courses. Intrinsic motivation was measured for two constructs that apply specifically to an authentic research context: doing research and writing a research report. Intrinsic motivation for collaboration was not measured because collaboration was seen as a more generic skill that does not apply particularly to a research context.

Through a stratified sample, 12 students were interviewed to gain more insight in possible incentives for self-efficacy beliefs and intrinsic motivation. These interviews also served to evaluate how students used the collaboration script. Taken together, the research questions of this study are as follows:

(1) How do students' self-efficacy beliefs about collaboration and academic writing and their intrinsic motivation for research and academic writing develop during an undergraduate research project?
(2) To what extent does the collaboration script affect self-efficacy beliefs about collaboration and academic writing?

Method

Participants and educational context

Participants were 147 undergraduate students (2 men, 145 women) in the second year of a bachelor programme in Education and Child Studies (M_{age} = 20.28, SD_{age} = 1.85). They followed a course called "Research Practice" in which they worked on a research project throughout an entire academic year. This course aimed at preparing students for their bachelor thesis at the end of the study programme. During the course, students experienced the whole process of doing research, from formulating research questions to reporting and discussing the results. At beginning of the course, the main teacher shared 12 research themes with her students on the electronic learning environment (ELO) of the course. Examples of these themes were "cognitive load and attention during reading" and "diagnostics in problematic upbringing situations". Students could indicate which theme they preferred. The main teacher assigned students to nine workgroups, taking into account their preferred themes as much as possible. This resulted in six large workgroups of 24–26 students and three smaller workgroups of 10–15 students. Despite the fact that students were assigned to their workgroups as much as possible according to their preferred theme, this could not be realised for all students. At the end of the course, 27.8% of the students indicated that the theme of their workgroup was not their first choice (N = 49).

The course was taught by nine teachers. Each teacher supervised one workgroup, helping them to plan and conduct their research and writing the research report. Teachers provided feedback on draft versions of the research report and monitored students' progress. Some

teachers used the data that students gathered for their own research publications. The amount of agency students had in their project varied per workgroup. In some workgroups, the research method was determined at the beginning of the project and could not be changed. In other workgroups, students had more freedom to choose the research methodology.

Before the course started, the first author discussed the design of the course with the main teacher. From these discussions, it became clear that the available teaching staff was limited, so large workgroups had to be formed. The main teacher of the course anticipated that student collaboration would become difficult in these large workgroups. Therefore, she was searching for a method to let students collaborate effectively. This resulted in the collaboration script that the authors constructed.

The three smaller workgroups were not included in the study because one of the workgroup teachers was also one of the researchers and the smaller group size may have caused a confounding effect on the outcomes of the study. Each workgroup was assigned to one research topic and submitted a collaboratively written research paper at the end of the course. All students gave informed consent to participate in this study. In addition, a stratified sample of 12 students (one student-pair from each working group) was taken to participate in the interviews. The interviewed students received a voucher of 10 Euros. One of the interviewees stopped following the course and another student was recruited as replacement.

Materials

Collaboration script

The collaboration script was based on a script for collaborative writing described by Lowry, Curtis, and Lowry (2004). It was presented in a booklet in which students received some general information about the script and the electronic learning environment (ELO) that students used to share and give feedback on each other's writings. The script divided students' writing activities in five rounds over the academic year. In the first round, each workgroup wrote the introduction of the paper. In the second round, each subgroup wrote the method section, in the third round the results section and in the fourth round the discussion. The fifth round was at the end of the year. In this round, students edited their final version of the research paper.

In round 1 through 4, students split up their workgroup in four equally sized subgroups (three to seven students per subgroup, depending on the size of the entire workgroup). In each subgroup, students worked on a sub-question of their projects' main research question. In addition, one of the four subgroups was responsible for merging the texts of the four subgroups into a text that could be used for the final paper. Within each subgroup, half of the students took the role of "drafter/reviser" and the other half took the role of "reviewer/editor". Drafters/revisers wrote a first draft of the text (i.e. the introduction in round 1, the method section in round 2, etc.) and uploaded this text to the ELO to share it with the reviewers/editors. Reviewers/editors gave feedback on the content, grammar and structure of the text, and subsequently shared the reviewed text in the ELO with the drafters/revisers, who then revised the text based on the received peer feedback. Next, the drafters/revisers shared the new version of the text in the ELO with the reviewers/editors, who edited the final text by improving its' coherence and lay-out. The reviewers/editors then uploaded this final text in the ELO. Finally, one of the subgroups (called the "merge" subgroup) also merged

all the final texts into one coherent text. Merging the texts was an extra task that each subgroup performed one time during the year. This final, merged text became part of the final research paper.

