Collaboration and psychological ownership: how does the tension between the two influence perceived learning?

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Abstract   Collaborative writing may evoke conflict between individuals' feeling of contribution and their sense of ownership toward the collective outcomes. The present study tested the relations between perceived psychological ownership, perceived quality of the product, and perceived learning in five experimental conditions: two collaborative, two sharing, and a control. Analysis of the changes made between versions revealed differences in quantity and in types of changes between collaboration, sharing, and control conditions. Results showed that collaboration may improve the perceived quality of the written product more than sharing or control. In addition, less intrusive collaboration seems to enhance the sense of perceived learning. The relation between perceived ownership and perceived learning was mediated by perceived quality of the written product. We conclude that students may avoid collaboration partly because they do not want to lose a sense of personal ownership or to lessen peer ownership.

Keywords   Ownership · Collaboration · Perceived learning

1 Introduction

There are many ways to learn collaboratively. Students can work together on a project in which each student contributes something to initialize a project, to develop and then to finalize it. Different mode of collaboration is when collaborators comment on each other's work in order to improve it. Students may work alone, but share findings or insights between them. Collaboration may be classified by the means that afford it (e.g., Bafoutsou and Mentzas 2002), or by the situation or interaction that take place

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(e.g., Dillenbourg 1999; Dillenbourg et al. 1996). The present research tested how different modes of collaboration affected the perceived quality of written products and perceived learning. A key issue in this research is psychological ownership, which is discussed below.

Psychological ownership is defined as "the state in which individuals feel as though the target of ownership or a piece of that target is 'theirs'" (Pierce et al. 2003, p. 86). This sense of possession is not restricted to physical objects, but may be felt toward ideas, words, creations, academic products (Pierce et al. 2003), or information (Raban and Rafaeli 2007). It is also distinct from the legal ownership of objects (Etzioni 1991; Heyman et al. 2004; McCracken 1986). Pierce et al. (2003) ascribed the genesis of psychological ownership to either biological structure, namely an innate genetic needs for possession, or to socio-cultural practices that begin at the very early developmental stages of a child, in which possession of an object helps to define the boundaries between self and others. Pierce et al. (2001) argued that psychological ownership has important emotional, attitudinal and behavioral effects.

Psychological ownership can be manifested in terms of what is "mine" or what is "ours". For example, Van Dyne and Pierce (2004) measured psychological ownership by using items that emphasize possessions (e.g., "I sense that this is *my* company", or "This is *our* company"). Similar phrasings are found in other study instruments (e.g., Avey et al. 2009; Fubry 1978). In many cases, "my", "mine", "our", and "ours" have similar meaning and have no conflict. However, in other cases, what is "mine" cannot at the same time be perceived to be "ours". Sharing knowledge is an example. Owning certain knowledge or information gives superiority to the owner over those who don't have this specific knowledge or information (Szulanski 1996; Webster et al. 2008). Webster et al. (2008) claimed that generating ideas is likely to engender feelings of territoriality, because of the time and effort one has invested in generating the ideas, and the intimate familiarity with that knowledge. Thus, people tend to withhold their own self-generated knowledge and are reluctant to share it. Only after sharing the knowledge, it may become "our" knowledge instead of "my" knowledge.

In collaborative projects, a similar tension may also arise. Projects that were put together collaboratively may be perceived as "ours". Only if a specific part or element of the whole project was fully created by a single individual, this individual may perceive *this part* as his "own". In collaborative work, a conflict between "my" work and "our" work may appear. What is perceived to be "ours" cannot be fully perceived to be "mine". Thus, collaboration may impair the sense of psychological ownership.

The tension between collaboration and sense of ownership might be a critical issue in learning environments (see e.g., Kirschner et al. 2004). For example, assessment and evaluation of an individual student's contribution to a collaborative learning is difficult, and might direct students to reduce their level of accountability (and hence ownership) for the learning output. Both ownership (Biggs 1999; Gross 1997; Jonassen 1999) and collaboration (Johnson et al. 1998, 2000) may be advantageous for learning, but when they are in conflict, they may have trade-off relationships.

