International Journal of Bilingual Education and Bilingualism

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/rbeb20

Note taking in bilingual students: does using a first or second language influence note-taking quality and memory of newly learnt content?

Amy Canham, Marion Coumel, Juliana Manolova & Angela de Bruin

To cite this article: Amy Canham, Marion Coumel, Juliana Manolova & Angela de Bruin (20 Aug 2024): Note taking in bilingual students: does using a first or second language influence note-taking quality and memory of newly learnt content?, International Journal of Bilingual Education and Bilingualism, DOI: 10.1080/13670050.2024.2390862

To link to this article: https://doi.org/10.1080/13670050.2024.2390862

INTERNATIONAL JOURNAL OF BILINGUAL EDUCATION AND BILINGUALISM
https://doi.org/10.1080/13670050.2024.2390862

Note taking in bilingual students: does using a first or second language influence note-taking quality and memory of newly learnt content?*

Amy Canham, Marion Coumel, Juliana Manolova and Angela de Bruin

Department of Psychology, University of York, York, UK

ABSTRACT

Bilingual students can take notes in their first language (L1) or their second language (L2). Higher note-taking quality, which might differ between the L1 and L2, has been associated with better memory of new content. In this study, we examined how language of note taking within bilinguals affects note quality and memory of new content. One hundred bilinguals watched three videos while typing notes in L2-English, their L1, or while using their languages freely. One week later they completed a memory test. Memory test scores did not differ between the L1, L2-English, and free note-taking conditions. Note-taking quality was higher in the L2 and free language conditions than in the L1, likely because the video content was presented in the L2. However, note-taking quality was only significantly related to memory test performance in the free note-taking condition and not in the L1 or L2 conditions. Across all conditions, L2-English proficiency was positively related to both note-taking quality and test performance. Together, these results suggest that, when learning content in an L2, the note-taking language can influence note quality but does not strongly impact how well new information is remembered.

ARTICLE HISTORY
Received 12 April 2024
Accepted 6 August 2024

KEYWORDS
Bilingualism; note taking; international students

1. Introduction

Research with students studying in their first language (L1) has emphasised the importance of note taking for academic performance (e.g. Bohay et al. 2011). For instance, higher quality notes relate to better performance when students are tested on newly acquired content (e.g. Peverly and Sumowski 2012). However, globally, many students study in English as a second language (L2-English). Those students can take notes in their L2, their L1, or a mix of both (e.g. Siegel 2022a, 2022b). The current study therefore investigated the impact of note-taking language (L1, L2-English, or free language choice) on note quality and memory performance in L2-English students.

1.1. Note taking in L1 students

Note taking is common amongst both L1 and L2 students (Dunkel and Davy 1989; Palmatier and Bennett 1974). Note taking can help to encode information to improve memory (Encoding Theory,

CONTACT Angela de Bruin angela.debruin@york.ac.uk
*For the purpose of open access, a Creative Commons Attribution (CC BY) licence is applied to any Author Accepted Manuscript version arising from this submission.
Supplemental data for this article can be accessed online at https://doi.org/10.1080/13670050.2024.2390862.

Di Vesta and Gray 1972) and by acting as a source to revise from (External Storage Theory, Di Vesta and Gray 1972). Indeed, Di Vesta and Gray (1972) showed that participants who took notes while listening to passages noted more 'ideas' (key events and descriptors) in a later free recall task than non-note-takers. Similarly, Peverly and Sumowski (2012) showed that note quality was positively correlated with memory performance on a later multiple-choice test asking about information presented in the studied text. Participants received 15 minutes to take notes, with note quality scored by raters who assessed how much of the key content in the input was included in the notes. This relationship between note quality and memory of content has also been shown in other types of studies (e.g. Austin et al. 2002; Narjaikaew, Emarat, and Cowie 2009; Rahmani and Sadeghi 2011).

However, the relationship between note taking and memory performance is complex. For instance, Peverly and Sumowski (2012) showed that note-taking quality positively predicted performance on knowledge questions (testing facts) but not on inference questions (measuring application of new knowledge). This suggests good notes only benefit questions about explicitly presented material, but not necessarily how that knowledge is applied. The authors suggested this could be related to their note-quality scoring system, which better assessed knowledge than its application. Conversely, another study found that note-takers performed worse on fact retention and better on inference questions than non-note-takers (Peper and Mayer 1986). One possible explanation is that note taking as such improves performance on inference questions compared to no notes (regardless of quality), while note-takers might only benefit on knowledge questions if their notes are of good quality.

1.2. Note taking in L2 users

Research on students studying in a L2 has shown that their academic performance too benefits from taking notes (as compared to not taking notes, e.g. Aminifard and Aminifard 2012; Jin and Webb 2024). The relationship between note-taking quality (measured as the amount of presented content included in the notes) and memory performance has also been observed for L2 students (Dunkel 1988). However, note-taking quality can be lower in L2 students than in L1 students. For example, notes can be less organised in an L2 than in an L1 (Fahmy and Bilton 1990), contain fewer important content points (Zetawi and Lipka 2019), or be less structured (Clerehan 1995). L2 students furthermore reported lower note-accuracy and note-comprehensiveness satisfaction than L1 students (Desselle and Shane 2019). Together, this suggests that students who study in an L2 may work with notes of a lower quality. This could impact how well they remember new content, although this is often not assessed. Furthermore, most research has compared groups of L1 and L2 students (e.g. Fahmy and Bilton 1990; Zetawi and Lipka 2019). This design introduces confounds, such as previous educational and note-taking differences between home and international students.

1.3. Note taking in an L1 or L2

Furthermore, bilingual students have the *choice* to take notes in their L1 or in their L2. On the one hand, note taking might be faster and more efficient in a more proficient L1 (even if it is not the language of instruction). Lexical access in (written and spoken) language production is typically faster in the L1 than the L2 (e.g. Iniesta et al. 2021). If bilinguals benefit from faster writing in their L1, the quality and completeness of notes might be higher. This could lead to better memory performance if it relates to note quality (Peverly and Sumowski 2012).

On the other hand, when the lecture content is in the L2 (as is the case for many international students), taking notes in the language in which the information is presented might be faster than taking notes in the 'other' language, even if that language is the more proficient L1. Using the L1 might require additional time (especially if the student has to translate specific terms) and increase cognitive load due to switching between listening in the L2 while writing in the L1 (cf.

Wong and Maurer 2021). Cognitive load is a drawback of note taking, as note taking while listening or reading increases cognitive load (Jansen, Lakens, and IJsselsteijn 2017; Piolat, Olive, and Kellogg 2005), especially when taking notes in another language than the language of the content (Chen 2020). Furthermore, memory performance may be higher when the language of encoding and testing match (Marian and Fausey 2006), with students with high L2 proficiency benefiting most from this (Marian and Fausey 2006; Vander Beken, De Bruyne, and Brysbaert 2020). Memory might therefore be higher when both the new content and the notes are in the L2.

At this point, it remains unclear whether notes in the L1 or in L2 differ in terms of note quality and memory performance *within bilinguals* as most studies have compared L1 and L2 users rather than comparing the L1 and L2 within bilinguals. The few studies that do compare the L1 and L2 within bilinguals have mostly focused on immediate listening comprehension, and provide mixed results. For instance, Tsai-Fu and Wu (2010) asked students to listen to new information in English while taking notes in their L2-English or L1-Chinese. Comprehension scores on the immediately following test were higher after L2 than after L1 note taking. However, it is unclear if these effects only concern immediate comprehension or also influence how well new content is learnt and remembered over time. Furthermore, other studies have not shown effects of the note-taking language in terms of note-taking quality and comprehension tested shortly after listening to new information (e.g. comparing L1-Korean to L2-English, Park 2019). Proficiency might further modulate note-taking quality and comprehension (Song 2012; Wang 2021), with students with a higher L2 proficiency perhaps benefiting more from faster lexical access and a larger vocabulary in their L2.

