Computer Assisted Language Learning Electronic Journal (CALL-EJ), 23(1), 374-400, 2022

Students' Emotional and Behavioral Engagement: Cloud-based Collaborative Writing and Learning Analytics

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Abstract

Collaboration on, around, and through written text has been facilitated with the integration of cloud tools and platforms. Thanks to the learning analytics tools available on these platforms, large educational datasets on learners' logs and online learning behavior are now at the instructors' fingertips. Consequently, affective factors (like learning engagement), that have long been thought of as difficult and labor-intensive to observe and assess, can now be easily and objectively measured. In response, the current study examined the influence of cloud-based collaborative writing on EFL learners' emotional and behavioral engagement using cloud learning analytics tools. A cohort of 27 junior EFL college students was selected and exposed to the eight-week intervention practicing collaborative writing and feedback on Google Docs. The quasi-experimental mixed-method design was followed. Quantitative data about behavioral engagement were collected using 4 indices: number of self-edits, frequency of learner logs, number of comments, and time spent per task. A pre-post emotional engagement scale was also administered. Quantitative results of the study revealed that, generally, students' behavioral engagement did not change after the intervention, whereas their overall emotional engagement did. Qualitative data collected from the open-ended perceptions survey were generally in line with the quantitative ones.

Keywords: cloud-based collaborative writing; EFL; emotional engagement; behavioral engagement; learning analytics.

Introduction

As a new and promising area of learning sciences, learning analytics is increasingly and rapidly making its way into educational sectors. Now, owing to the plethora of learning analytics and data mining tools and applications, student online performance tracking and analysis has been a much easier and more objective process than ever before. Data-driven insights and decisions are very crucial to the teaching and learning process, to which EFL teaching and learning is no exception.

In this vein, there is a mounting interest to conduct studies using learning analytics to gather data on varied learning aspects: (a) *collaborative writing* (Hu, 2017); (b) *oral performance in a flipped classroom* (Lin & Hwang, 2018); (c) *reading skills*

(Aristizábal, 2018); (d) *vocabulary learning* (Hsiao et al., 2017); (e) *learning achievements using e-book* (Mouri et al., 2018); (f) *student perceptions of feedback* (Misiejuk et al., 2021); (g) *online interaction in language MOOCs* (Martín-Monje et al., 2018); (h) *peer assessment* (Divjak & Maretić, 2017); (i) *online and offline language learning environments and student engagement* (Rienties et al., 2018); (j) *online language learning and teaching* (Wen & Song, 2021; Youngs, 2021); and (k) *ethical issues* (Heath, 2021; Weng, 2021).

Collaboration has become commonplace both in academic as well as practical and professional contexts and even obligatory in many of them (Skaf-Molli et al., 2007). These practices have been augmented and enhanced by the emergence and integration of Web 2.0 tools which have been widely explored by recent writing researchers (e.g., Hafour & Al-Rashidy, 2020; Ebadi & Rahimi, 2017; Marandi & Seyyedrezaie, 2017; Suwantarathip & Wichadee, 2014).

As such, with the emergence of a plethora of user-friendly and full-featured cloud tools and applications, collaborative writing has become easier and more effective. Moreover, the add-in learning analytics tools that these cloud platforms host have facilitated the process of tracking learners' logs and performance. As such, latent learning aspects like learning engagement, motivation, and participation can be assessed directly and objectively with the least effort exerted on the part of the teacher or assessor. In response, the current study was conducted to examine the impact of cloud-based collaborative writing on EFL learners' emotional and behavioral engagement using cloud learning analytics tools. Thus, the main research questions were:

1. Does EFL learners' behavioral engagement evolve after cloud-based collaborative writing?
2. Does EFL learners' emotional engagement evolve after cloud-based collaborative writing?
3. How do students perceive their engagement during cloud-based collaborative writing?

Literature review

Learning analytics (LA)

Learning Analytics is a field that tries to analyze and make sense of educational big data for the purpose of improving and/or understanding the teaching and learning process using students' behavioral logs (Gelan et al., 2018; Hwang et al., 2018). LA often deals with large datasets (Misiejuk et al., 2021). It is an area of research that is defined as the collection, organization, analysis of data about both learners and their learning contexts to guide pedagogical decision-making (Reimann, 2016). According to Godwin-Jones (2017), big data have emerged and become much related to computer-assisted language teaching and learning (Godwin-Jones, 2017). With the development of LA, decision-making processes have been informed and guided with behavioral information that supports students' language learning (Wen & Song, 2021).

Despite still being in its infancy, LA educational potentials are increasingly acknowledged including: (a) explaining and understanding unexpected learning

behaviors; (b) detecting misplaced effort and misconceptions; (c) identifying and highlighting successful learning patterns; (d) increasing learners' awareness of their own actions and progress; (e) proposing appropriate interventions (Wen & Song, 2021); (f) shifting the focus from reporting feedback information to gaining insights on this feedback (Ryan et al., 2019); (g) giving rise to new challenges such as generating automated coding of peer feedback (Misiejuk et al., 2021; Xiong et al., 2012); and (h) helping to identify feedback accuracy, using predictive analytics (Wahid et al., 2016).

Previous studies approached learning analytics differently: (a) Youngs (2021) developed an LA visualization tool and explored its value and use in making informed decisions with respect to student French language learning. The results suggested that the LA tool can be exploited in intervention with low-achieving learners as well as determining if they struggled as a result of poor course materials; (b) Wen and Song's (2021) study identified the factors influencing learning analytics in collaborative language learning contexts; (c) Misiejuk et al. (2021) used learning analytics to understand students' perceptions of peer feedback; (d) Shibani (2017) examined writing analytics and how to use automated feedback to bolster peer feedback; (e) Cheng et al. (2015) used text analytics to investigate the impact of different types of feedback on learners' writing performance; (f) Li et al. (2018) used LA to examine students' self-regulated behaviors using logging data; (g) Aristizábal (2018) showed how data and LA have been used to probe students' learning from the varied forms of assessment; (h) Mouri et al. (2018) evaluated the effectiveness of a learning analytics tool in connecting the digitally learned vocabulary to that acquired from real-life in higher education. The tool was useful in automatically visualizing and analyzing all learning logs; and (i) Hsiao et al. (2017) developed a learning analytic technique to visually understand the effect of different learning strategies on students' vocabulary in a virtual context.