The current study focuses on collaborative writing. Collaborative writing is defined broadly as an activity that involves the production of a document by more than one author (Allen et al. 1987; Dillon 1993). At the mere technical level, it is a complex process that depends on both the number of contributors, the types of division of labor

among them, and the number of different activities involved (e.g., outlining, drafting, reviewing, editing, etc.). Psychological ownership may be affected by these variables as well as by some non-technical variables. For example, it is possible that perceived ownership toward a draft edited by a peer will be higher than toward the same draft edited by two peers, lower if peers only commented without changing the draft, or even lower if it was commented by a supervisor.

There are many tools that afford collaborative writing; some were adopted for instructional purposes. For example, recent studies reported utilizing Wikis, a tool that allows different students to write collaboratively, but also enables evaluation of individual contributions (Ioannou and Artino 2008; Jones 2008; Ravid et al. 2008; Wheeler et al. 2008). For this tool, many findings suggest that ownership overrides collaboration: students preferred not to engage in collaborative learning using Wikis, but rather continued to cultivate a practice of individual accountability and individual ownership (Ioannou and Artino 2008). When requested to collaborate by using Wikis, students tended to avoid changing other students' written documents (Dalke et al. 2007). They often felt that it was inappropriate to edit others' work (Coyle 2007). When they did, it was more on a language level than on a content level (Lund and Smørdal 2006), by adding information and changing format rather than by deleting sentences (Meishar-Tal and Gorsky 2010). Users also did not encourage others to edit their own entries (Da Lio et al. 2005).

The trade-off between collaborative writing and ownership has been discussed in different academic settings (Ede and Lunsford 2001; Jones and Issroff 2005; Saunders 1989). The rationale for co-authoring an academic piece is that co-authoring elevates the quality of the product (e.g., Hollis 2001). In learning settings, collaborative writing increases student participation, facilitates discussion between students (Ruberg et al. 1996), and enhances critical thinking (Tynjälä 2001). It encourages students to continually assess their own performance and compare it to that of their peers (Jacobsen and Mueller 1998).

Thus, on the one hand, collaborative writing is expected to produce a document of high quality. It is therefore possible that the "deeper" the collaboration, the better the outcomes. In this sense, editing a draft will improve it more than just adding comments. On the other hand, collaboration may have a cost in psychological ownership. An edited draft will be perceived to be less "mine" than a draft with a peer's comments. Furthermore, collaboration may affect the experience of learning. Caspi and Blau (2008) defined perceived learning as a "set of beliefs and feelings one has regarding the learning that has occurred" (p. 327). As such, perceived learning is a retrospective evaluation of the learning experience. Caspi and Blau claimed that perceived learning may rely on two independent sources: cognitive and socio-emotional. The cognitive source reflects the sense that new knowledge has been acquired, that some new understanding has been achieved (even if the knowledge and understanding are incorrect), in addition to other cognitive-based processes. The socio-emotional source reflects experiences and feelings (like difficulty or enjoyment), involvement in the learning, or a feeling of innovation in the current study. For the purpose of this study, we hypothesize that, given this distinction, different levels of collaboration will affect both the cognitive and the socio-emotional aspects of perceived learning. Possible results are that "deeper" collaboration (i.e., editing each other draft as opposed to

merely sharing drafts) will evoke a greater sense of learning in the cognitive source; but since this procedure might be more intrusive, especially regarding the sense of ownership, it will lead to lower sense of learning in the socio-emotional source.

2 Method

2.1 Participants

118 undergraduates (80% women) from the Department of Education and Psychology at the Open University of Israel received academic credit for participation in this research. The participants' ages ranged from 16 to 54, mean age was 27.1 years, and the median was 25.

2.2 Instruments

Classifying *changes from draft to final version* was done using Meishar-Tal and Gorsky (2010) hierarchical classification. They broadly divided editorial actions to "on" and "within" sentence. The former includes actions carried out on entire sentences (i.e., moving sentences from one place to another, adding sentences, or deleting whole sentences), whereas the later includes actions done on specific words within a single sentence (i.e., changing the order of words, replacing words, changing grammar, or format).