Finally, translanguaging, where students can take notes using multiple languages, is common practice across students (İnci Kavak and Kirkgöz 2022; Siegel 2022a, 2022b). Wang (2021) examined the impact of translanguaging on comprehension of English lecture material and retention after two weeks by having participants take notes in L1-Chinese, L2-English, or a mixture of both. Test performance was higher in L2-English and translanguaging conditions than in the L1-Chinese condition for fact-based retention and conceptual questions about the main topics (although not for retention of key numbers). This study suggests that students can benefit from taking notes in their L2-English as well as from using two languages but did not assess (a relationship with) potential differences in note-taking quality.

1.4. The current study

The present study aimed to further examine how the note-taking language can impact how well students take notes and remember new content. To do this, bilingual students completed a two-part study. In the first part, they listened to three TED talks in L2-English while taking notes in their L1, in L2-English, or in a free language condition in which they could use their languages as they wanted. Note-taking language was manipulated within-participants to avoid confounds associated with between-group comparisons. In the second part (one week later), participants completed multiple choice questions (MCQs) split into knowledge (retention of factual information) and inference questions (measuring knowledge application). We analysed note quality and performance on the MCQs, as well as the potential relationship with proficiency.

While previous studies have focused on hand-written notes, note *typing* is common in the classroom (e.g. Emory, Teal, and Holloway 2021, reported close to 70% of students using electronic methods to take notes). However, note typing (compared to hand writing) can increase cognitive effort (Bouriga and Olive 2021) and has been associated with worse learning (Mueller and Oppenheimer 2014). To better understand language effects in these potentially more demanding circumstances, the current study asked participants to take notes on a laptop.

As the first research question, we examined if and how note-taking language (L1 or L2-English) influenced note quality. If faster lexical access in the L1 (Iniesta et al. 2021) leads to better note-taking quality, we expected higher quality for L1 note taking. If translating L2 content into the L1

introduced a significant time or cognitive-load cost, as compared to using the language of the lecture content, we expected L2 note taking to lead to better quality.

As a second research question, we examined if and how L1 versus L2-English note taking influenced test performance. Peverly and Sumowski (2012) showed that increased note-taking quality may lead to higher test performance. Thus, if faster L1 lexical access results in better note-taking quality, then L1 note taking might result in better test performance. In contrast, memory performance may be higher when the language of encoding and language of testing match (Marian and Fausey 2006). If so, participants should have higher test performance when taking notes in their L2-English (the language of the lecture content). In line with Peverly and Sumowski (2012), we expected that the note-taking language would only affect knowledge question performance, as inference questions may be independent of note-taking quality.

Furthermore, as a third research question, we examined the potential role of L2-English proficiency. If L2-English proficiency increases English lexical access speed (cf. Issa, Awadh, and Ahmed 2022), or if more proficient L2 users show a larger benefit when encoding and testing languages are matched (Marian and Fausey 2006; Vander Beken, De Bruyne, and Brysbaert 2020), we expected students with a higher L2-English proficiency level to benefit (relatively) more from using their L2-English for note taking.

Finally, as a fourth question, we explored the effects of the free language condition. Specifically, we examined which languages people used in this condition (i.e. if many people used both languages), and we compared note quality and memory performance to the other two conditions. This analysis was exploratory because there is only little research on the academic effects of translanguaging.

2. Materials and methods

The pre-registration, data, and analysis script are available on osf.io/b4dmu.

2.1. Participants

489 participants completed a pre-screening questionnaire on Prolific (https://www.prolific.com/) to assess if they met our eligibility criteria. We recruited participants who were studying in an English-speaking country or had graduated in the past year from an English-speaking university and who spoke French, Spanish, Italian, Dutch, or German as their L1. We focused on these languages as they use the same script as English, which avoided influences of switching scripts in the free language condition. Furthermore, within the research team, these languages could be translated for note-quality scoring. Participants furthermore had to meet the following criteria: not having lived in an English-speaking country for more than 5 years prior to starting university; only having one L1; started acquiring English after the age of three; not studying/had not studied Biology, Archaeology, Medicine or Dentistry (too closely related to the video topics).

Based on these criteria, 158 eligible participants were invited to complete the first part. While 122 participants completed the first part of the study, only 103 eligible participants completed the second part. Of the participants that completed the first part of the study, 11 were not invited to the second session for not following the note-taking language instructions. Furthermore, following the video, participants rated their prior knowledge on the topic, and how well they understood the language used in the video apart from new topic-specific or technical terms. Following the pre-registered exclusion criteria, we excluded participants for scoring above 90% on prior knowledge of the topic (scale: 0 = knew nothing to 100 = topic expert; $N = 1$) or below 20% on understanding the language used (scale: 0 = did not understand the language at all to 100 = complete understanding; $N = 3$). This excluded any participants who either had too much prior expertise or struggled to understand the language in the videos. For the included participants, the mean rating of 'understanding the language used in the videos' was 89.98% ($SD = 16.15$), suggesting participants could understand

the videos well. Out of the participants who completed the second part of the study, three more were excluded for (self-reported) cheating in the memory test.

After exclusions, our final sample size of 100 participants met our pre-registered target (*M* age = 26.1, *SD* = 5.78, 66 females, 33 males, and 1 non-binary person). A reliable estimate of effect sizes for power analyses would need to be based on previous studies using comparable designs. This was not possible here because previous designs either used between-participant comparisons or assessed comprehension rather than note quality and memory-test performance. However, we estimated that 100 participants should provide sufficient power to detect medium-sized language effects. The final sample included 2 Dutch, 4 French, 7 German, 24 Italian, and 63 Spanish L1 users with no learning, hearing, reading or visual impairments. The study was approved by the Research Ethics Committee in the Department of Psychology at the University of York (approval number 20226). Participants provided informed consent and were paid for their time.

The participants' language background and proficiency were examined through a questionnaire and LexTALE tests. The LexTALE standardised test involves 60–90 trials (depending on the language version) where the participant decides if letter strings are words in the language or non-words. All participants completed the English LexTALE (Lemhöfer and Broersma 2012), and one of the L1 LexTALEs: German (Lemhöfer and Broersma 2012), Dutch (Lemhöfer and Broersma 2012), French (Brysbaert 2013), Italian (Amenta, Badan, and Brysbaert 2021), or Spanish (Izura, Cuetos, and Brysbaert 2014). The questionnaire furthermore assessed self-rated proficiency and language use across different contexts, based on the Language and Social Background questionnaire (LSBQ, Anderson et al. 2018). As shown in Table 1, the participants were highly proficient in L2-English, had mostly used their L1 during their childhood, but were presently (at the time of the study) frequently using English. The majority (72%) reported learning English in school and the others (also) learnt it outside the classroom. Fifty-nine participants reported not speaking another language than their L1 and English. The students reported taking notes in L2-English more than in their L1 during their English-speaking degree, averaging 3.8 on a scale from 1 (all L1) to 5 (all English). The majority of participants also preferred taking notes on paper (63%) compared to an electronic device.

Table 1. Participants' language background.

Language Background Measure	Mean (SD)
Age of Acquisition of English (years old)	8.82 (4.39)
Number of years spent learning English	11.0 (7.15)*
L2 self-rated language proficiency (0-100%)	
L2-English speaking	85.0% (10.9)
L2-English spoken understanding	91.1% (8.84)
L2-English writing	87.2% (9.82)
L2-English reading	94.2% (6.97)
L1 self-rated language proficiency (0-100%)	
L1 speaking	98.7% (3.55)
L1 spoken understanding	99.5% (1.75)
L1 writing	97.5% (4.21)
L1 reading	99.2% (3.18)
LexTALE proficiency (0-100%)	
L1 score	85.5% (11.4)**
L2-English score	78.7% (11.2)**
Self-rated language use (1 = all L1, 5 = all English)	
During childhood and teenage years	1.78 (0.581)***
Currently across contexts	2.97 (0.842)***

*One missing value.

**LexTALE proficiency was calculated relative to the number of words and non-words included, following Lemhöfer and Broersma (2012).

***Participants were also given answer options indicating they were using another language than their L1/L2-English or to indicate the context did not apply to them (e.g. no partner), which were not included when calculating the scores.