Students' roles changed each round, so drafters/reviewers became reviewers/editors in the next round and vice versa. This way, every student fulfilled each role an equal number of times. The role of the "merge" subgroup changed after each round, so every subgroup played this role once during the year. In the fifth round, one subgroup had to perform a final edit of the whole paper. In the script, students were advised to select one student from each subgroup to form a new subgroup that was responsible for this final edit.

Before the script was introduced, three students who did not participate in this study gave feedback on the content and textual aspects of the script. The script was adjusted based on this feedback.

Questionnaire

The questionnaire was administered three times during the course: at the beginning (T1), halfway through (T2) and at the end of the year (T3). Students could rate the statements from 1 (not at all applicable to me) to 5 (completely applicable to me). The questionnaire items represented several research-related activities that were also investigated in previous studies to student motivation for research (Hunter, Laursen, and Seymour 2007; Kardash 2000): doing research, writing research reports and collaborating. Four items were used to measure self-efficacy for writing (α_{range} = 0.79–0.84). These items were based on the Academic Efficacy-scale of the Patterns of Adaptive Learning Scales (PALS) (Midgley et al. 2000). (Example item: "I can write the most complex texts for my studies if only I do my best"). The other three scales were based on Ryan and Deci (2000b). Three items were used to measure self-efficacy for collaboration (α_{range} = 0.64–0.71). (Example item: "I can collaborate well if I do my best"). The original scale had four items, but one item was removed because it seemed inconsistent with the other three. Three items were used to measure intrinsic motivation for doing research (α_{range} = 0.79–0.83). (Example item: "I enjoy doing research"). Three items were used to measure intrinsic motivation for writing (α_{range} = 0.76–0.79). (Example item: "I enjoy writing a research report").

Interviews

Structured interviews were conducted three times during the course with two students of each workgroup. Like the questionnaires, the interviews were planned at the beginning, half-way through and at the end of the year. The interview questions focused on the constructs that were measured in the questionnaire. During the first interview, the questions were phrased in an open fashion. For instance, the interview question about intrinsic motivation for writing was: "To what extent do you like writing a research report?" During the second interview, the questions were geared more towards the effect of the collaboration methods that the workgroups used on the constructs. An example of a question in this interview is: "To what extent does the collaboration script/the collaboration method you use affect your motivation for writing the research report?" During the third interview, the questions aimed at perceived changes throughout the year. For instance, one question was: "To what extent do you think your motivation for writing a research report has changed during the year?"

In addition, during the first interview students were asked how they would collaborate during the course. This was done to check if students who had received the script were planning on using the script, and to explore how students who did not receive the script would collaborate during the course. During the second interview, interviewees who had received the script were asked to evaluate the script. Interviewees who had not received the script were asked to describe how they collaborated and how they evaluated this collaboration. During the third interview, students answered several yes-no questions about the features of the script they had used, without mentioning the script explicitly. These questions were added to define more specifically which features of the script had been used in both the workgroups that had received the script and that had not received the script. The yes-no questions were added because during the first two interviews, it became apparent that workgroups that had not received the script used collaboration methods that were similar to the steps described in the collaboration script.

Procedure

At the beginning of the course, half of the workgroups received the collaboration script. There were 14 workgroup meetings during the course. At the start of the course, the teachers of the script-groups received an individual, face-to-face briefing about the script. They received the printed booklets that contained the instructions and the script and were asked to distribute this booklet amongst their students. They also received a PowerPoint presentation to explain the collaboration process of the script to their students. They were asked not to share the information in the script with teachers of the workgroups that did not receive the script. Half-way throughout the year, two teachers were replaced for personal reasons.

Two researchers visited the second workgroup meeting to let students sign informed consent letters and hand out the questionnaires. Students gave informed consent by signing a letter that briefly explained the purpose of the study and asked students to complete the questionnaire three times during the course. The researchers also recruited students for the interviews at this time. The second and third administration of the questionnaire were also carried out during workgroup meetings. The second questionnaire was handed out when the workgroups had finished half of their research papers and the third one at the end of the course, when each workgroup had completed its' research paper.

The interviews took place around the same time as students completed the questionnaires. The first interviews took place three weeks after the workgroup in which the first questionnaire had been handed out. The interviews were conducted by two researchers (one per interview), audio recorded and transcribed verbatim.