2.2.1 Perceived ownership

Pre-revision Perceived ownership before the revision was measured by the average of two significantly correlated items ("I feel that the text I wrote is mine" and "I am responsible for the text I wrote", $r = .52$, $p < .001$).

Post-revision Perceived ownership after the revision was measured by the average of three items ("I feel that the text I wrote is mine", "I am responsible for the text I wrote", and "I feel that the text I wrote is mine, even if others contributed to its development"), Cronbach's alpha was .77.

2.2.2 Perceived quality

To measure perceived quality, we averaged six items ["to what extent your text is…(1) of good quality, (2) comprehensive, (3) exhaustive, (4) well-written, (5) exact, (6) presents information clearly"], Cronbach's alpha was .93 for pre-revision and .94 for post-revision tests.

2.2.3 Perceived learning

Cognitive aspect In order to measure the cognitive aspect of perceived learning, five items were averaged ["After this experience…(1) I know more things, (2) I expect to

remember the issue, (3) my prior knowledge deteriorated (reverse item), (4) I clearly understand the topic, (5) I learned"], Cronbach's alpha was .74.

Emotional aspect The emotional aspect of perceived learning was measured by the average of four items, two positive ("I enjoyed the experience" and "I loved the experience") and two negative statements ("I suffered from the experience" and "the experience annoyed me"), which were reversed. Cronbach's alpha was .90.

2.3 Procedure

First, all participants read a shortened Hebrew translation of Myers' (2007) paper that reviews human intuition. Second, they wrote an initial draft, summarizing this text in up to 400 words, using GoogleDocs[TM], an Internet application that allows collaborative writing. The GoogleDocs application allows access to a document from any computer, and eases the ability to collaborate by sharing a document with others as viewers or collaborators, or by publishing it on the web (Conner 2008). GoogleDocs supports synchronous editing and comment writing, and saves versions of the document—options that afford real-time collaborative learning. After submitting the draft, participants reported perceived ownership and perceived quality (*pre-revision test*).

Following this initial stage, participants were randomly allocated to five groups: four experimental groups and a control group.

Control group Each member of the control group ($N = 23$) read a summary of the same topic, which was written by one student. This summary was chosen because it was of average length and of average estimated quality. Then members revised their drafts and submitted the final document.

Suggesting group The participants in the "suggesting" group ($N = 25$) wrote comments on a peer's draft. Then they revised their own draft by receiving or rejecting peer's comments. This group *collaborated.*

Editing group The "editing" group ($N = 25$) read and edited a peer's draft and then revised their own draft (which was edited by a peer). This group also *collaborated.*

Publishing group The "publishing" group ($N = 22$) aimed to test the possible influence of the awareness of publishing a draft to unknown readers on perceived ownership and perceived quality of the written product. This group published their draft on the Web and read another "published" text—the same text read by the control group. After reading the text they revised their own draft. We consider this group as a *sharing* group.

Reading group Participants in the "reading" group ($N = 23$) *shared* their draft with a specific peer, instead of the unknown audience of the Web. They read a peer's draft and then revised their own draft. These two groups only shared their draft (the "publishing" group, actually, were only led to believe so), but did not collaborate in a way that may have improved the draft of a peer.

Thus, we had a control group, two "collaborative" groups, and two "sharing" groups.

At the last stage, all groups reported a perceived sense of ownership, perceived quality of the final document (*post-revision tests*), and perceived learning.

3 Results

3.1 Preliminary analyses

Google Docs is relatively new technology. Therefore we tested participants' prior utilization with that tool. None of the participants had utilized Google Docs application before, but all reported that this application was easy or very easy to use (Mean > 5.09, scale from 1—very complicated tool to 6—very simple tool).

Before testing our main hypotheses, we first analyzed possible differences in *number of words* written as a function of group. A repeated measure ANOVA, with group as a between-subjects factor, and number of words as a within-subject factor, revealed the effect of revision. Number of words in the draft (Mean: 276.63, SD: 110.71) was significantly lower than number of words in the final document (Mean: 301.56, SD: 103.82), $F(1, 113) = 20.84$, $p < .001$, partial $\eta^2 = .16$. There was no effect of group or interaction.