2.2. Materials

2.2.1 Videos

The videos were ten-minute TED talks (without captions) focusing on three academic topics: dinosaur lung specialisation, nanotechnology tattoos, and how migration is tracked using tooth enamel. While TED talks differ from lectures in, for example, their intended audience, their scripted nature, and the amount of academic vocabulary (e.g. Wingrove 2017), they are used frequently in the note-taking literature (e.g. Mueller and Oppenheimer 2014).

2.2.2 Memory test

The comprehension test included 30 multiple-choice questions (10 per video) similar to undergraduate exam questions. Half were explicit knowledge questions and half questions on applying knowledge (inference questions). An example of a knowledge question was: 'What shape at the back of the incisors indicates European or African ancestry?' An example of an inference question was: 'Which of the following is **NOT** a possible consequence of being able to detect UV light using a dot?' (see Supplementary Materials for the full list of questions). Similar to exams, the questions used low-frequency words and topic-specific terms that participants were introduced to in the video. Four answer options were given and answers were scored as correct (1) or incorrect (0).

2.3. Procedure

The study was completed online using Qualtrics and Gorilla.sc (Anwyl-Irvine et al. 2020). Participants first filled out a pre-screening questionnaire to ensure they fit our previously mentioned eligibility criteria. If they met these requirements, they were invited to the first part of the study, where they completed a checklist to again confirm eligibility. Before starting the videos, participants were played another 20-second clip to adjust their audio. They were then shown the three L2-English TED talks and were asked to type notes in a text box displayed beneath the video. For one video, participants were asked to take notes in their L1, for one in their L2-English, and for one using both languages as they saw fit. Because of the online format, participants could only type words and could not add drawings or other visuals. The order of the note-taking language(s) and which video was used for which note-language conditions were counterbalanced across participants. After each video, participants had two minutes to finish their notes, read through them, and make any changes. After watching the video, participants rated on a 0–100 scale the amount of knowledge they previously had on the topic, and how much they understood the language of each video. Finally, L1 and L2 proficiency were assessed using LexTALE.

Participants were invited to the second part of the study a week later, completing the second part an average of 7.48 days after the first part (between 7 and 12 days). This second part included an MCQ test on the lecture material of all three lectures, giving one minute per question. Participants did not have access to their notes during this test and were also asked if they 'cheated' by looking up any answers online. Afterwards, they completed a questionnaire collecting demographic and language-background information (see Table 1). An attention check was also implemented, asking participants to select one specific answer.

2.4. Data pre-processing and analysis

The main independent variable Note-Taking Language Condition was manipulated within participants and had three levels: L1, L2-English, and free language use. The second independent variable was Question Type (knowledge or inference questions). There were two key dependent variables (DVs): note quality and memory test score.

For our note-quality scoring, we created a table of sub-themes in the videos, and important points of information within these sub-themes (the Supplementary Materials provide a detailed description

of the note-scoring system, including all sub-themes). This was very similar to Zetawi and Lipka (2019). While the first author scored all notes, a second coder advised on the scoring system by scoring a subset of the notes before the full scoring was done. Through this process more clarity was added to the different scoring points, and points were added or removed. Following this, the first author and the second coder independently scored 15 notes from five participants to test inter-rater reliability. High consistency was found between the two sets of scores, with an intraclass correlation of .856 ($F(14,14) = 12.844$, $p < .001$). Participants could score between 0 and 43 points for each video.

Data were analysed using package *lme4* (version 1.1-33) in R (version 4.3.0). Model assumptions were checked through the *performance* package (Lüdecke et al. 2021). Our first analyses, as pre-registered, compared the L1 and L2 note-taking conditions. We pre-registered starting with this comparison only as the inclusion of the free language condition was more exploratory. A generalised mixed effects analysis (family = poisson) was used to study effects of Language Condition and English proficiency, and their interaction, on Note-taking Quality. Participants and Videos were included as random effects. The initial model included all random slopes. When models did not converge, we removed correlations between slopes and intercepts and then the slopes explaining the lowest amount of variance until convergence was reached. The final model included Language Condition as the participant slope. Another generalised mixed effects analysis (family = binomial) was used to study Memory Performance. Question Type, Language Condition (L1/L2), English proficiency (L2 LexTALE scores), Note-taking Quality and all interactions were added as fixed effects. The final model included participant and item intercepts and the participant slope for Language Condition. All two-level variables were contrast coded (Language Condition L1 = −0.5; L2 = 0.5; Question Type inference = −0.5; knowledge = 0.5). The continuous variables Note Quality and L2 Proficiency were centred and scaled.

The final analyses also examined note quality and memory test performance, but now included the free language condition as a third level within Language Condition. This variable was sum-coded to compare free language and L2 note taking (free = −1/3; L1 = −1/3; L2 = 2/3) and free language and L1 note taking (free = −1/3; L1 = 2/3; L2 = −1/3). The model on Note Quality converged with random intercepts for participants and videos. The model on Memory Performance converged with random intercepts and the participant slope for Question Type x Language Condition. In addition, we also examined how and why people used their languages in the free language note-taking condition. We ran an exploratory regression analysis (as there were no items or within-subject variables) including these predictors: self-rated L2-English writing proficiency (included as it was most directly related to the task, which used writing), currently daily L2-English language use, and L2-LexTALE proficiency scores. L1 proficiency was not included as it was close to ceiling (self-rated scores > 95%). We conducted these analyses with two DVs: percentage of L1 used in the free language notes (to assess language choice) and percentage language mixing in these notes (to assess translanguaging).

3. Results

3.1. Effects of L1 and L2-English language conditions on note quality (RQ1&3)

In the Note Quality analysis, we found a significant effect of Language Condition ($\beta = 0.154$, $SE = 0.049$, $z = 3.143$, $p = .002$), with a lower note quality score for L1 note taking ($M = 8.80$ points, $SD = 5.04$) than in the L2-English note-taking condition ($M = 10.33$, $SD = 6.34$, See Figure 1). Higher English proficiency was related to higher note quality ($\beta = 0.209$, $SE = 0.049$, $z = 4.216$, $p < .001$). The interaction between Language Condition and English proficiency was also significant ($\beta = 0.154$, $SE = 0.051$, $z = 3.026$, $p = .002$). While L2-English proficiency was significantly related to Note Quality in both conditions, the relationship was much stronger in the L2-English note-taking condition ($\beta = 0.289$, $SE = 0.060$, $z = 4.799$, $p < .001$) than in the L1 condition ($\beta = 0.132$, $SE = 0.055$, $z = 2.404$, $p = .016$, see Figure 2).