Analyses

Complete questionnaire data were obtained for 129 of the 147 students. To answer the first research question, a repeated measures multivariate analysis of variance (RM-MANOVA) was performed with the time the questionnaires were administered (T1, T2 and T3) as within-subjects factor and self-efficacy for writing, self-efficacy for collaboration, intrinsic motivation for writing and intrinsic motivation for research as the dependent variables. Pairwise comparisons with Bonferroni-corrections for multiple comparisons were used to check for significant differences between T1, T2 and T3, and between the dependent variables. Mauchly's

test of sphericity showed that the assumption of sphericity had been violated for the effect of measurement interval, $\chi^2 = 14.13$, $p = .001$. Therefore, Greenhouse-Geisser estimates of sphericity ($\varepsilon = 0.90$) were used to correct the degrees of freedom.

To analyse the differences between T1, T2 and T3 for each dependent variable, four repeated measures analyses of variance (RM-ANOVAs) were performed, one for each dependent variable. Post hoc analyses (Bonferroni) were used to analyse the mean differences between T1 and T2, T1 and T3, and T2 and T3.

To explore further how students' self-efficacy beliefs and intrinsic motivation developed throughout the year, the interview transcripts were coded in Atlas.ti. Only the interview data were analysed of the students who were in the workgroups that were included in the quantitative analysis. The data were coded using the names of the four dependent variables (constructs) as labels. The data were also coded as "positive" or "negative" beliefs. For instance, a student's remark that "writing the results was fun" was coded as "intrinsic motivation for writing" and "positive". The codes were categorised per construct, and depicted graphically in concept maps. These concept maps were used to identify incentives for positive and negative beliefs per construct.

To answer the second research question, the above-mentioned RM-MANOVA was repeated with script/no script as between-subjects factor. In addition, the answers to the yes-no questions in the third interview were summarised in a table and the interview results were analysed exploratively to find out how students collaborated in script- and non-script workgroups.

Results

Concerning the first research question, the tests of within-subjects effects of the RM-MANOVA showed a significant overall difference between T1, T2 and T3, $F(1.81, 231.62) = 10.57$, $p < 0.001$, $\eta^2 = 0.076$. The tests of between-subjects effects showed a significant overall difference between the dependent variables, $F(2.25, 287.82) = 87.51$, $p < .001$, $\eta^2 = 0.406$. Overall, students rated their self-efficacy for collaboration the most positively, followed by self-efficacy for writing, intrinsic motivation for research and intrinsic motivation for writing. The pairwise comparisons between T1, T2 and T3 showed small but significant increases between T1 and T2 ($M_{diff} = 0.107$, $p = 0.008$) and between T1 and T3 ($M_{diff} = 0.148$, $p < 0.001$). The difference between T2 and T3 was not significant ($M_{diff} = 0.042$, $p = 0.399$). The pairwise comparisons between the dependent variables showed that self-efficacy for collaboration was significantly higher than self-efficacy for writing ($M_{diff} = 0.502$, $p < 0.001$), intrinsic motivation for research ($M_{diff} = 0.613$, $p < 0.001$) and intrinsic motivation for writing ($M_{diff} = 0.957$, $p < 0.001$). Self-efficacy for writing was significantly higher than intrinsic motivation for writing ($M_{diff} = 0.455$, $p < 0.001$) and intrinsic motivation for research was significantly higher than intrinsic motivation for writing ($M_{diff} = 0.344$, $p < 0.001$).

Table 1 shows the results of the post hoc analyses of the four additional RM-ANOVAs. All variables except intrinsic motivation for research increased significantly from T1 to T2 or from T1 from T3. Figure 1 illustrates how the estimated means of the four dependent variables changed during from T1 to T3.

Table 2 shows the incentives for positive and negative beliefs that resulted from the interviews. In general, experience was mentioned in relation to all four constructs as a positive incentive. Incentives related to collaboration were mentioned in relation to three of the

Table 1. Mean differences between dependent variables at Time1, Time2 and Time3.

	Mean differences		
Dependent variable	T1 and T2	T2 and T3	T1 and T3
Self-efficacy for collaboration	$M_{diff} = 0.047, p = 0.599$	$M_{diff} = 0.062, p = 0.182$	$M_{diff} = 0.109, p = 0.018$*
Self-efficacy for writing	$M_{diff} = 0.220, p < 0.001$*	$M_{diff} = 0.011, p = 0.115$	$M_{diff} = 0.231, p < 0.001$*
Intrinsic motivation for doing research	$M_{diff} = 0.001, p = 1.000$	$M_{diff} = 0.008, p = 1.000$	$M_{diff} = 0.006, p = 1.000$
Intrinsic motivation for writing	$M_{diff} = 0.152, p = 0.035$*	$M_{diff} = 0.073, p = 0.385$	$M_{diff} = 0.225, p = 0.002$*

*Significant at $p < .05$.