The second preliminary analysis tested the *changes from draft to final version*. We examined between group differences in terms of Meishar-Tal and Gorsky (2010) hierarchical classification of editorial actions. Table 1 presents the average number of changes done by each group for the highest hierarchy. Repeated measures ANOVA, with group as a between-subjects factor, and type of change as a within-subject factor, revealed significant difference between groups, $F(4, 113) = 5.36$, $p = .001$, partial $\eta^2 = .16$. Pairwise comparisons (LSD) revealed that all experimental groups made more changes than the control group (all p's < .05). It is possible that since this group did not believe that their product will be read by others, participants made less effort to improve it.

Table 1 Highest order classification of changes: Average (and SD) changes by conditions

	On sentence	Within sentence	Average number of total changes	Average difference between On and Within changes*
Control	1.87 (2.18)	2.30 (1.61)	4.17 (2.95)	−0.43 (2.45)
Publishing	3.95 (4.88)	8.00 (5.38)	11.95 (9.35)	−4.05** (4.27)
Reading	5.96 (6.96)	2.96 (2.85)	8.91 (8.66)	3.00*** (6.19)
Suggesting	7.12 (5.87)	6.76 (4.42)	13.88 (9.38)	0.36 (4.46)
Editing	5.32 (4.99)	6.76 (4.73)	12.08 (7.70)	−1.44 (5.94)
Total	4.90 (5.45)	5.38 (4.57)	10.28 (8.56)	−0.48 (5.29)

* Negative value = more within sentence changes then on sentence changes
** $t(22) = 4.44$, $p < .001$
*** $t(22) = 2.33$, $p < .05$

In addition, we found a significant group by type of change interaction, $F(4, 113) = 6.31$, $p < .001$, partial $\eta^2 = .18$. The right most column of Table 1 presents the difference between *on* sentence and *within* sentence changes for the five groups. Interestingly, only the two sharing groups (publishing and reading) had significant differences between 'on' and 'within' sentence changes.

To analyze the lower level categories of Meishar-Tal and Gorsky's classification, we need to take into account the difference between the two collaborative groups (suggesting and editing) and all other groups. These two groups may rely not only on their impressions from and comparison with a peer's draft, but also from overt editorial suggestions made on their own draft. Table 2 presents the average changes done for each group (the right most column is identical to the within column of Table 1).

A repeated measure ANOVA, with group as a between-subjects variable, and type of editorial action done by the participant as a within-subject variable, revealed a significant group effect [$F(4, 113) = 5.36$, $p = .001$, partial $\eta^2 = .16$] that replicated the observation reported above; namely that the control group made significantly less overall changes relative to the other groups. The effect of type of editorial action was also significant, $F(2.758, 311.651^1) = 55.91$, $p < .001$, partial $\eta^2 = .33$. All differences between average number of editorial actions were significant (at $p < .05$), suggesting that participants overall did more within sentence changes; then, in decreasing order, they added sentences, moved sentences and deleted sentences. The group by type of action interaction was also significant, $F(11.032, 303.299) = 4.76$, $p < .001$, partial $\eta^2 = .15$, replicating the analysis reported above.

Another clear pattern presented in Table 2 is the difference between number of suggestions and the amount of rejected suggestions in the two collaborative groups. To further test these differences, we compared the suggestions to add or to delete sentences against rejections of these changes by the author. In the first repeated measure ANOVA, we tested the difference between suggestions to *add* sentences and rejections of these suggestions (a within-subject factor) in the two collaborating groups (a between-subject factor). Clearly, participants accepted most of the changes suggested (Mean suggestions to add sentences: 1.64, SD: 2.15, Mean rejection: 0.34, SD: 0.87), $F(1, 48) = 19.50$, $p < .001$, partial $\eta^2 = .29$. The effect of group was insignificant, but the interaction was statistically significant, $F(1, 48) = 5.65$, $p < .05$, partial $\eta^2 = .11$: the editing group received more suggestions and accepted more suggestions than the suggesting group. We ran a second, identical analysis with suggestions and rejections to *delete* sentences. Again, overall, participants accepted most of the changes (Mean suggestions to delete sentences: 1.04, SD: 1.52, Mean rejection: 0.46, SD: 1.30), $F(1, 48) = 11.99$, $p < .001$, partial $\eta^2 = .20$. The groups did not differ significantly, but the interaction between groups and actions was statistically significant, $F(1, 48) = 6.29$, $p < .05$, partial $\eta^2 = .12$: the editing group accepted more suggested changes than the suggesting group.