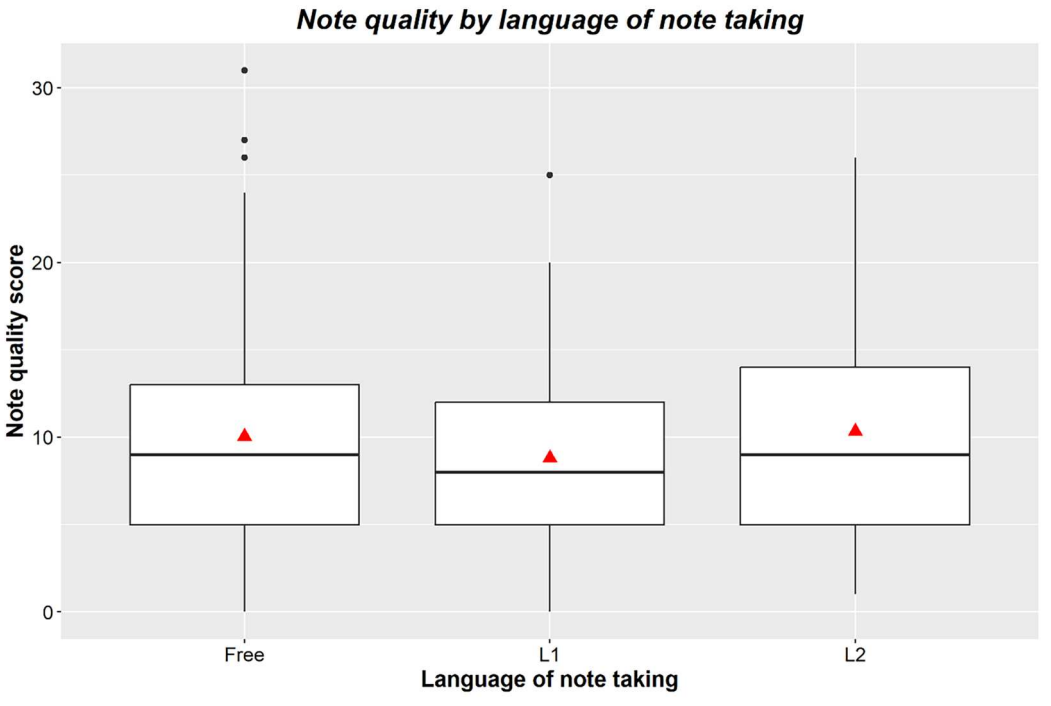

Figure 1. Note quality score by note-taking condition (Free language use, L1, L2). The triangles show mean scores. The free language use analyses are presented in Section 3.3.

3.2. Effects of L1 and L2-English language conditions on memory test performance (RQ2&3)

The memory performance analysis is reported in Table 2. There was a significant effect of Question Type, with higher accuracy for inference questions ($M = 54.60\%$, $SD = 18.66$) than knowledge questions ($M = 46.80\%$, $SD = 15.69$). Higher English proficiency was also related to a higher test score, across question types and language conditions. Participants showed similar memory performance across the L1 ($M = 50.50\%$, $SD = 17.20$) and the L2-English conditions ($M = 50.90\%$, $SD = 19.13$; see Figure 3). Note Quality showed no significant relationship with memory performance: people with

Table 2. Results of the analysis examining effects of L1 versus L2 note taking on memory test performance.

Fixed effects	Estimate	Standard Error	z-value	*p*-value
Intercept	0.010	0.070	0.144	.886
Question Type	−0.338	0.099	−3.433	**<.001**
Language Condition	−0.050	0.108	−0.461	.645
English Proficiency	0.150	0.056	2.697	**.007**
Note Quality	0.121	0.067	1.797	.072
Question Type x Language Condition	0.017	0.197	0.088	.930
Question Type x English Proficiency	−0.092	0.099	−0.932	.351
Language Condition x English Proficiency	−0.053	0.111	−0.477	.633
Question Type x Note Quality	−0.107	0.110	−0.979	.327
Language Condition x Note Quality	0.003	0.121	0.025	.980
English Proficiency x Note Quality	0.062	0.061	1.015	.310
Question Type x Language Condition x English Proficiency	−0.029	0.198	−0.148	.882
Question Type x Language Condition x Note Quality	0.078	0.219	0.357	.721
Question Type x English Proficiency x Note Quality	−0.019	0.111	−0.175	.861
Language Condition x English Proficiency x Note Quality	0.086	0.122	0.710	.478
Question Type x Language Condition x English Proficiency x Note Quality	0.261	0.221	1.181	.238

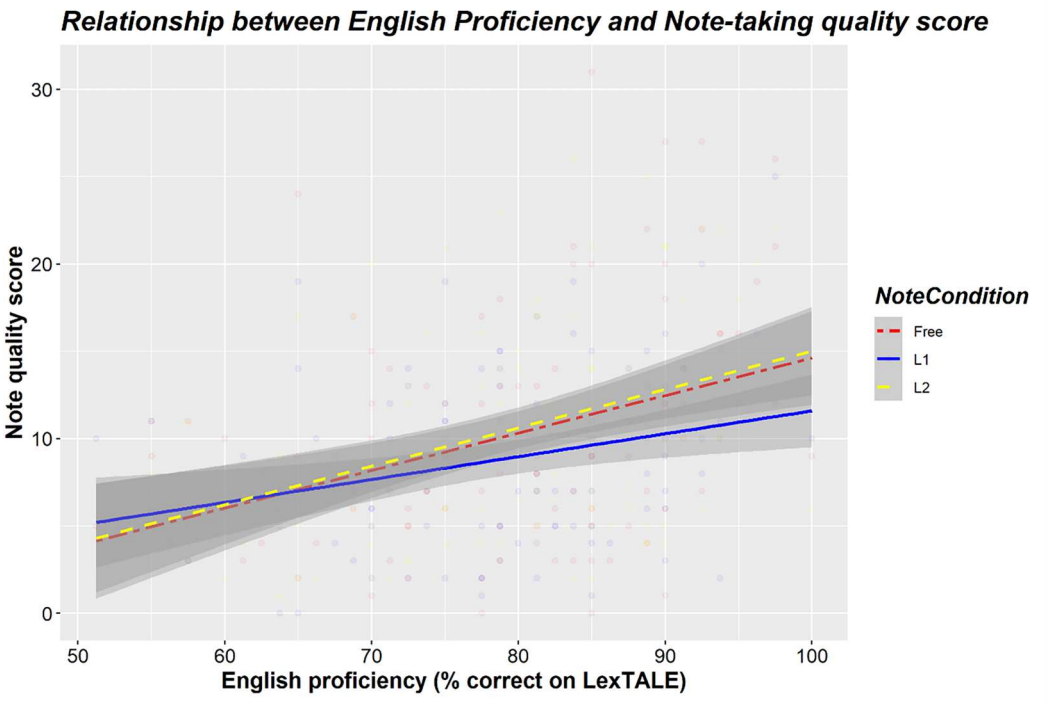

Figure 2. The relationship between note quality and L2-English proficiency, shown by language condition (the red two-dashed line shows the free language condition, the blue solid line the L1 note-taking condition, and the yellow dashed line the L2 note-taking condition).

higher note-taking quality did not perform significantly better in the MCQ than participants with lower note-taking quality in the L1 and L2 note-taking conditions (see Figure 4).

There were no significant interactions between Language Condition and any other variables, suggesting Language Condition did not significantly influence the effects of Question Type or Note Quality on Memory Performance. None of the other interactions were significant either (see Table 2).

3.3. Free language note taking (RQ4)

In the free language condition, 49% of participants used a substantial mix of L1 and L2-English, defined as neither L1 nor L2 words exceeding 95% of the total words. 39% of participants used 95% or more L2-English words and 12% used 95% or more L1 words. Overall, participants wrote an average of 40.23% of words in their L1 (*SD* 39.24%, ranged from 0 to 100%).

The amount of L1 words used was related to self-rated L2-English writing proficiency ($\beta = -9.890$, $SE = 3.642$, $t = -2.715$, $p = .008$) and current daily L2-English language use ($\beta = -13.681$, $SE = 3.659$, $t = -3.739$, $p < .001$). The higher the self-reported English writing proficiency and daily English language use, the fewer L1 words were used in the free language condition. LexTALE English proficiency scores did not predict language choice in free language notes ($\beta = -3.047$, $SE = 3.744$, $t = -0.814$, $p = .418$).

Unlike the amount of L1 words, the amount of language mixing did not relate to self-rated English writing proficiency ($\beta = -0.777$, $SE = 1.621$, $z = -0.480$, $p = .633$), or current English language use ($\beta = -2.638$, $SE = 1.628$, $z = -1.620$, $p = .108$). It also was not predicted by LexTALE English proficiency scores ($\beta = -2.194$, $SE = 1.666$, $t = -1.317$, $p = .191$).