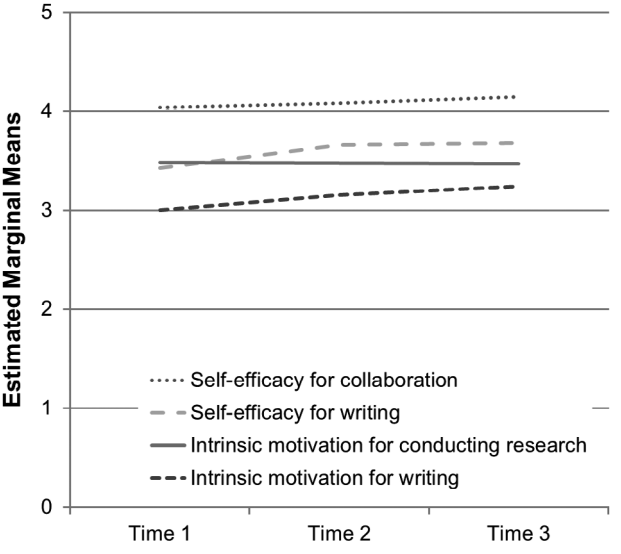

Figure 1. Estimated marginal means of self-efficacy beliefs and intrinsic motivation at T1, T2 and T3.

four constructs and were predominantly positive. However, there were also negative aspects to collaboration. For instance, the collaboration script was a positive incentive for self-efficacy for collaboration, but combining different writing styles in one coherent text was a negative incentive for self-efficacy for writing. Students found this editing-task difficult because it was hard to merge different writing styles in one coherent text. Other positive and/or negative incentives that emerged were teacher feedback (related to self-efficacy for writing), feelings of pride, the research topic, a sense that the research was irrelevant and a sense of a lack of autonomy (all related to intrinsic motivation for research).

Concerning the second research question, the RM-MANOVA with script/no script as between-subjects factor showed no significant difference between workgroups with the script and workgroups without the script, $F(1, 127) = 0.080$, $p = 0.778$, $\eta^2 = 0.001$. In other words, the questionnaire results did not differ between these two groups. Table 3 shows the answers to the yes-no questions. Most of the features of the collaboration script were used by students in all workgroups, regardless of whether they had received the script or not. The only script feature that workgroups without the script apparently did not use, was "sharing feedback with the subgroup". Also, students in one workgroup without the script did not check if each student contributed to each part of the research paper.

Table 2. Incentives for positive and negative self-efficacy and motivational beliefs.

Dependent variable	Incentives for positive beliefs	Incentives for negative beliefs
Self-efficacy for collaboration	New collaboration experiences, like delegating tasks and collaborating with new people	Need for personal control and having difficulties with delegating tasks
	Collaboration script, which provides structure and clarity about tasks and responsibilities	Large group size, which makes collaboration difficult
	Positive social interdependence (depending on others to succeed)	
Self-efficacy for writing	New writing experience/writing practice	Difficulty of merging different writing styles in one coherent text
	Teacher feedback on how to write	Repetitive teacher feedback that text needs improvement
	Learning new rules for writing and reading research articles as examples for writing	Need for personal control and having difficulties with delegating tasks
	Performing different writing tasks (writing, reviewing, editing)	
	Frequent peer feedback and variety of opinions in the peer feedback	
Intrinsic motivation for doing research	Experiencing the whole process of doing research	Parts of the research process that take too long and/or are uninteresting
	Being proud of the final project results	Feeling that the research project is irrelevant
	Research topic	Research topic
		Lack of autonomy in choosing the research method
Intrinsic motivation for writing	Experiencing the process of writing and analysing data; writing down the results	Large group size, which reduces individual engagement and motivation to write
	Research topic	Research topic
	Social aspect of writing together and helping each other	
	Reduction of workload through good division of labour and stepwise approach to write collaboratively	
	Being proud of the final project results	
	Collaboration script, which provides structure and clarity about tasks and responsibilities	

Table 3. Features of the script used by all workgroups.