The lowest level categories of Meishar-Tal and Gorsky's classification of editorial actions that we employed were types of 'within' sentence changes. Table 3 presents the results.

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[1]   In a few ANOVAs we used Greenhouse-Giesser correction to account for a violation of sphericity.

Table 2 Second order classification of changes: Average changes by conditions

	Add			Delete			Move			Edit		
	Suggested	Rejected	Done	Suggested	Rejected	Done	Suggested	Rejected	Done	Suggested	Rejected	Done
Control			0.91 (1.51)			0.04 (0.21)			0.91 (1.65)			2.30 (1.61)
Publishing			1.59 (2.72)			0.05 (0.21)			2.32 (3.88)			8.00 (5.38)
Reading			3.83 (5.24)			0.87 (1.25)			1.26 (1.98)			2.96 (2.85)
Suggesting	1.20 (1.29)	0.60 (1.12)	3.96 (4.78)	1.04 (1.77)	0.88 (1.74)	1.40 (3.06)	0.48 (1.00)	0.00	1.76 (3.24)	1.08 (1.87)	0.00	6.76 (4.42)
Editing	2.08 (2.72)	0.08 (0.40)	2.32 (3.47)	1.04 (1.27)	0.04 (0.20)	1.00 (1.29)	1.96 (2.83)	0.00	2.00 (2.81)	6.28 (4.72)	0.00	6.76 (4.73)
Total changes in the final document			2.55 (3.95)			0.69 (1.69)			1.65 (2.83)			5.38 (4.57)

Table 3 Third order classification of changes: Average (and SD) changes by conditions

	Content	Lingual	Grammar	Formatting
Control	0.87 (1.06)	0.17 (0.39)	0.22 (0.42)	1.04 (1.55)
Publishing	1.50 (1.79)	0.27 (0.77)	1.27 (1.49)	4.95 (5.05)
Reading	0.30 (0.70)	0.17 (0.65)	0.17 (0.49)	2.30 (2.72)
Suggesting	1.80 (2.06)	0.32 (0.75)	0.28 (0.54)	4.36 (4.48)
Editing	2.92 (2.89)	0.84 (1.24)	0.28 (0.61)	2.72 (2.79)
Total	1.51 (2.10)	0.36 (0.84)	0.43 (0.88)	3.07 (3.76)

A repeated measure ANOVA, with group as a between-subjects factor, and type of editing as a within-subject factor, revealed a significant effect of group, $F(4, 113) = 9.15$, $p < .001$, partial $\eta^2 = .26$. A post-hoc analysis showed that the control group and the reading groups did less editing than all other groups (all $p's < .001$). There was a significant type of editing effect, $F(1.483, 167.538) = 42.32$, $p < .001$, partial $\eta^2 = .27$. Pairwise comparisons revealed significant differences between all types of editing (all $p's < .001$) except grammar and lingual changes. Most edits were in formatting, the most superficial action. The interaction between group and type of editing was also significant, $F(5.93, 150.951) = 3.79$, $p < .005$, partial $\eta^2 = .12$.

3.2 Main analyses

Changes in perceived ownership We tested the change in perceived ownership from pre-revision to post-revision. A repeated measure ANOVA, with group as a between-subject factor, and perceived ownership as a within-subject factor, revealed a significant effect of group, $F(4, 113) = 3.00$, $p < .05$, partial $\eta^2 = .09$, and significant group by ownership interaction, $F(4, 113) = 3.49$, $p < .01$, partial $\eta^2 = .11$. Average perceived ownership is presented in Fig. 1.