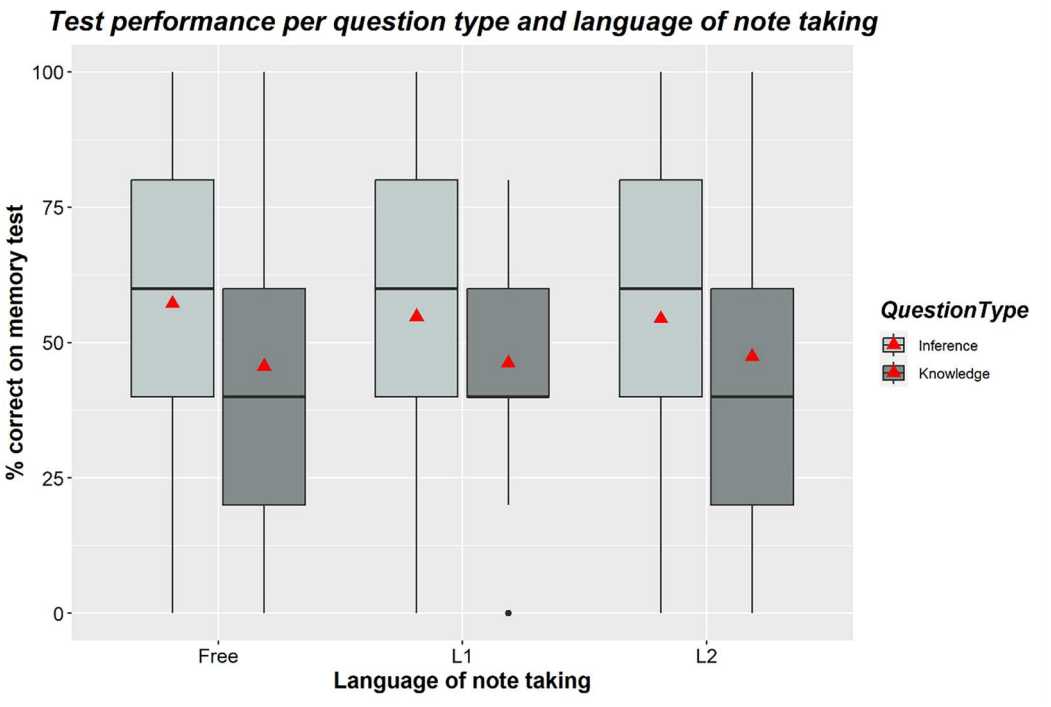

Figure 3. Performance on the memory test (percentage correct) by note-taking condition (Free language use, L1, L2) and question type (inference questions shown in lighter colour and Knowledge questions in darker colour). The triangles show mean scores.

3.3.1. Effects of free language note taking on note quality

Next, we examined differences in note-taking quality between the three language conditions, now also including the free condition. The free language condition ($M = 10.04$, $SD = 6.66$) had a significantly higher average note quality score than the L1 condition ($M = 8.80$, $SD = 5.04$; $\beta = -0.134$, $SE = 0.047$, $z = -2.845$, $p = .004$, see Figure 1) and did not differ from the L2-English condition ($M = 10.33$, $SD = 6.34$; $\beta = 0.030$, $SE = 0.046$, $z = 0.652$, $p = .514$). Proficiency still positively predicted note quality ($\beta = 0.210$, $SE = 0.051$, $z = 4.127$, $p < .001$) and interacted with Language Condition, but only when comparing the free language condition to the L1 ($\beta = -0.097$, $SE = 0.048$, $z = -2.043$, $p = .041$). There was no significant interaction between English proficiency and Language Condition when the L2-English and free language conditions were compared ($\beta = 0.055$, $SE = 0.047$, $z = 1.182$, $p = .237$). Both the L2-English and the free language condition showed a positive relationship between English proficiency and note quality, which was stronger than the relationship observed for the L1 notes (see Figure 2).

3.3.2. Effects of free language note taking on memory performance

The results analysing memory performance with all language conditions can be seen in Table 3. As before, inference questions were answered better than knowledge questions. Similarly, the positive relationship with English proficiency remained significant. The effect of Language Condition remained non-significant in both the comparison between L1 ($M = 50.50\%$, $SD = 17.20$) and the free language condition ($M = 51.40\%$, $SD = 19.49$) and L2-English ($M = 50.90\%$, $SD = 19.13$) and the free language condition (see Figure 3).

Although Note Quality was not a significant predictor of memory performance with only the L1 and L2-English language conditions included, it became a significant positive predictor when the free language condition was added (see Figure 4). There was also a significant interaction

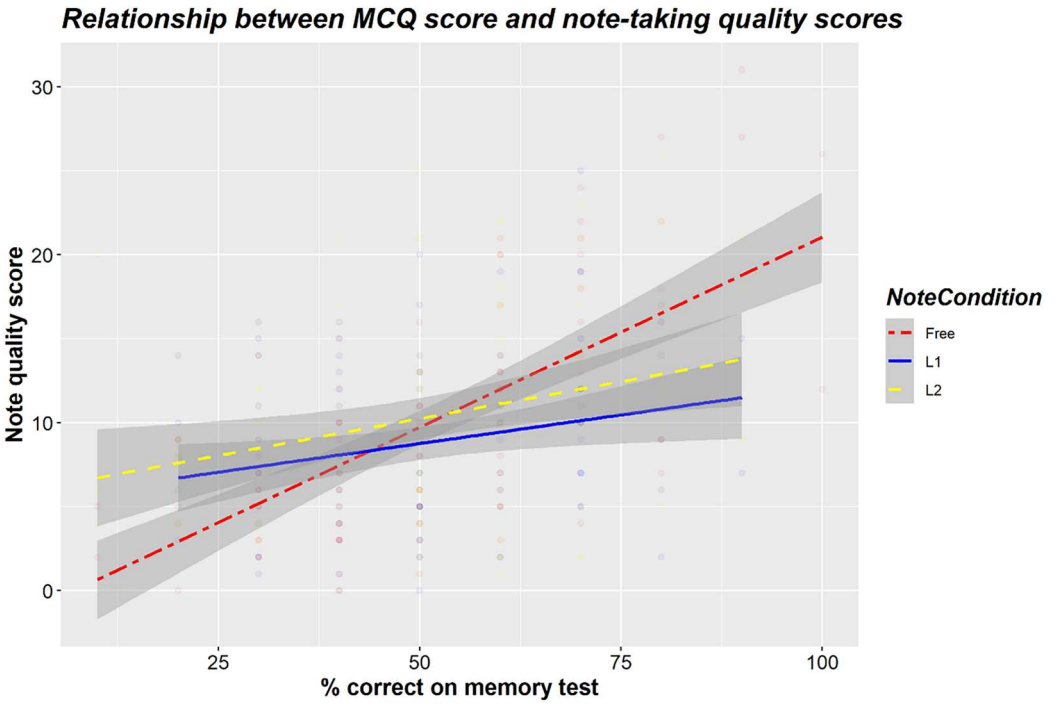

Figure 4. The relationship between note quality and MCQ test performance, shown by language condition (the red two-dashed line shows the free language condition, the blue solid line the L1 note-taking condition, and the yellow dashed line the L2 note-taking condition).

Table 3. Results of the analysis examining effects of note-taking language condition on memory test performance, including the free language condition.

Fixed effects	Estimate	Standard Error	z-value	*p*-value
Intercept	0.014	0.065	0.220	.826
Question Type	−0.409	0.083	−4.954	**<.001**
Language Condition (L1 vs Free)	−0.003	0.099	−0.031	.976
Language Condition (L2-English vs Free)	−0.045	0.100	−0.454	.650
English Proficiency	0.154	0.047	3.254	**.001**
Note Quality	0.211	0.054	3.903	**<.001**
Question Type x Language Condition (L1 vs Free)	0.210	0.198	1.058	.290
Question Type x Language Condition (L2-English vs Free)	0.224	0.203	1.103	.270
Question Type x English Proficiency	−0.124	0.083	−1.495	.135
Language Condition (L1 vs Free) x English Proficiency	0.031	0.100	0.309	.757
Language Condition (L2-English vs Free) x English Proficiency	−0.021	0.102	−0.210	.834
Question Type x Note Quality	−0.107	0.090	−1.192	.233
Language Condition (L1 vs Free) x Note Quality	−0.347	0.115	−3.016	**.003**
Language Condition (L2-English vs Free) x Note Quality	−0.322	0.105	−3.067	**.002**
English Proficiency x Note Quality	0.072	0.049	1.459	.144
Question Type x Language Condition (L1 vs Free) x English Proficiency	0.111	0.199	0.559	.576
Question Type x Language Condition (L2-English vs Free) x English Proficiency	0.082	0.206	0.398	.691
Question Type x Language Condition (L1 vs Free) x Note Quality	−0.036	0.225	−0.159	.874
Question Type x Language Condition (L2-English vs Free) x Note Quality	0.039	0.213	0.184	.854
Question Type x English Proficiency x Note Quality	0.020	0.090	0.226	.821
Language Condition (L1 vs Free) x English Proficiency x Note Quality	−0.056	0.114	−0.490	.624
Language Condition (L2-English vs Free) x English Proficiency x Note Quality	0.025	0.104	0.237	.813
Question Type x Language Condition (L1 vs Free) x English Proficiency x Note Quality	−0.250	0.224	−1.116	.264
Question Type x Language Condition (L2-English vs Free) x English Proficiency x Note Quality	0.012	0.211	0.055	.956