	Workgroups					
Script features used	With script			Without script		
Group number	1	2	3	4	5	6
Working in subgroups	Y	Y	Y	Y	Y	Y
Different sub-question for each subgroup	Y	Y	Y	Y	Y	Y
Subgroup that merges texts of other subgroups	Y	Y	Y	Y	Y	Y
Roles within subgroup:						
• Drafter	Y	Y	Y	Y	Y	Y
• Reviewer	Y	Y	Y	Y	N	Y
• Reviser	Y	Y	Y	Y	Y	Y
• Editor	Y	N	Y	Y	Y	N
Contribution of each student to each part of research paper	Y	Y	Y	N	Y	NS
Sharing feedback with subgroup	Y	Y	N	N	N	N
Changing roles within subgroups after each round	Y	Y	Y	Y	Y	NS
Agreeing on deadlines within subgroup	Y	N	Y	Y	NS	Y

Notes: Y = Yes, N = No, NS = Interviewees Not Sure.

During the first interview, all interviewees of the script workgroups (1, 2 and 3) mentioned that they would use the collaboration script. During the second and third interview, the interviewees of workgroup 1 reported that they did not always use the step-by-step procedure for the subgroups. Time pressure sometimes prevented them from following those steps. The interviewees of workgroup 2 said they did not use the script, because it was easier for them to make mutual agreements themselves. However, they did split up the workgroup in subgroups and each group was responsible for one task, like merging the texts of other groups. The interviewees of workgroup 3 reported that they used the script. One of the students said that they had not changed a lot in the working approach of the script.

In the non-script workgroups (4, 5 and 6), all interviewees reported that they divided their workgroup in subgroups that wrote one part of the paper. In the interviews, it was mentioned that the main teacher of the course advised all the workgroups to do this. Also in group 4, 5 and 6, there were subgroups that merged texts to a final text. Students of workgroup 4 and 5 were content with the way they collaborated. In workgroup 4, one point of critique was that some students did most of the work. They had solved this problem by delegating the final tasks to students who had contributed the least over the year. Students of workgroup 6 were less content about their collaboration process, which was chaotic according to the interviewed students. However, a new teacher was assigned during the course. This teacher provided the group with a schedule of what needed to be handed in when, which facilitated the collaboration.

Discussion

Concerning the first research question, all constructs except intrinsic motivation for research increased significantly over the year. Self-efficacy and intrinsic motivation for writing increased significantly between T1 and T2, but not between T2 and T3. The increase between T1 and T2 may have been caused by the fact that students learned most of their new writing skills in the period between T1 and T2. During this period, students wrote the introduction of their research paper. Writing an introduction can be seen as a relatively complex writing task, more complex than reporting the method and results for instance. Learning to master this challenging task, combined with feedback from peers and the teacher, may have caused the most significant learning gains and therefore also the largest gains in self-efficacy and intrinsic motivation for writing.

The increases were small though and this begs the question why self-efficacy and motivational beliefs did not increase more during the course. Several authors suggest that students should become actively involved in doing research (Brew 2003; Healey et al. 2010), but apparently, allowing students to do research in an authentic research setting does not necessarily boost their intrinsic motivation for research and academic writing a their self-efficacy beliefs for writing and collaboration. If we want to motivate students at an early stage in their studies to become actively involved in research, perhaps we should be able to identify what drives undergraduates for doing research and what does not.

The interview results shed some light on which factors contributed or reduced motivation and self-efficacy beliefs. Some of these findings appear to be fairly context-specific, for instance the fact that group sizes were large. Below, findings that seem more generalisable to other educational contexts will be discussed.

Increases in self-efficacy beliefs may partly be explained by the principles of enactive mastery and vicarious experience (Bandura 1997). Enactive mastery can be derived from the findings that new collaboration and writing experiences improved self-efficacy beliefs. Vicarious experiences can be derived from the fact that students used research articles as examples (i.e. models) for their own writing. The writings of other students and feedback on those writings may also have served as models. The interviews also indicate that feelings of positive social interdependence (see Johnson, Johnson, and Smith 2007) contributed to positive self-efficacy beliefs about collaboration.

The fact that self-efficacy for collaboration increased over the year is consistent with previous findings that students who participate in research felt better team players (Hunter, Laursen, and Seymour 2007). The present findings add to this that a clear structure and clarity about tasks and responsibilities contributed to positive self-efficacy beliefs.