Learning engagement (LE)

For effective learning to take place, learning engagement is an essential prerequisite (Fredricks et al., 2004). Student engagement contributes significantly to language teaching and learning as engaged students often do better in learning (Prasetyawati & Ardi, 2020). Despite being difficult to conceptualize and measure (Han & Hyland, 2015), learning engagement is defined by Marks (2000) as "a psychological process, specifically, the attention, interest, investment, and effort students expend in the work of learning" (pp. 154–155). It is generally associated with the behaviors, experiences, and efforts that students exert in educationally purposeful activities (Fredricks et al., 2004; Hu & Kuh, 2002).

In pertinent literature, learning engagement is generally viewed as a multi-dimensional construct of three sub-components: behavioral, emotional/ affective, and cognitive engagement (Fredricks et al., 2004; Han & Hyland, 2015). These components are dynamically interconnected (Han, 2017). Behavioral engagement refers to involvement and participation in learning activities. Emotional engagement can be defined as feelings toward peers, teachers, and learning activities. Cognitive engagement relates to students' cognitive investment in learning (Fredricks et al., 2004). According to Christenson et al. (2012), researchers have to identify their conceptualization of the LE concept. Accordingly, this study conceptualizes this construct as outlined by Marks (2000) who identified two domains: behavioral and

affective. He refers to affective engagement as the "motivation to learn" or "emotional involvement" while relating behavioral engagement to "students' participation".

Though cognitive and emotional engagement has a significant influence on achievement and learning in general, their measurement and inference are still challenging issues (Azevedo, 2015; Maskell, & Collins, 2017). Besides, most of the measurement methods used (i.e., observation and self-report) involve subjective human intervention. Conversely, behavioral engagement is much easier and more objective to measure and observe, especially with learning analytics tools (Wang, 2017). Behavior engagement observable indicators may include work involvement, completion of homework, and participation in classroom activities (Fredricks et al., 2004). However, this adds extra burdens on teachers in addition to being impractical in large classes. Therefore, other objective methods of measuring behavioral engagement use learning management systems (LMS) to gather log data about learners' online behavioral engagement (Wang, 2017).

Higher levels of engagement have been associated with improving low academic achievement and decreasing high dropout rates (Fredricks et al., 2004). The more students actively participate and focus in class, the better they will learn and retain information and the more enjoyable the school will be (Garwood, 2013). LE has also been associated with improved critical thinking (DeNoyelles & Reyes-Foster, 2015); developed cognitive and personal skills (Pascarella et al., 2010); enhanced grades (Lindt & Miller, 2014); and increased creativity (Al-Bogami & Elyas, 2020). Since engagement is one of the significant factors affecting language learning, teachers are required to look for ways to boost it, on top of which is integrating technological tools in the language teaching and learning process (Prasetyawati & Ardi, 2020).

Previous studies tackled learner engagement in relation to different variables: (a) *online learning modalities/ management systems like MOOCs* (Mac Lochlainn et al., 2021); (b) *Online social media forums/ Facebook groups* (Bailey & Almusharraf, 2021; Mai et al., 2020); (c) *interactive digital textbooks* (Bikowski & Casal, 2018); (d) *online situated (and offline) language learning environments* (Rienties et al., 2018; Yang, 2011); (e) *social media sites* (Mahdiuon et al., 2020); (f) *intercultural encounter* (Oskoz & Gimeno-Sanz, 2020); (g) *blended learning* (Korkealehto et al., 2021); (h) *e-learning applications* (Imlawi, 2021); (i) *flipped classroom* (Kusuma et al., 2021); (j) *use of iPad apps* (Al-Bogami & Elyas, 2020); (k) *(written corrective) feedback* (Han, 2017; Han & Hyland, 2015; Zhang, 2017; Zheng & Yu, 2018); (l) *automated content feedback* (Lee, 2020); (m) *game-based learning/ writing* (Le, 2020); and (n) *mobile learning-based writing* (Prasetyawati & Ardi, 2020) *and speaking projects* (Huang, 2021).

With respect to previous research, Lee and Wang (2013) examined the factors contributing to students' engagement in a wiki-based collaborative project. The findings suggested some factors such as students' communication and appreciation of varied views, the type and nature of the learning tasks, and the difficulties they faced during asynchronous communication. Liu et al. (2016) explored students' engagement patterns and motivation during participation in Web 2.0 storytelling activities. Results revealed two cycles of disengagement and reengagement. Learners faced a number of challenges that led to the observed disengagement phases. This highlighted that specific types of learning support are needed. Mac Lochlainn et al. (2021) reported on learner behavior and the dynamics of participation in a language MOOC. Findings showed that learners were selective in their interactions and learning methods.

Cloud-based collaborative writing

Collaboration is increasingly becoming commonplace. This is not only in the academic but in a variety of practical and professional contexts. It is even mandatory in some of them (Skaf-Molli et al., 2007). In respect of writing, it is defined as involving more than one learner in the writing process and thus they share equal responsibility for the final written product (Haring-Smith, 1994). To coordinate this process, one of the following collaborative writing (CW) strategies should be set in advance (Haring-Smith, 1994; Lowry et al., 2004):

1. Sequential writing: Each student writes a part of the draft consecutively.
2. Parallel writing: Each student writes a different parallel draft.
3. Co-authored writing: All students synchronously co-construct one single draft.
4. Group single-author writing: One student at a time writes the group-representative draft.
5. Mixed-mode writing: More than one of these strategies is followed.

For the purpose of facilitating these processes, collaborative writing technologies are increasingly exploited. CW technologies fall into three categories:

1. Desktop-based applications that need to be installed on the desktop of each collaborator like PREP Editor, Gobby, Recdit, and plug-ins in Microsoft Word (Vens, 2010).
2. Asynchronous web-based applications and tools such as blogs, wikis, and e-mails.
3. Synchronous cloud-based tools which provide a platform for real-time collaboration (e.g., Etherpad, Google Docs, Zoho Writer, SynchroEdit, TypeWith.me, and Writeboard).