between Note Quality and the Language Condition for both the L1/ free language comparison and the L2-English/ free language comparison. Memory performance was positively and significantly predicted by Note Quality in the free language condition (β = 0.104, *SE* = 0.016, *z* = 6.513, *p* < .001). While numerically all three language conditions showed a positive relationship between note-taking quality and memory performance, this relationship was much stronger (and only significant) when participants could freely use their languages in their notes (see Figure 4).

3.3.3. Language choice

Finally, we conducted an exploratory analysis to examine whether the participants' language behaviour within the free language note-taking condition related to memory performance and note quality. A linear regression model (ran because the mixed-effects analyses did not converge) showed a small but non-significant relationship between memory performance and amount of L1 use, suggesting lower L1 use in the notes related to higher memory performance (β = −0.029, *SE* = 0.016, *t* = −1.834, *p* = .068). A similar analysis examining a relationship between L1 use in the notes and note quality showed no significant relationship (β = −0.053, *SE* = 0.063, *z* = −0.846, *p* = .398). Frequency of language mixing did not show a relationship with either memory performance (β = −0.017, *SE* = 0.016, *t* = −1.065, *p* = .288) or note quality (β = −0.041, *SE* = 0.064, *t* = −0.651, *p* = .515).

4. Discussion

This study aimed to investigate the impact of language of note taking in bilingual students studying in their L2. We first tested whether taking notes in the L1 or in the L2 would be more beneficial for note quality (RQ1) and memory performance as measured on MCQs (RQ2). We furthermore examined if both note quality and memory performance while studying in an L2 were related to L2 proficiency (RQ3). We also examined whether free language use during note taking influenced the results (RQ4).

Overall, note quality was higher in the L2 (the content language) than in the L1 (RQ1). Memory performance did not differ between the note-taking conditions (RQ2). English proficiency was significantly related to note quality, in particular in the L2 note-taking condition, and to memory performance across conditions. (RQ3). Finally, note quality was higher in the free language condition than in the L1, with no difference compared to the L2. The free language condition did not differ from the L1 and L2 note conditions in terms of memory performance (RQ4).

4.1. Note quality

L2-English note quality was higher than L1 quality. Previous research comparing different groups of L1 and L2 users found lower L2 than L1 note quality (Fahmy and Bilton 1990). However, this could reflect other group differences, for example in educational background and note-taking practices (cf. Siegel and Kusumoto 2022). Other research comparing notes within bilinguals suggested there might not be a difference between the L1 and L2 (Park 2019). Our findings suggest that in some contexts L2 note-taking quality might be higher than L1 quality. Taking notes in the L2 while listening to L2 content can avoid costs associated with language switching across modalities (e.g. Wong and Maurer 2021). Furthermore, L1 note taking can require translation of L2 terms, which may increase cognitive load (Jansen, Lakens, and IJsselsteijn 2017; Piolat, Olive, and Kellogg 2005). For instance, the TED talks used in this study included technical terms, which is typical of academic lectures but may have been hard to translate. These academic words associated with the L2 might be processed especially fast in the L2 (cf. Shiron, Liu, and de Bruin 2021). The proficiency findings further support the importance of L2 vocabulary and lexical access, with participants with higher L2 proficiency showing higher note quality in all conditions (likely because they understood the

vocabulary in the L2 videos better) and especially in the L2 note-taking condition (where they benefited most from written L2 vocabulary).

We defined note-taking quality, in line with previous studies (Di Vesta and Gray 1972; Dunkel 1988; Peverly and Sumowski 2012; Zetawi and Lipka 2019), as the number and accuracy of content points covered in the notes. Exactly how notes are scored can influence whether language differences are observed. For instance, Park (2019) found no L1-L2 differences when measuring propositions in the notes, word count, and how well the notes could answer questions from the test, although their lower sample size (20 participants) could also have played a role.

4.2. Memory performance

In terms of memory performance, participants performed better on inference questions than knowledge questions. This was likely related to the difficulty level, with the knowledge questions requiring participants to provide detailed information that had to be remembered precisely from the video. Contrary to note quality, MCQ performance did not differ between the L1 and L2 note-taking conditions. Some previous studies, mostly focusing on comprehension rather than memory, have shown no L1-L2 difference (Park 2019) while others showed a significant difference favouring L2 note taking (Tsai-Fu and Wu 2010; Wang 2021). Our study found no difference between the L1 and L2, suggesting the match between the language of encoding in the notes and the language of testing did not help to improve memory performance (Marian and Fausey 2006; Vander Beken, De Bruyne, and Brysbaert 2020). However, with language of encoding of the video content and the test language matched in all conditions in our study, it is possible any note-taking encoding effects were not sufficiently strong to influence performance. The week delay between note taking and testing could have further diminished any encoding effects.

No significant relationship was found between memory performance and note quality when taking notes in the L1 and L2. Previous research found a link between note-taking quality and test performance (Peverly and Sumowski 2012), in particular for knowledge questions. Their participants were able to review their notes for 10 minutes before completing the memory test. Our participants did not review their notes before the test, which might have reduced any impact of note quality.

L2 proficiency was related to overall higher test performance, likely because the questions were asked in L2-English. This did not interact with note-taking condition, potentially because better English proficiency helped to understand the questions regardless of the note-taking language. This might partly be related to the questions including low-frequency words and topic-specific terms, like the exam questions students frequently encounter. This can also explain why these proficiency effects were observed despite working with participants who, at the group level, already had reached a high L2 proficiency level.

4.3. Free language use during note taking

While most previous studies compared note taking in one language to another language, we also included a condition in which participants could freely use their languages as they wanted. In real-life note taking, bilingual students use both languages (cf. İnci Kavak and Kirkgöz 2022; Siegel 2022a, 2022b). Indeed, approximately half of our participants used both languages in this free condition.

Amount of L1 use was negatively predicted by L2 self-rated writing proficiency and L2 language use, but not by LexTALE scores. Given its focus on writing, self-rated writing proficiency in this case may be more important for note-taking choices during writing. However, this relationship could also be driven by self-ratings at least partly reflecting how students *perceive* their written L2 proficiency. Participants with greater confidence in their L2 written proficiency might be more likely to use their L2 in their notes (cf. Siegel and Kusumoto 2022, for a discussion of other biases influencing self-

ratings). Daily-life language use may have predicted L1 word use in the free language condition because of its association with L2 lexical access (Peñaloza et al. 2019). None of these predictors, however, significantly related to language *mixing* (translanguaging).

In addition to examining *how* people used their languages freely, we also examined whether free language use influenced note quality and memory performance. It is possible that conditions requiring participants to only use one language did not match their preferences of language mixing in real-life note taking. Furthermore, grouping it as L1 or L2 conditions does not necessarily capture that some participants prefer using the L1 and some the L2. Note-taking quality was higher in the free language condition than in the L1, with no difference to the L2. Proficiency was more strongly related to quality in the free condition than in the L1, just like the L2. This may be due to the fact that many people still used L2-English in their notes in the free language condition, the language of the video content. However, an analysis examining a relationship with amount of L1/L2 use showed no direct relationship with note quality in terms of individual differences in language choice.