The finding that self-efficacy for writing increased is also consistent with previous research (Kardash 2000). The present findings add to this that, apart from the incentives discussed above, taking on different roles (writing, reviewing, editing) enhanced feelings of self-efficacy for writing. These different roles gave students a more diverse writing experience, which may have raised confidence in their own writing capabilities.

So far, self-efficacy beliefs have been discussed. We now turn to intrinsic motivation. A general finding was that the whole experience of doing research could boost intrinsic motivation. Some students mentioned that writing became more fun when the results were known. This indicates that positive experiences do not only increase self-efficacy, but intrinsic motivation as well. This seems to be in line with Bandura (1997), who states that enactive mastery (i.e. experiences of success) increases self-efficacy, which in turn drives intrinsic motivation.

Social aspects, specifically writing together and helping each other, increased motivation for writing. Thus, it appears that there was a need for relatedness, which is a positive incentive for intrinsic motivation (Ryan and Deci 2000a, 2000b). Rosenkranz, Wang, and Hu (2015) also found signs for a need for relatedness. In their study, students mentioned that teamwork and a belief that research contributes to scientific knowledge and practice boosted their motivation for research. Teamwork also seemed to be a positive incentive for motivation in the present study, but the value of contributing to scientific knowledge and practice was not mentioned in the interviews. In contrast, some students thought that their research project was irrelevant. This may explain why intrinsic motivation for research did not increase.

Another explanation may be that students experienced a lack of autonomy in their research projects. Not all students had full autonomy over choosing their own research method. In addition, not all students were assigned to their preferred research topic at the beginning of the course. From the perspective of SDT (Ryan and Deci 2000), this can be explained as a lack of self-determination that may have tempered intrinsic motivation for research and writing.

As with self-efficacy for writing, a clear structure for collaboration appeared to boost intrinsic motivation for writing. More specifically, a clear division of tasks and a structured, stepwise approach to write decreased the workload and this reduced workload increased the motivation to write. This indicates that there is a relation between the organisation of group work and intrinsic motivation. Negotiating clear and structured collaboration methods can increase confidence in the ability to successfully complete the task, which can increase the intrinsic motivation to do such tasks.

Considering the second research question, the script had no significant impact on self-efficacy beliefs. The interview results show that students in script-workgroups collaborated much in the same way as students in non-script-workgroups. Therefore, it may not be surprising that the script had no impact on self-efficacy. Most workgroups used collaboration methods that were described in the script, which may be explained by three reasons. First, script-workgroups did not follow the instructions completely. One workgroup kept using the script over the year, but the other two did not use it or made adjustments to the working procedure. Second, non-script-workgroups also received instructions to divide the workgroups in subgroups. The main teacher of the course advised all workgroups to do this. In addition, it cannot be ruled out that students or teachers came up with collaboration methods that were similar to the script. Dividing a large workgroup in subgroups and dividing the work within those subgroups according to different roles may have been a logical thing to do. Third, despite the fact that teachers of the script-workgroups were asked not to share ideas from the script with teachers of the no-script-workgroups, teachers (or students) in the script-workgroups may still have exchanged information with teachers (or students) in the non-script-workgroups. This seems plausible because teachers and students were in the same course during an entire year. A suggestion for a follow-up study would therefore be to provide all workgroups with the script and monitor what choices workgroups make in using the script. This could lead to the discovery of different "collaboration profiles", different ways students implement the script.

A limitation of this study is that, although a stratified sample was used, the interviews were held with just two students per workgroup. Answers were based on personal experiences and may not have been representative for all the students. However, every pair of students worked closely with the other students in the workgroup and we can expect them to know what the other students thought about the research project. Furthermore, the interviews did provide a deeper understanding of the incentives for self-efficacy beliefs and intrinsic motivation. Future research could focus more on gathering qualitative data to find out which underlying mechanisms increase students' self-efficacy and intrinsic motivation.

Another limitation is the borderline value of Cronbach's alpha of the scale that measured self-efficacy for collaboration. This suggests that the reliability of this scale was suboptimal and the results of this scale should be interpreted with caution.

Taken together, the present findings suggest that self-efficacy beliefs and intrinsic motivation for research can be promoted by offering students choice and autonomy, promoting feelings of relatedness and stimulating positive social interdependence. Motivation may increase further when students see their research project as being relevant. The interview results suggest that these relations exist, but this needs to be investigated further. If teachers want to increase student motivation for research, they should perhaps let them work in small groups, give them autonomy over their project, promote relatedness and positive interdependence, and let them work on a project that has academic or societal relevance.

Disclosure statement

No potential conflict of interest was reported by the authors.

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