A contrast analysis revealed that the editing group had significant lower perceived ownership relative to all other group (except the reading group, all $p's < .05$). This result is expected, since the collaboration employed by this group was the most
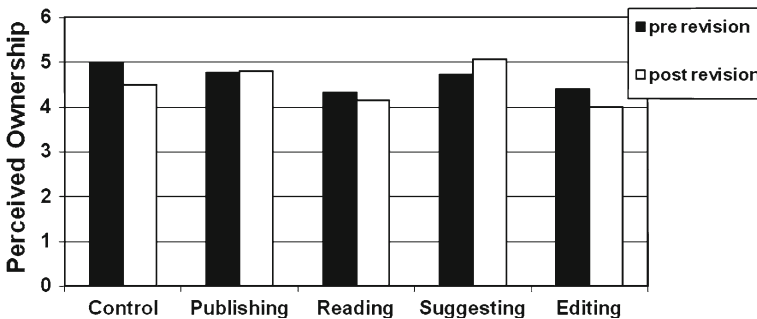

Fig. 1 Average perceived ownership by conditions

intrusive. The reading group had a significantly lower score relative only to the suggesting group ($p = .01$). There was no significant difference between groups in the pre-revision test, $F(4, 117) = 1.39, p = .24$, but only in the post-revision test, $F(4, 117) = 5.41, p < .001$. A series of planned comparisons was run to test the difference between pre- and post-revision in the different groups. Significant change in perceived ownership was found for three groups: control, $t(22) = 2.38, p < .05, d' = 0.51$, suggesting, $t(24) = 2.20, p < .05, d' = 0.50$, and editing, $t(24) = 2.27, p < .05, d' = 0.46$. As Fig. 1 clearly presents, while perceived ownership was reduced in the control and in the editing groups, it increased in the suggesting group, and remained unchanged in the publishing and reading groups.

For the two collaborative groups, we examined whether the change in perceived ownership depended on the amount and type of editorial suggestions made by a peer. We tested the effect of acceptance of changes suggested by a peer above and beyond the effect of the group, by using a hierarchical regression, but failed to find any significant contribution made by amount or type of acceptances. This result suggests that changes in perceived ownership were not a result of number (or type) of accepted changes, but rather because of the collaboration activities. That is, involvement in a certain type of collaboration (editing or suggesting) may influence the sense of ownership more than the actual number of editorial suggestions.

Changes in perceived quality   The changes in perceived quality were tested by repeated measures ANOVA, with pre- versus post- revision tests as a within-subject factor, and group as a between-subject factor. We found a significant difference in perceived quality of the written product between pre and post revisions, $F(1, 113) = 11.85, p < .001$, partial $\eta^2 = .10$, and significant interaction with group, $F(4, 113) = 2.63, p < .05$, partial $\eta^2 = .09$. Average perceived quality is presented in Fig. 2.

A series of planned comparisons was run to test the difference between pre- and post-revision tests in the different groups. Significant effects were found for the suggesting group, $t(24) = 2.03, p = .05, d' = 0.41$ and for the editing group, $t(24) = 4.15, p < .001, d' = 0.85$. These two groups received constructive suggestions, either as comments or as editorial changes, which were considered when revising the draft.
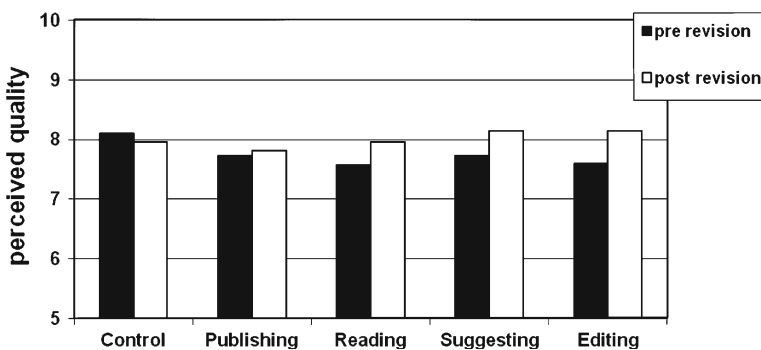

Fig. 2 Average perceived quality of the written product by conditions

For these two groups, we also examined whether perceived quality depended on the amount and type of suggestions to change the draft made by a peer. We tested the effect of acceptance of changes suggested by a peer above and beyond the effect of the group using hierarchical regression, but failed to find any significant contribution of amount or type of accepted changes. This result suggests that changes in perceived quality were not affected by number of suggestions, but may result from the active collaboration itself that took place in these groups.