In line with the L1-L2 comparison, memory performance did not differ for the free language condition either. However, the relationship between memory performance and note quality was significant in the free language condition. Therefore, notes taken in the language(s) of the participants' choosing can have a positive impact on note-taking quality (relative to the L1) *and* can also (at the individual level) predict memory performance, even if it does not lead to advantages at the group level. This might reflect that participants can use their note-taking language strategically to best capture lecture content in the language(s) that work(s) most efficiently for them. The data suggested, although this did not reach significance, that higher L2 usage in the free language condition was associated with better memory. This again could suggest that the way participants optimise their L2 use while learning new content in the L2 could, at the individual level, optimise how well they remember new content. However, these benefits did not arise at the group level, potentially because people differ in their approaches and best ways of using their languages in notes.

4.4. Limitations and future research

Our study also raises several questions for future research. Firstly, we focused on users of two closely related same-script languages, to facilitate language switching while typing. Previous research has focused on students with more dissimilar languages (e.g. Chinese and English) and note taking can be influenced by L1-L2 similarity (cf. Jin and Webb 2024). Therefore, future research should include similar and different language pairs to examine any potential influence of language similarity.

Another consideration is that we did not allow our participants to review their notes, to avoid individual differences in time spent revising. Notably, previous research has suggested that it is not the act of note taking itself but rather the re-reading of notes that can consolidate memory (Di Vesta and Gray 1972). For instance, in one study, participants' memory was not influenced by note taking but rather by note revision (Knight and McKelvie 1986). Other evidence suggests that while note taking did facilitate encoding of lecture information, this effect was outweighed by that of re-reading notes (Rickards and Friedman 1978). Overall, being unable to review notes in this study may have minimised effects of note-taking language on memory. This might especially apply here because of the one-week delay between learning and testing (with this delay often being even longer for real exams).

A final point of consideration is the method of note taking. The majority of participants (63/100) reported preferring to take notes with pen and paper rather than digitally (cf. McBride and Garcés-Manzanera 2022). In the study, participants had to type their notes, which may have influenced the results and can have resulted in worse notes than if they were able to write using pen and paper (cf. Mueller and Oppenheimer 2014).

5. Conclusion

In conclusion, this study aimed to better understand note taking in international students and the potential impact of the note-taking language on note quality and memory of new content. Note quality was higher in the L2 or while students could take notes using both languages if they wanted to. However, at the group level there was no significant impact of note-taking condition on memory performance. A positive relationship between note-taking quality and memory performance was only significant in the free language condition. In the current study, note-taking language thus only had a limited impact on how well new information was remembered. Free language use (and mixing) did not have a negative impact. Indeed, this aligns with the translanguaging observed in this study and in bilingual classrooms. Furthermore, our data highlighted the importance of L2 proficiency, both in terms of note quality and memory test performance.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by Experimental Psychology Society (EPS) Undergraduate Research Bursary awarded to the first author.

Notes on contributors

Amy Canham is a 4th year MSci Psychology student at the University of York, UK. Her research interests include, but are not limited to, neurodiversity, bilingualism, and the impact of social class.

Marion Coumel completed a PhD in Psychology at the University of Warwick and a postdoctoral position at the University of York (UK). She investigates how people learn and process a second language. Her interests also include bilingualism and second language teaching.

Juliana Manolova is a Psychology student at the University of York, UK. She is in the final year of her undergraduate course. Her areas of interest within psychology are microanalysis of communication, bilingualism, and behaviour change.

Angela de Bruin is a Senior Lecturer (Associate Professor equivalent) at the University of York, UK. Her main research interests are bilingualism, language switching, and cognitive aging.

Data availability statement

The preregistration, data, and analysis script are available on osf.io/b4dmu.

ORCID

Angela de Bruin http://orcid.org/0000-0001-8326-0294

References

Amenta, S., L. Badan, and M. Brysbaert. 2021. "LexITA: A Quick and Reliable Assessment Tool for Italian L2 Receptive Vocabulary Size." *Applied Linguistics* 42 (2): 292–314. https://doi.org/10.1093/applin/amaa020.

Aminifard, Y., and A. Aminifard. 2012. "Note-taking and Listening Comprehension of Conversations and Mini-Lectures: Any Benefit?" *Canadian Social Science* 8 (4): 47.

Anderson, J. A. E., L. Mak, A. Keyvani Chahi, and E. Bialystok. 2018. "The Language and Social Background Questionnaire: Assessing Degree of Bilingualism in a Diverse Population." *Behavior Research Methods* 50 (1): 250–263. https://doi.org/10.3758/s13428-017-0867-9.

Anwyl-Irvine, A. L., J. Massonnié, A. Flitton, N. Kirkham, and J. K. Evershed. 2020. "Gorilla in our Midst: An Online Behavioral Experiment Builder." *Behavior Research Methods* 52 (1): 388–407. https://doi.org/10.3758/s13428-019-01237-x.

Austin, J. L., M. G. Lee, M. D. Thibeault, J. E. Carr, and J. S. Bailey. 2002. "Effects of Guided Notes on University Students' Responding and Recall of Information." *Journal of Behavioral Education* 11 (4): 243–254. https://doi.org/10.1023/A:1021110922552.

Bohay, M., D. P. Blakely, A. K. Tamplin, and G. A. Radvansky. 2011. "Note Taking, Review, Memory, and Comprehension." *The American Journal of Psychology* 124 (1): 63–73. https://doi.org/10.5406/amerjpsyc.124.1.0063.

Bouriga, S., and T. Olive. 2021. "Is Typewriting More Resources-Demanding Than Handwriting in Undergraduate Students?" *Reading and Writing* 34 (9): 2227–2255. https://doi.org/10.1007/s11145-021-10137-6.

Brysbaert, M. 2013. "Lextale_FR a Fast, Free, and Efficient Test to Measure Language Proficiency in French." *Psychologica Belgica* 53 (1): 23–37. https://doi.org/10.5334/pb-53-1-23.

Chen, S. 2020. "The Impact of Directionality on the Process and Product in Consecutive Interpreting Between Chinese and English: Evidence from Pen Recording and Eye Tracking." *The Journal of Specialised Translation* 34:100–117.

Clerehan, R. 1995. "Taking it Down: Notetaking Practices of L1 and L2 Students." *English for Specific Purposes* 14 (2): 137–155. https://doi.org/10.1016/0889-4906(95)00003-A.

Desselle, S. P., and P. A. Shane. 2019. "Native English Speakers and English as a Foreign Language (EFL) Students' Performance and Notetaking in a Doctor of Pharmacy Health Systems Course." *Research in Social & Administrative Pharmacy: RSAP* 15 (9): 1154–1159. https://doi.org/10.1016/j.sapharm.2018.09.023.

Di Vesta, F. J., and G. S. Gray. 1972. "Listening and Note Taking." *Journal of Educational Psychology* 63 (1): 8–14. https://doi.org/10.1037/h0032243.

Dunkel, P. 1988. "The Content of L1 and L2 Students' Lecture Notes and its Relation to Test Performance." *TESOL Quarterly* 22 (2): 259. https://doi.org/10.2307/3586936.

Dunkel, P., and S. Davy. 1989. "The Heuristic of Lecture Notetaking: Perceptions of American & International Students Regarding the Value & Practice of Notetaking." *English for Specific Purposes* 8 (1): 33–50. https://doi.org/10.1016/0889-4906(89)90005-7.

Emory, J., T. Teal, and G. Holloway. 2021. "Electronic Note Taking Technology and Academic Performance in Nursing Students." *Contemporary Nurse* 57 (3-4): 235–244. https://doi.org/10.1080/10376178.2021.1997148.

Fahmy, J. J., and L. Bilton. 1990. *Listening and Note-Taking in Higher Education*. http://files.eric.ed.gov/fulltext/ED366189.pdf.