Cloud-based CW tools, like Google Docs, are merited for a number of advantages: (a) collaborators can access them anytime and anywhere; (b) they outperform asynchronous CW tools as they override 'Blind Modification', as named by Skaf-Molli et al. (2007), where collaborators cannot immediately see their peer edits while re-editing already edited mistakes; (c) performing writing tasks repeatedly enhanced students' writing automaticity and increased their freer attentional capacity to different writing aspects (Amiryousefi, 2016); and (d) collaborative applications opt for varying degrees of writer proximity (working at the same or different locations) and synchronicity (working at the same or different times). As such, they allow learners to adjust learning mode to their conditions. In short, they provide for three modes of collaboration when collaborators (Hafour & Al-Rashidy, 2020):

1. Collaborate on text through adding, substituting, deleting, or rearranging parts of a text (in the editor mode).
2. Collaborate around text using add-in commenting features and chat rooms (in the viewer mode).
3. Collaborate through text using written language to communicate (in all modes).

Previous research on cloud-based collaborative writing has examined it from manifold perspectives. To explain, Ebadi and Rahimi (2017) compared Google Docs-based to face-to-face peer editing in respect of academic writing skills. Shintani (2015) concluded that Google Docs-based corrective feedback enhanced students' EFL writing. Besides, Suwantarathip and Wichadee (2014) found that students in Google Docs-based CW were better at writing than face-to-face ones. Similarly, Kessler et al. (2012) examined the use of Google Docs-based CW to plan and report on their research projects. Previous research revealed the positive impact of using cloud-based tools on collaborative writing, but little research examines their effect on affective factors like learning engagement. The study at hand is an attempt to bridge the gap in this respect.

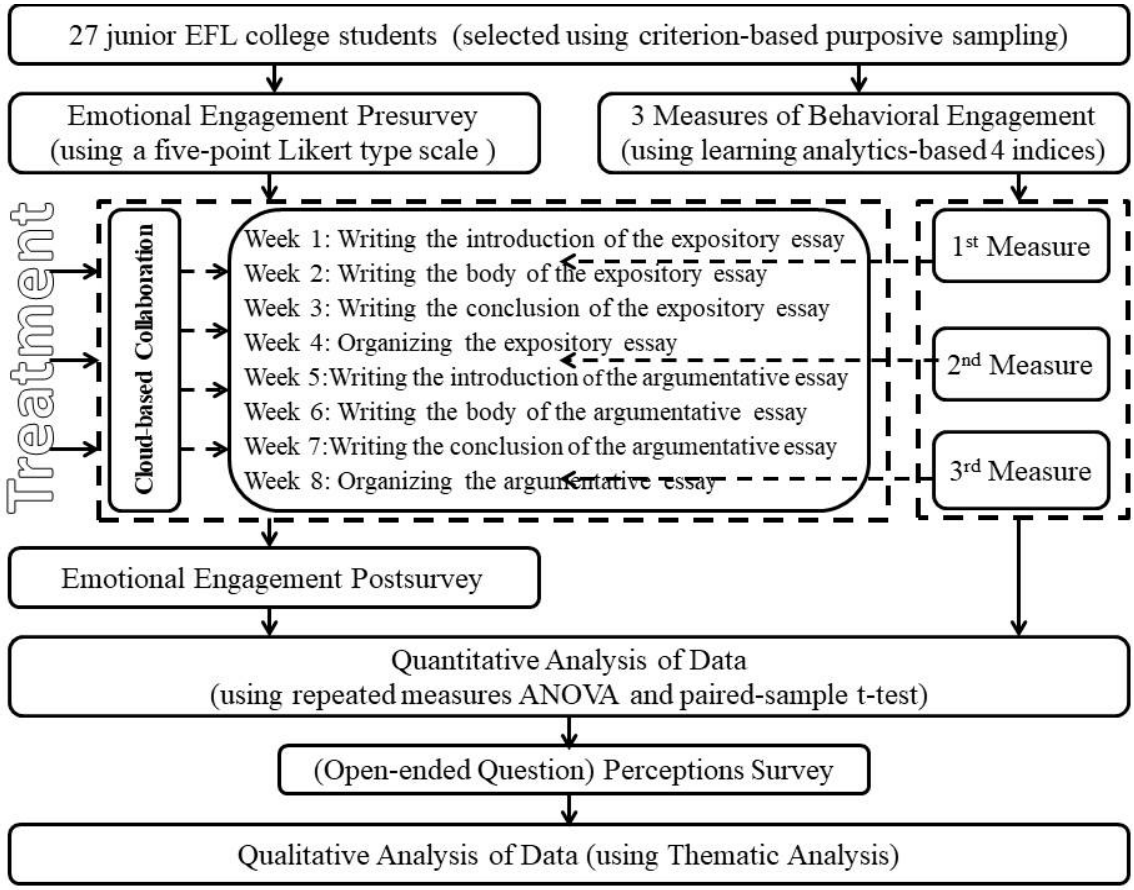
Method

Study design

The quasi-experimental mixed-method design was used in this study. Accordingly, quantitative and qualitative data collection and analysis techniques were implemented. Figure 1 details these procedures.

Figure 1

Study Design and Implementation Procedures



Participants

A cohort of 27 junior EFL College students was selected, using criterion-based purposive sampling which selects participants based on their representativeness of study-relevant criteria (Collins et al., 2007). Eligibility criteria were: (a) the availability of a constant internet connection, (b) demonstrating an acceptable level of digital literacy, and (c) consent and willingness to participate in the study.

The average of the participants' ages was 20 years. They were enrolled in English Department courses, among which is a writing course for one semester each year. Therefore, before the study, they had passed two writing courses: one focusing on paragraph writing and the other on essay writing and analysis of model essays.

Instruments

Quantitative data collection tools included an emotional engagement scale in addition to Google Learning Analytics tools to collect data about students' behavioral engagement. Qualitative data were collected using an open-ended questions perceptions survey.