We tested the correlations between perceived ownership and perceived quality. Both correlations were statistically significant: Before the revision, $r = .44$, $p < .001$, and after the revision, $r = .29$, $p < .01$. We further tested the correlation between the change in perceived ownership and the change in perceived quality. Overall, this correlation was not significant, $r = .08$. Testing the last correlation separately for each group revealed a significant correlation only for the editing group, $r = .42$, $p < .05$. It is noted that this positive correlation means that a sense of improvement in the quality of the text was associated with an *increased* sense of ownership and not, as we may have expected from editing intervention, in a *decreased* sense of ownership.

Perceived learning A significant difference between cognitive and emotional aspects of perceived learning was found, $F(1, 113) = 47.16$, $p < .001$, partial $\eta^2 = .29$. Participants perceived their cognitive aspect of learning to be lower than their emotional aspect (Means 3.45 and 4.15, SDs: 0.92 and 1.38 for cognitive and emotional, respectively). Collaborative conditions did not interact with perceived learning. The correlations between the cognitive and emotional aspects were above .51 for all groups.

Based on the above results, we tested a model that suggests that perceived learning is predicted by perceived ownership and perceived quality. The model assumes that perceived quality mediates the relation between perceived ownership and perceived learning. The model is presented in Fig. 3.

For the cognitive aspect of perceived learning, the data-to-model fit was high, $\chi^2(2) = 0.42$, $p = .81$, RMR $= .02$, GFI $= .99$, AGFI $= .99$, CFI $= 1.00$, and RMSEA $= .001$. The direct paths are presented in Fig. 4. As can be clearly seen, only perceived ownership and perceived quality at pre-revision significantly predicted perceived learning. In addition, the significant correlation between perceived ownership at post revision and perceived quality at post revision disappeared. We compared
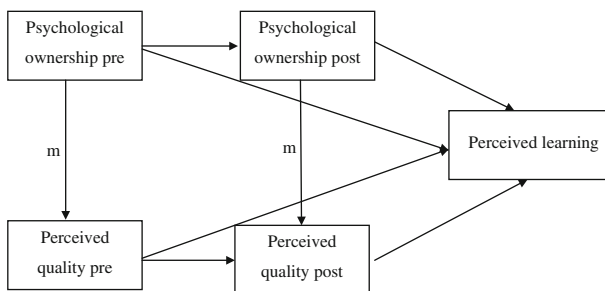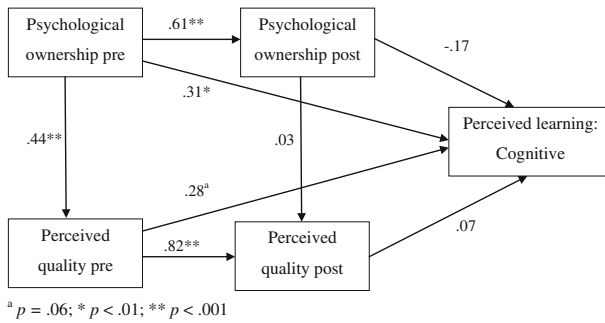

Fig. 3 A schema of the mediation model

Fig. 4 Structural equation modeling of the relations between psychological ownership, perceived quality, and perceived learning (cognitive aspect)

this model against a model without mediation (i.e., excluding the paths from perceived ownership to perceived quality, denoted *m* in Fig. 3). Data-to-model fit of the alternative model was low [$\chi^2(4) = 26.48$, $p < .001$, RMR $= .30$, GFI $= .93$, AGFI $= .72$, CFI $= .91$, and RMSEA $= .22$]. Testing the improvement of the proposed model against the alternative model revealed a significant difference, $\chi^2(2) = 26.06$, $p < .001$. Thus, the mediation of perceived quality was significant.

A similar analysis was run for the emotional aspect of perceived learning. None of the predictors of perceived emotional aspect of learning reached significance.