Iniesta, A., D. Paolieri, F. Serrano, and M. Teresa Bajo. 2021. "Bilingual Writing Coactivation: Lexical and Sublexical Processing in a Word Dictation Task." *Bilingualism: Language and Cognition* 24 (5): 902–917. https://doi.org/10.1017/S1366728921000274.

Issa, S. H. M., F. H. A. Awadh, and H. R. Ahmed. 2022. "The Role of Proficiency Level in the Speed of Lexical Activation." *Cogent Arts & Humanities* 9 (1): 1999613. https://doi.org/10.1080/23311983.2021.1999613.

Izura, C., F. Cuetos, and M. Brysbaert. 2014. "Lextale-Esp: A Test to Rapidly and Efficiently Assess the Spanish Vocabulary Size." *PSICOLOGICA* 35 (1): 49–66.

İnci̇ Kavak, V., and Y. Kirkgöz. 2022. "Üniversite Öğrencilerinin edebiyat derslerinde not tutmalarını keşfetme: Bir dillerarası geçiş perspektifi." *Cukurova University Faculty of Education Journal* 51 (2): 1468–1486. https://doi.org/10.14812/cuefd.1027947.

Jansen, R. S., D. Lakens, and W. A. IJsselsteijn. 2017. "An Integrative Review of the Cognitive Costs and Benefits of Note-Taking." *Educational Research Review* 22:223–233. https://doi.org/10.1016/j.edurev.2017.10.001.

Jin, Z., and S. Webb. 2024. "The Effectiveness of Note Taking Through Exposure to L2 Input: A Meta-Analysis." *Studies in Second Language Acquisition* 46 (2): 404–426. https://doi.org/10.1017/S0272263123000529.

Knight, L. J., and S. J. McKelvie. 1986. "Effects of Attendance, Note-Taking, and Review on Memory for a Lecture: Encoding vs. External Storage Functions of Notes." *Canadian Journal of Behavioural Science. Revue Canadienne Des Sciences Du Comportement* 18 (1): 52–61. https://doi.org/10.1037/h0079957.

Lemhöfer, K., and M. Broersma. 2012. "Introducing LexTALE: A Quick and Valid Lexical Test for Advanced Learners of English." *Behavior Research Methods* 44 (2): 325–343. https://doi.org/10.3758/s13428-011-0146-0.

Lüdecke, D., M. S. Ben-Shachar, I. Patil, P. Waggoner, and D. Makowski. 2021. "Performance: An R Package for Assessment, Comparison and Testing of Statistical Models." *Journal of Open Source Software* 6 (60): 3139. https://doi.org/10.21105/joss.03139.

Marian, V., and C. M. Fausey. 2006. "Language-dependent Memory in Bilingual Learning." *Applied Cognitive Psychology* 20 (8): 1025–1047. https://doi.org/10.1002/acp.1242.

McBride, S., and A. Garcés-Manzanera. 2022. "Higher Education L2 Writing: A Comparison of Undergraduate Perceptions on Digital and pen-and-Paper Writing." *El Devenir de La Lingüística y La Cultura: Un Estudio Interdisciplinar Sobre Lengua, Literatura y Traducción*, 1152–1170. https://dialnet.unirioja.es/servlet/articulo?codigo=8473906.

Mueller, P. A., and D. M. Oppenheimer. 2014. "The pen is Mightier Than the Keyboard: Advantages of Longhand Over Laptop Note Taking." *Psychological Science* 25 (6): 1159–1168. https://doi.org/10.1177/0956797614524581.

Narjaikaew, P., N. Emarat, and B. Cowie. 2009. "The Effect of Guided Note Taking During Lectures on Thai University Students' Understanding of Electromagnetism." *Research in Science and Technological Education* 27 (1): 75–94. https://doi.org/10.1080/02635140802658917.

Palmatier, R. A., and J. M. Bennett. 1974. "Notetaking Habits of College Students." *Journal of Reading* 18 (3): 215–218.

Park, H. 2019. *The Effect of L1 and L2 Notetaking in Academic Lecture Listening on Listening Comprehension and Analysis of Notes* [St. Cloud State University]. https://repository.stcloudstate.edu/tesl_etds/1.

Peñaloza, C., U. Grasemann, M. Dekhtyar, R. Miikkulainen, and S. Kiran. 2019. "BiLex: A Computational Approach to the Effects of age of Acquisition and Language Exposure on Bilingual Lexical Access." *Brain and Language* 195:104643. https://doi.org/10.1016/j.bandl.2019.104643.

Peper, R. J., and R. E. Mayer. 1986. "Generative Effects of Note-Taking During Science Lectures." *Journal of Educational Psychology* 78 (1): 34–38. https://doi.org/10.1037/0022-0663.78.1.34.

Peverly, S. T., and J. F. Sumowski. 2012. "What Variables Predict Quality of Text Notes and are Text Notes Related to Performance on Different Types of Tests?" *Applied Cognitive Psychology* 26 (1): 104–117. https://doi.org/10.1002/acp.1802.

Piolat, A., T. Olive, and R. T. Kellogg. 2005. "Cognitive Effort During Note Taking." *Applied Cognitive Psychology* 19 (3): 291–312. https://doi.org/10.1002/acp.1086.

Rahmani, M., and K. Sadeghi. 2011. "Effects of Note-Taking Training on Reading Comprehension and Recall." *Reading* 11 (2): 116–128.

Rickards, J. P., and F. Friedman. 1978. "The Encoding Versus the External Storage Hypothesis in Note Taking." *Contemporary Educational Psychology* 3 (2): 136–143. https://doi.org/10.1016/0361-476X(78)90020-6.

Shiron, V., H. Liu, and A. de Bruin. 2021. "Being a Student or at Home: Does Topic Influence How Bilinguals Process Words in Each Language?" *Languages* 6 (3): 150. https://doi.org/10.3390/languages6030150.

Siegel, J. 2022a. "Translanguaging in Notes: A Swedish Perspective." *ASLA:S Skriftserie/ASLA Studies in Applied Linguistics* 29:99–118.

Siegel, J. 2022b. "Translanguaging Options for Note-Taking in EAP and EMI." *ELT Journal* 77 (1): 42–51. https://doi.org/10.1093/elt/ccac027.

Siegel, J., and Y. Kusumoto. 2022. "A Cross-Cultural Investigation of L2 Notetaking: Student Habits and Perspectives." *Journal of Multilingual and Multicultural Development*, 1–17. https://doi.org/10.1080/01434632.2022.2108611.

Song, M.-Y. 2012. "Note-taking Quality and Performance on an L2 Academic Listening Test." *Language Testing* 29 (1): 67–89. https://doi.org/10.1177/0265532211415379.

Tsai-Fu, T., and Y. Wu. 2010. "Effects of Note-Taking Instruction and Note-Taking Languages on College EFL Students' Listening Comprehension." *New Horizons in Education* 58 (1): 120–132.

Vander Beken, H., E. De Bruyne, and M. Brysbaert. 2020. "Studying Texts in a non-Native Language: A Further Investigation of Factors Involved in the L2 Recall Cost." *Quarterly Journal of Experimental Psychology* 73 (6): 891–907. https://doi.org/10.1177/1747021820910694.

Wang, X. 2021. "An Analysis of Note-Taking Strategies: The Effect of Translanguaging on Content Comprehension and Knowledge Retention." *Journal of Language Teaching* 1 (3): 1–20.

Wingrove, P. 2017. "How Suitable are TED Talks for Academic Listening?" *Journal of English for Academic Purposes* 30:79–95. https://doi.org/10.1016/j.jeap.2017.10.010.

Wong, W. L., and U. Maurer. 2021. "The Effects of Input and Output Modalities on Language Switching Between Chinese and English." *Bilingualism: Language and Cognition* 24 (4): 719–729. https://doi.org/10.1017/S136672892100002X.

Zetawi, M. A., and O. Lipka. 2019. "Note-taking Skill among Bilingual Students at the Academia: Literacy, Language and Cognitive Examination." *Frontiers in Psychology* 10 (APR): 870. https://doi.org/10.3389/fpsyg.2019.00870.