The emotional engagement scale

To assess students' emotional engagement, a five-point Likert type scale (Appendix A) was adapted from previous research (e.g., Azevedo, 2015; Birjandi & Tamjid, 2010; Fredricks et al., 2004; Fredricks & McColskey, 2012; Lin et al., 2014; Maskell & Collins, 2017; Payne, 2012; Yesilyurt, 2008). The items of the scale (12 categorical positive and negative items) were revised taking into consideration differences in culture. The face and content validity of the scale was assessed by a panel (N= 13) of educational psychology and TEFL experts. Accordingly, necessary revisions and modifications were carried out. The scale was then piloted on a sample (N= 20) of EFL students (other than the ones selected in the study). Piloting was carried out to check the validity, discrimination, wording difficulties, and reliability of the scale. The internal consistency coefficient of the scale, estimated based on the data collected from the pilot administration, was calculated. Following Gliem and Gliem's (2003) benchmarks, it was found to be high as the value of Cronbach's alpha coefficient was .84. This revealed that the scale was reliable enough to be administered for assessing EFL learners' emotional engagement. The scale was administered twice: before and after the treatment. To score the participants' responses, Likert's summated-rating method was adopted. The students were asked to respond to the scale statements by selecting whether they strongly disagree, disagree, are unsure, agree, or strongly agree with them. Then, 1 to 5 point values were given to their responses. For scoring negative items, these values were reversed.

The learning analytics tools

To collect quantitative data about students' behavioral engagement, Google docs-based learning analytics tools (such as version history and comment history features) were used. To explain, Google Documents (GD), where students did their

collaborative writing and feedback tasks, were accessed to get quantitative data about the 4 behavioral engagement indices (during collaborative feedback): number of self-edits, frequency of learner logs, number of comments, and time spent per task. These indices were partly suggested by Li et al. (2021), Gettinger and Walter (2012), Macfadyen and Dawson (2010), and Morris et al. (2005). The main benefit of using actual data of students' viewing and editing behaviors is that it is expected to reflect students' engagement directly and objectively (Fredricks & McColskey 2012; Wang, 2017). The learning analytics tools used were the version history and comment history features embedded in Google Documents. Data were collected at 3 different time points: at the beginning (after the first CW task/week 1), in the middle (after week 4), and at the end (after the last CW task/ week 8) of the study.

Perceptions survey

Designed and administered online (using Google Forms), an open-ended questions survey was used to collect students' perceptions of their engagement during cloud-based collaborative writing. These open-ended questions gathered data about the engaging and disengaging aspects as well as students' self-evaluation of their engagement at the individual and group levels.

Treatment

For 8 weeks, students were assigned expository and argumentative collaborative writing tasks, wherein students (in groups of three members) practiced process collaborative writing on Google Docs abiding by a preset CW strategy (See Appendix C for Cloud Work Plans Outline). These CW practices were monitored by the instructor, the first author, using cloud monitoring tools such as synchronous viewing, commenting, chatting. Process CW and feedback phases were:

Prewriting (in Google Docs)

Collaboratively, group members generated ideas on the assigned topic. Then, using synchronous chatting and commenting tools on the cloud, they negotiated, selected, and made necessary modifications to proposed ideas. As such, an outline for the to-be-written essay was ready.

Drafting (in Google Docs)

Abiding by the preset CW strategy, each group collaboratively generated its first draft. In this respect, three strategies were followed: serial, parallel, and single-author CW strategy.

Revising (in Google Sheets and Google Docs)

Each group collaboratively made a revision of their written sample(s) following the guidelines provided in the (Google Sheets) Revision Checklist posted on the cloud (Google) drive.

Editing (in Google Docs)

This is the phase when the data regarding students' behavioral engagement were collected. In this phase, through comments with editing suggestions, self-edits in the written text were made. Consequently, the instructor gave her comprehensive and detailed corrective and non-corrective feedback. The document revision history and comments history tools made available in Google Documents were the ones accessed for the aforementioned learning analytics-based behavioral engagement factors.

Publishing (on the web)

Having made the required self-edits and revisions, based on peer and instructor feedback, the final draft was published on the web using the online publishing feature in Google Docs.

Data analysis

Quantitative data analysis

Data were collected, at 3 different time points, from Google learning analytics tools (Appendix B includes screenshots of these data sources) with respect to students' behavioral engagement indices (i.e., number of self-edits, frequency of learner logs, number of comments, time spent in collaborative feedback per task) were quantitatively analyzed. For this purpose, repeated measures ANOVA (using SPSS 23) was used to compare behavioral engagement indices in the first, fourth, and eighth CW tasks. As for emotional engagement, the data collected, after administering the scale before and after the study, were compared using the paired sample t-test. Repeated measures ANOVA and paired sample t-test assumptions (data normality and sphericity and homogeneity, respectively) were verified. Normality was checked using skewness and kurtosis indices; they were within the allowable range: ±2 (according to Field, 2009; Gravetter & Wallnau, 2014). The only exception is that the sphericity assumption was violated only on feedback time ($p<.05$). Therefore, the Greenhouse-Geisser test of within-subject effects was used.

Qualitative data analysis

Qualitative data were analyzed using a three-stage thematic analysis: First, data collected from the online perceptions survey were discretely coded with a descriptive label (open coding phase). Second, similar and overlapping codes were aggregated and condensed into broader categories (axial coding). Last, categories or codes that do not have enough supporting data were removed, and then overarching categories were labeled (selective coding and labeling phase). Afterwards, for the joint display of data, a statistics-by-theme method was used (Creswell & Plano Clark, 2018). The researchers counted the frequency of the code across students' responses. Then, exemplar quotes were cited.

Results

Quantitative results

Analysis of students' behavioral engagement

Students' behavioral engagement data were analyzed descriptively as indicated in Table 1.

Table 1
Descriptive Statistics of the Four Indices of Behavioral Engagement

Index	1st Measure		2nd Measure		3rd Measure	
	M	*SD*	*M*	*SD*	*M*	*SD*
Number of self-edits per CW task	8.44	12.50	10.89	11.58	5.11	4.40
Frequency of learner logs	8.56	3.05	4.67	1.80	5.44	2.35
Number of comments per CW task	21.78	16.72	17.67	18.43	10.78	11.61
Time spent in collaboration per task (in minutes)	169.22	63.58	151.56	130.25	64.22	41.66

Subsequently, these data were inferentially analyzed using the Repeated Measures ANOVA test. The results pertaining to students' behavioral engagement sub-indices are presented in Table 2.