4 Discussion and conclusions

The aim of this study was to test the relations between collaboration and psychological ownership. We suggested that a possible trade-off between collaboration and ownership may affect perceived quality and perceived learning. As predicted, different types of collaboration affected psychological ownership. Editing, the "deepest" level of collaboration, which had the higher level of intrusion, decreased psychological ownership. This type of collaboration had a psychological cost, but did it also have a cost in terms of learning process and outcomes? Our data revealed that collaboration by editing each other's draft improved perceived quality and did not impair perceived learning. Thus, at least in terms of perceived quality of learning, the benefit of this collaboration type might be higher than the cost of losing a sense of ownership.

To our surprise, suggesting—which is a "softer" and less intrusive type of collaboration—increased the sense of ownership. It is possible that the comments made by peers were supportive, or were written in an encouraging tone. Like editing, the perceived quality of the written product increased after the intervention, and did not reduce perceived learning. It seems that this type of collaboration "wins" along all three dimensions.

For the two collaboration conditions, changes in psychological ownership and changes in perceived quality were not affected by the *amount* of suggestions accepted vis-à-vis adding or deleting words or sentences. Thus, it is suggested that these changes may have resulted from the mere active collaboration that took place between

participants in these groups. In other words, even a very minor comment or small edition changed perceived psychological ownership, albeit in different directions, and, at the same time, led to a positive change in perceived quality. It is noted that an improvement in perceived quality was found exclusively only in these two groups, emphasizing the advantage of collaboration over knowledge sharing.

Overall, the editing group received more suggestions and accepted more suggestions than the suggesting group. This result may partly explain why psychological ownership decreased in the editing group and increased in the suggesting group.

We found a positive correlation between psychological ownership and perceived quality, which decreased substantially between pre and post revisions. It seems that *before* revealing the draft to a peer (or believing that this is the case in some conditions), the more individuals believed the piece is their own, the better its perceived quality. While this pattern remained even *after* a peer read the draft (and in some cases added comments or made editorial changes), the act of collaborating weakened this relation. We consider this result to signify the tension between ownership and collaboration. Furthermore, it might explain why students tend to avoid "deep" collaboration and prefer "surface" or soft forms, such as changing language rather than content (Lund and Smørdal 2006), and adding, more than deleting sentences (Meishar-Tal and Gorsky 2010).

Furthermore, ownership correlated positively with perceived learning. This correlation was mediated by perceived quality, but only for the cognitive aspect of perceived learning, and not for the emotional one. This mediation calls for comments. First, it appeared that before the act of collaboration (or sharing), the correlations between ownership, quality, and perceived learning were stronger than afterwards. Second, the relations between ownership and perceived learning, as well as quality and perceived learning, are significant before and insignificant after the review and revision process. Taken together, it might mean that the perception that learning had occurred was established earlier in the process, and did not elaborate during it. It is noted that in terms of the emotional aspect of perceived learning, none of these correlations was significant. This difference between the cognitive and emotional aspects of perceived learning is further evidence of their independence.

The limitations of the current study are as follows. First, the decrease in psychological ownership in the control group was unexpected, since this group kept the draft to themselves and did not present it to any actual or imagined audience. We have no plausible explanation for this result. Second, we ran this study as a controlled laboratory experiment, where participants wrote and collaborated on an ad-hoc topic. The influence of motivation and involvement on the relations between ownership, collaboration, and learning was thus not tested. Third, it was beyond the scope of the present work to examine differences in actual quality and actual learning. In some cases, the relations between perceived and actual learning are weak (e.g., Astin 1993; Dumont and Troelstrup 1980; for review, see Gonyea 2005). Last, our participants were predominantly females. It is possible that this skewed distribution may influence our results. However, while there are some indications that women prefer collaborative communication and work (Blum 1999; Carr et al. 2004; Gilligan 1982), there are some counter-indications (e.g., Lee and Bozeman 2005), and the cumulative evidence is not clear (Prinsen et al. 2007).

We conclude that the tension between psychological ownership and collaboration may play a role in learning. It seems that less intrusive collaboration (i.e., suggesting changes) might be a better way to learn. We found that collaboration may improve quality more than sharing or merely being exposed to a random example of a peer's work. It appears that students may avoid collaboration in part because they do not want to lose a sense of ownership, or to reduce the ownership of peers.

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