Table 2
Repeated Measures ANOVA Test Results on Behavioral Engagement

Index	SS	*Df*	MS	F	*P*
Number of self-edits per CW task	151.41	2	75.70	0.680	.521
Frequency of learner logs	76.22	2	38.11	12.416	.001
Number of comments per CW task	556.07	2	278.04	2.482	.115
Time spent in collaborative feedback per task	56892.67	1.17	48516.10	3.287	.098

Table 2 indicates that the mean differences between the three measures (at different time points) on behavioral engagement indices were not statistically significant ($p>.05$), except for the frequency of learner logs index. This shows that students' self-edits, number of comments, and time spent in collaborative feedback sessions did not increase after cloud-based collaborative writing. However, the mean differences between the three measures on the frequency of learner logs were statistically significant ($p<.05$). For the purpose of finding out where exactly this difference exists, multi-pairwise comparisons, between the three time-point measures of frequency of

learner logs, were conducted using Bonferroni corrections. The results are presented in Table 3.

Table 3
Bonferroni Post-hoc Test Results

Index	Measurement time point	MD	SE	*P*
Frequency of logging on GD	First vs. Second	3.889	0.824	0.005
	First vs. Third	3.111	0.807	0.015
	Second vs. Third	-0.778	0.846	1.000

As shown in Table 3, in respect of frequency of learner logs on GD, there was a statistically significant mean difference between the first and second measurements in favor of the first one as well as the first and third also in favor of the first one ($P<0.05$). However, there was no statistically significant mean difference between the second and third measurements. That is, students' logs in the first time measure were more than theirs in the second and third ones between which there were no statistically significant differences. This implies that students, at the beginning of CW on the cloud, were more engaged (only in respect of the frequency of learner logs) than after 3 weeks or at the end of the treatment.

Analysis of students' emotional engagement

As regards their emotional engagement, the paired sample t-test was conducted for each individual item and the total score. Its results are reported in Table 4.

Table 4
Paired Sample T-test Results of Emotional Engagement Scale

Component	Test	*N*	*M*	*SD*	*df*	*t*	*p*
1. I enjoy writing.	Post	27	4.15	0.602	26	5.769	.000
	Pre	27	3.26	0.813			
2. I write for the pleasure I feel while improving my writing performance.	Post	27	3.96	0.940	26	0.979	.336
	Pre	27	3.70	1.137			
3. I get pleasure from reading what I have written.	Post	27	4.41	0.797	26	4.519	.000
	Pre	27	3.37	1.043			
4. I would take writing classes even if they were not compulsory.	Post	27	4.04	0.854	26	2.202	.037
	Pre	27	3.48	1.051			
5. I would like to have more	Post	27	3.93	0.829	26	1.474	.152

opportunities to write in classes.	Pre	27	3.56	0.974			
6. I would rather spend my time on tasks other than writing.	Post	27	3.19	0.681	26	2.126	.043
	Pre	27	2.74	0.764			
7. I like to write even if my writing will not be graded.	Post	27	3.78	0.974	26	2.565	.016
	Pre	27	3.15	0.770			
8. If my teacher wants someone to do an extra writing assignment, I will certainly volunteer.	Post	27	3.63	0.839	26	2.199	.037
	Pre	27	3.19	1.039			
9. I am really doing my best to improve my writing performance.	Post	27	4.52	0.643	26	6.400	.000
	Pre	27	3.33	0.961			
10. I easily give up writing tasks which seem hard to do.	Post	27	3.60	0.888	26	0.901	.376
	Pre	27	3.37	1.182			
11. I put a lot of effort into my writing.	Post	27	4.48	0.700	26	3.425	.002
	Pre	27	3.78	0.847			
12. I give up a lot to do well in writing.	Post	27	3.26	0.984	26	1.122	.272
	Pre	27	2.93	1.141			
Total score	Post	27	46.93	3.573	26	5.406	.000
	Pre	27	39.85	6.056			

Results of the paired-samples t-test indicate that there was a statistically significant difference ($p<.01$) between students' pre-and post-scale mean total scores as well as their mean scores on items 1, 3, 9, and 11 in favor of the post-administration. However, there was no statistically significant difference ($p>.01$) between their pre-and post-scale mean scores on items 2, 4, 5, 6, 7, 8, 10, and 12 This shows that students' overall emotional engagement increased after cloud-based collaborative writing as evidenced by the positive change in the total score as well as 4 emotional engagement items.

Qualitative results

Participants' responses to the open-ended questions perceptions survey were qualitatively analyzed as detailed in Table 6.

Table 6
Participants' Responses to the Open-ended Questions Survey

Survey item	**Response theme**	**Percentage**
What engaged you most during cloud-based collaborative writing?	Cloud-based feedback practices	48%
	Collaboration	48%
	Google Docs varied potentials	4%
What disengaged you most during cloud-based collaborative writing?	Publicity of pointing out mistakes	41%
	Sensitivity to criticism by some peers	30%
	Inappropriate or incorrect comments by some peers	19%
	Unequal participation	10%
What did you do to overcome the problems/ failures you faced while doing the required collaborative activities?	Consulting and coordinating with other group members	40%
	Accessing cloud-based resources	20%
	Consulting the instructor	20%
	Planning well	11%
	Doing nothing	9%
How effectively did your group members engage in cloud-based collaborative writing?	Extremely well	22%
	Well	26%
	Adequately	45%
	Poorly	7%
How many members (out of the three group members) engaged actively most of the time?	Three	3%
	Two	30%
	One	67%
	None	0%

As indicated in Table 6, analysis of responses yielded that nearly half of the participants attributed their engagement to the collaborative activities they practiced and especially the collaborative feedback sessions facilitated by the cloud application "Google Docs". Examples of students' quotes, in this respect, included "Collaboration and exchange of ideas", "my colleagues' comments and corrective feedback of my writing", "Sharing ideas with group members as well as exchanging opinions", "What I liked most is collaborative feedback on Google Docs", "Being in a group", and "Working with each other as if we [were] one person".

However, they reported that they were disengaged by a number of factors which, respectively, included their mistakes being corrected in public, sensitivity by some peers to being criticized even constructively, linguistically incorrect, and contextually inappropriate edits and comments by some peers, and individual unaccountability for group projects. Students' quotes were as follows: "sometimes [,] during the discussion [,] I felt attacked", "Sometimes someone may argue me that I'm wrong and disagree with me when I know that I'm right", and "I did not like that the others saw my mistakes being highlighted". This is summarized as "There was no communication between the members in the group", in one of the students' terms. This shows that though students were (emotionally) engaged during cloud-based collaborative writing, some factors and practices disengaged them and stood against their full or increased behavioral engagement.

Further, about one-fifth of students reported that they accessed cloud-based resources to get over the problems they faced during writing. The resources they mentioned were cloud dictionaries, mini-lessons, and translation and editing resources as well as links to further readings and tutorials on the cloud. Besides, the number of students who sought their peers' support (using cloud communication tools like the side chatbox and commenting tools) was two-fold those who mainly consulted the instructor. Students' quotes were as follows: "Sometimes I was asking my group", "I asked my supervisors and she helped me to overcome these problems.", and "My peers guided me through the process". Further, few students mentioned planning as a way out and they were roughly the same number as those who did nothing at all. These data show how the cloud with its communication tools and resources facilitated engagement in collaborative activities and helped students overcome the difficulties they faced during writing.

In respect of students' evaluation of group engagement in cloud-based collaborative writing, nearly half of them described their group engagement as adequate (not well or extremely well). Also, the majority of students (67%) mentioned that only one member of the group participated and engaged actively in the collaborative activities practiced, whereas nearly none (only one student) of them reported that all the members of the group were as such. Overall, students' evaluation of their engagement, both at the group and individual level, was in line with the quantitative findings in that they were not generally behaviorally engaged.

Discussion

Quantitative results of the study revealed that students' behavioral engagement did not increase at the level of the number of self-edits and comments and the time spent, whereas it did at the level of the frequency of learner logs. Conversely, students were generally more emotionally engaged after practicing cloud-based collaborative writing, despite the lack of positive change at the level of some items. Correspondingly, qualitative findings showed that though students were (emotionally) engaged during cloud-based collaborative writing, some disengaging factors and peer practices deterred their full or increased behavioral or emotional engagement.

These results are consistent with those of Zheng and Yu (2018) who reported that although learners were emotionally engaged, their behavioral engagement was quite

low after receiving written corrective feedback in EFL writing classes. Similarly, Zhang (2017) found that although the overall behavioral engagement pattern of the participant was unclear, her emotional engagement was relatively positive in the context of computer-generated corrective feedback. Also, the current findings are partially in line with those of Lee and Wang (2013) who found that more proficient English writers appeared to be more engaged in the tasks after practicing wiki-based collaborative writing projects and peer editing tasks. They are also relatively in agreement with the findings of Prasetyawati and Ardi (2020) and Huang (2021) who reported that students were more engaged in mobile app-based collaborative (writing) projects. In the same vein, Lu and Churchill (2014) found that social interaction in a social networking environment had a positive effect on learner engagement. Correspondingly, Wang (2017) reported that involving students in self-assessment and self-reflection activities had a positive impact on their engagement in online learning activities and social interaction.

On the one hand, the significant development in students' overall emotional engagement could possibly be attributed to the new and challenging online learning environment which, according to Huang (2021) provided learners with emotional and academic support to enhance their learning engagement. Prasetyawati and Ardi (2020) highlighted the influential role of online learning environments on students' engagement. Hafour (2022) added that students developed positive perceptions of using technology in teaching and learning EFL after being trained on using the different EFL mobile apps which in turn might have affected their engagement one way or another. Another reason might be the social interaction activities (i.e., peer feedback, chatting, commenting, and meaning negotiation) they were involved in during cloud-based collaborative writing. As reported by Lu and Churchill (2014), these interactional activities enabled learners to get access to varied points of view and thus be more engaged and attentive to their learning tasks.

Besides, students' evaluation behavior during cloud-based collaborative writing was another engaging factor, the idea that is reiterated by previous studies (e.g., Li et al., 2021; Su et al., 2019) which posit that peer evaluation is a key factor explaining learners' engagement. According to Li et al. (2021) and Wang (2017), students' online evaluation behaviors may induce an increased sense of ownership and responsibility for the collaboratively produced document which necessarily triggers active engagement in writing tasks. Getting involved in self-reflection and self-assessment activities has a positive impact on engagement in online learning as well as social interaction activities (Wang, 2017).

On the other hand, the lack of overall improvement in students' behavioral engagement and some emotional engagement items could possibly be due to the fact that they are not used to cloud tools or even collaborative writing itself. Consequently, as supported by the qualitative data (students' perceptions), some factors disengaged them behaviorally such as sensitivity to criticism, inappropriate or incorrect peer edits and comments, publicity of pointing out mistakes, and unequal participation. In addition, as observed by the instructor and reflected by their frequency of logging to the cloud-based CW documents, they were much more curious about the tool and the activities practiced (especially peer evaluation and feedback) at the beginning of the study than in later assignments and tasks. Learners' curiosity about new learning apps and platforms is usually at its peak in the beginning and then tends to decrease over time.

Conclusion

The implications inferred from the findings of the study at hand support the usefulness of cloud-based collaborative writing in fostering EFL learners' emotional, but not overall behavioral, engagement. However, due to some limitations, these results should be generalized cautiously. To elaborate, the scope of the current study was limited as only 27 students' wrote only expository and argumentative essays using only Google Docs as a cloud tool. Also, learners' engagement was assessed at the emotional and behavioral levels only and assessment was confined to collaborative feedback sessions only, not the whole collaborative writing process and phases. Eventually, behavioral engagement data were collected at the group, not individual, level tracking just 4 indices as aforementioned.

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Appendix A

Emotional Engagement Scale

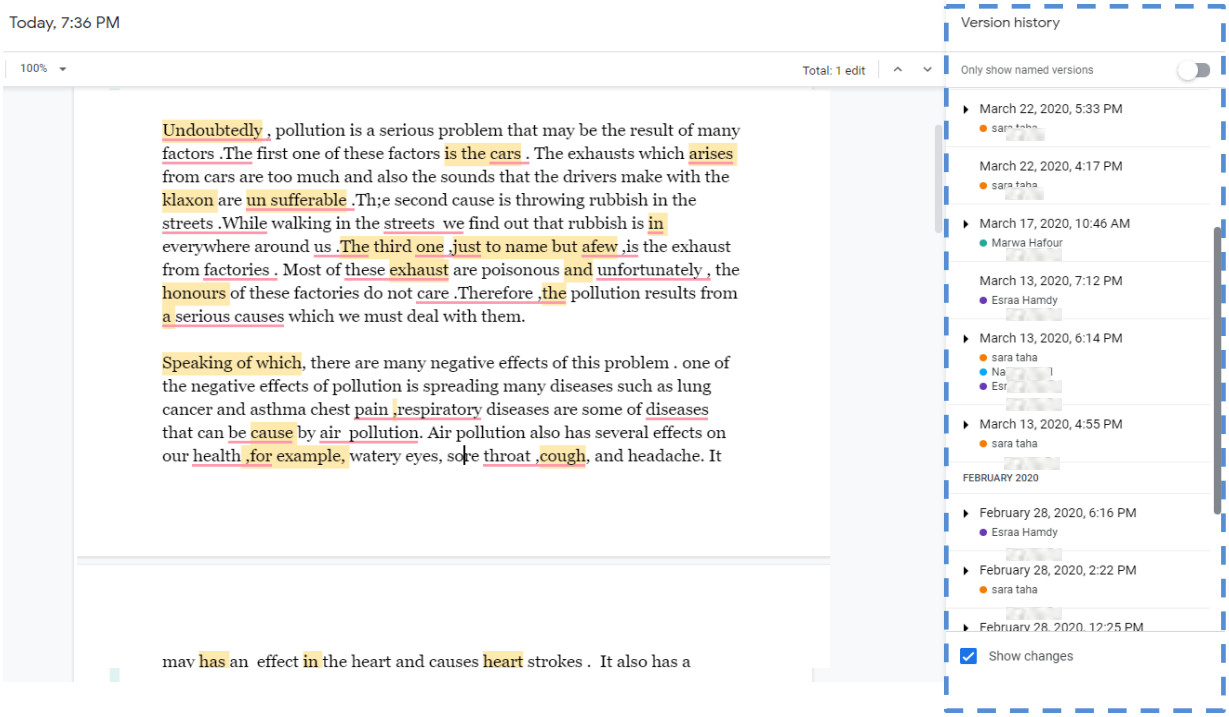
Statement	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
1. I enjoy writing.					
2. I write for the pleasure I feel while improving my writing performance.					
3. I get pleasure from reading what I have written.					
4. I would take writing classes even if they were not compulsory.					
5. I would like to have more opportunities to write in classes.					
6. I would rather spend my time on tasks other than writing.*					
7. I like to write even if my writing will not be graded.					
8. If my teacher wants someone to do an extra writing assignment, I will certainly volunteer.					
9. I am really doing my best to improve my writing performance.					
10. I easily give up writing tasks which seem hard to do.*					
11. I put a lot of effort into my writing.					
12. I give up a lot to do well in writing.					

* These items are negatively-loaded ones, and thus they were scored reversely.

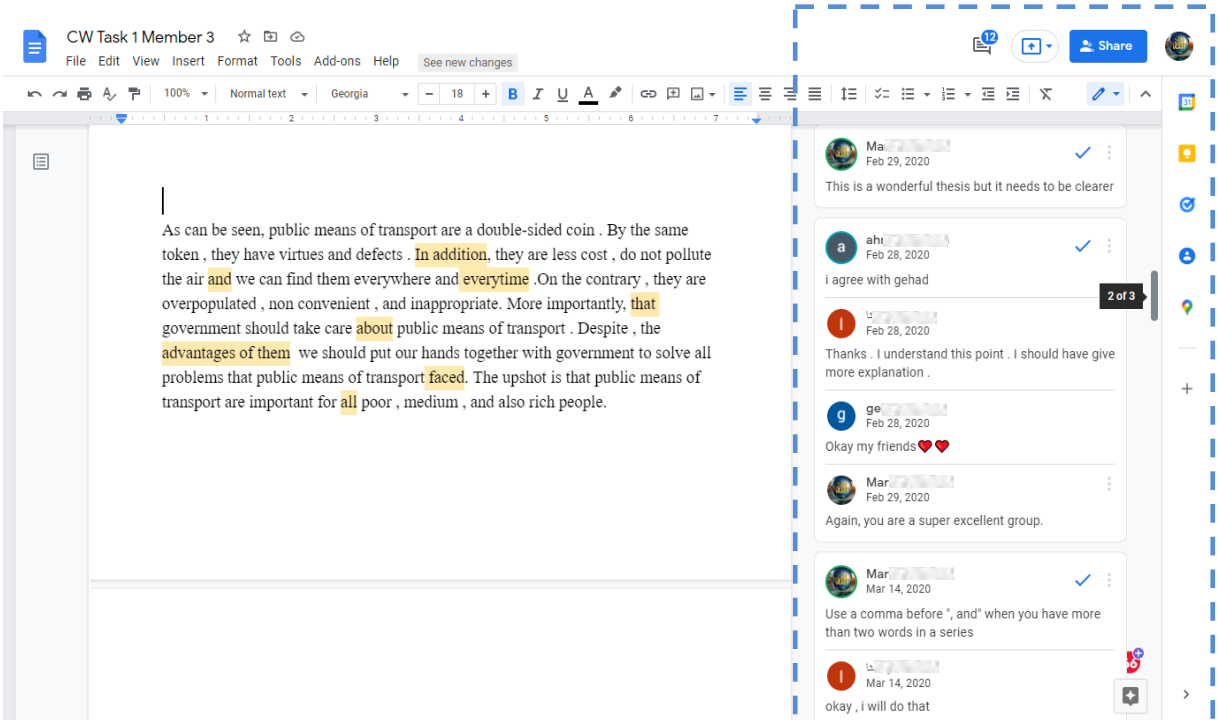
Appendix B

Screenshots of the Data Source of Cloud Learning Analytics

- Version History as a cloud tool to gather data about the frequency of learner logs, time spent in collaborative feedback per task, and number of self-edits per CW task.



- Comments side box as a cloud tool to identify the number of comments per CW task.



Appendix C

Cloud Work Plans Outline

<table>
<tr><th rowspan="3">Session</th><th rowspan="3">General Theme</th><th rowspan="3">Specific Theme</th><th rowspan="3">Writing Genre</th><th colspan="4">Writing Topics**</th><th rowspan="3">Produced Samples</th><th rowspan="3">Cloud Tools</th><th colspan="2">CW Strategy</th></tr>
<tr><th rowspan="2">Model</th><th rowspan="2">Joint(byT&Ss)*</th><th colspan="2">CW (by groups)</th><th rowspan="2">In Class</th><th rowspan="2">Out Class</th></tr>
<tr><th>In Class</th><th>Out Class</th></tr>
<tr><td>1</td><td>Introduction</td><td>Program Familiarization and Group Formation</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>2</td><td>Technical Orientation</td><td>Cloud Tools Familiarization and Activities Training</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td rowspan="10">Google Docs – Google Slides – Google Forms – Google Sheets</td><td>-</td><td>-</td></tr>
<tr><td>3</td><td>Genre Instruction</td><td>The Introduction of Expository Essays</td><td>Expository</td><td>1</td><td>2</td><td>3</td><td>4</td><td>Introduc-tion</td><td>Single Author Writing</td><td>Parallel Writing</td></tr>
<tr><td>4</td><td>Genre Instruction</td><td>The Body of Expository Essays</td><td>Expository</td><td>1</td><td>2</td><td>3</td><td>4</td><td>Body</td><td>Co-authored Writing</td><td>Sequential Writing</td></tr>
<tr><td>5</td><td>Genre Instruction</td><td>The Conclusion of Expository Essays</td><td>Expository</td><td>1</td><td>2</td><td>3</td><td>4</td><td>Conclus-ion</td><td>Co-authored Writing</td><td>Parallel Writing</td></tr>
<tr><td>6</td><td>Writing Criteria Training</td><td>The Organization of Expository Essays</td><td>Expository</td><td>3</td><td>5</td><td>6</td><td>7</td><td>Full Essay</td><td>Co-authored Writing</td><td>Sequential Writing</td></tr>
<tr><td>7</td><td>Genre Wrap-Up</td><td>Full Expository Essay Writing</td><td>Expository</td><td>8</td><td>-</td><td colspan="2">9***</td><td>Full Essay</td><td colspan="2">Sequential Writing</td></tr>
<tr><td>8</td><td>Formative Assessment</td><td>Expository Essay Writing (Cloud-based & Individually)</td><td>Expository</td><td colspan="4">10</td><td>Full Essay</td><td>-</td><td>-</td></tr>
<tr><td>9</td><td>Genre Instruction</td><td>The Introduction of Argumentative Essays</td><td>Argument-ative</td><td colspan="2">11</td><td>12</td><td>13***</td><td>Introduc-tion</td><td colspan="2">Parallel Writing</td></tr>
<tr><td>10</td><td>Genre Instruction</td><td>The Body of Argumentative Essays</td><td>Argument-ative</td><td colspan="2">11</td><td>12</td><td>13***</td><td>Body</td><td>Co-authored Writing</td><td>Sequential Writing</td></tr>
</table>

Session	General Theme	Specific Theme	Writing Genre	Writing Topics**				Produced Samples	Cloud Tools	CW Strategy	
				Model	Joint (byT&Ss)*	CW (by groups)				In Class	Out Class
						In Class	Out Class				
11	Genre Instruction	The Conclusion of Argumentative Essays	Argument-ative	11	12	13***		Conclusion	Google Docs – Google Slides – Google Forms – Google Sheets	Parallel Writing	
12	Writing Criteria Training	The Organization of Argumentative Essays	Argument-ative	13	14	15***		Full Essay		Co-authored Writing	Sequential Writing
13	Genre Wrap-Up	Full Argumentative Essay Writing	Argument-ative	16	-	17***		Full Essay		Co-authored Writing	Sequential Writing
14	Formative Assessment	Argumentative Essay Writing (Cloud-based & Individually)	Argument-ative	18				Full Essay		-	-
15	Writing Criteria Training	Style	Argument-ative & Expository	1 11	-	19***		Full Essay		Parallel Writing	
16	Writing Criteria Training	Diction	Expository & Argument-ative	1 11	-	2 0	21	Full Essay		Co-authored Writing	Parallel Writing

* "Joint Writing Topics" were used as prompts for writing at the phase of "Joint Construction" by the instructor and all students as a kind of guided practice on the criteria/ part of the essay taught in the preceding mini-lesson. This was followed by the phase of "Independent Construction" where students, in groups, collaboratively wrote on CW topics without the help of the instructor (that is why this was called independent CW as contrasted with Joint writing with the help of the instructor).

** The writing topics were as follows:

1. "The Negative Effects of Playing Video Games"
2. "The Causes and Effects of Overpopulation"
3. "The Advantages and Disadvantages of Public Transport"
4. "The Causes and Effects of Pollution"
5. "The Problem of Road Accidents: The Causes and Suggested Solutions"
6. "The Process of Job Hunting"
7. "Pieces of Advice to College Freshmen"
8. "The Positive and Negative Consequences of Taxing Private Car Owners Heavily to Solve Traffic Problems"

9. "The Positive and Negative Effects of Learning Foreign Languages at an Early Age"
10. "The Positive and Negative Effects of Women Going out to Work"
11. "Should Governments be Held Responsible for Graduate Unemployment?"
12. "Should Governments Raise Customs to Decrease Imports?"
13. "Should Smoking Be Banned in Public Places?"
14. "Should Countries Permit the Immigration of its Scientists and Experts to Work in the More Developed Ones?"
15. "Some people claim that the best place for a woman is her house with her children and that they should not go out to work. How far do you agree or disagree?"
16. "To solve traffic problems, some parliamentary members propose to tax private car owners heavily. How far do you agree or disagree?"
17. "Some parliamentary members are proposing to send husbands to prison for 6 months if they marry for the second time without informing their first wives. How far do you agree or disagree?"
18. "Some people see that foreign languages should be taught at an early age while others believe that this should be delayed till children master their native languages first. Which point of view do you agree with?"
19. "The Causes and Effects of Terrorism."
20. "Compare and Contrast between any Two TV. Programs."
21. "Define a Good Teacher."

******* In these sessions, out-class collaborative process writing was a completion of the essays initiated in class, thus the same CW topic was assigned in and out of class.