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The advantages of listening to academic content in a second language may be outweighed by disadvantages: A cognitive load theory approach

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Background. It is frequently implicitly assumed that advantages in language acquisition when learning content through a second language exceed the disadvantages of reduced content acquisition.

Aims. Based on cognitive load theory, that assumption was tested experimentally. The theory is concerned with techniques for reducing extraneous working memory load in order to facilitate learning.

Materials. This study used a listening task.

Methods. French students of Law and Political Science listened to an audio document about the European Court of Humans Rights under one of four experimental conditions: in their native language (French) twice; in a second language (German) twice; first in French, then in German; or first in German then in French. After the listening task, we tested students' understanding of both the German language and of the academic content.

Results. Our results indicated that listening to the content in French before listening to it in a second language was beneficial for both content and language learning. In contrast, listening to content in a second language not only depressed content acquisition as is to be expected, but also depressed language acquisition. We discuss the relevance of cognitive load theory to frame learning tasks aimed at teaching content through a second language.

Frequently, it is assumed that teaching academic content in a language other than the home language of students (L1) has beneficial consequences sometimes referred to as 'killing two birds with one stone' (Dallinger, Jonkmann, Hollm, & Fiege, 2016; Dalton-Puffer, 2011; Dearden, 2015; Doiz, Lasagabaster, & Sierra, 2012; Eurydice, 2006; Jexenflicker & Dalton-Puffer, 2010; Loranc-Paszylk, 2009). While learning content in a second language (L2) is likely to reduce content acquisition, it is hoped that second language improvement will compensate for the reduction in content acquisition. In fact, there are few theoretical grounds for this assumption and limited empirical evidence.

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Indeed, from a cognitive load theory perspective (Sweller, Ayres, & Kalyuga, 2011), it can be hypothesized that learning content in a second language may not only depress content acquisition, but also be an inefficient way of acquiring second language skills (Roussel, Joulia, Tricot, & Sweller, 2017).

In higher education, the most widespread approach to teaching content in a second language is called 'English as a Medium of Instruction' (EMI) which referrers to 'the use of the English language to teach academic subjects (other than English itself) in countries or jurisdictions where the first language of the majority of the population is not English' (Macaro, Curle, Pun, An, & Dearden, 2018, p. 37). This acronym concerns teaching in English where English is a second language but similar cognitive consequences can be expected when other languages such as German are used to teach academic content where German is a second language, which is the case in this study. However, regardless of the language used to teach academic content, there is a lack of consensus concerning learning outcomes in these contexts.

The mixed results found in the literature make it difficult to arrive at any conclusions about the effectiveness of practices aiming at teaching content through a second language (Graham, 2006). Researchers in the field (Airey, 2012; Costa & Coleman, 2010; Doiz et al., 2012; Erling & Hilgendorf, 2006; Jiménez-Muñoz, 2016) underline that students face major challenges when a language that is not their first language is used as the medium of instruction. Their initial language proficiency is often insufficient to follow a lecture in their field of study in a second language (Erling & Hilgendorf, 2006). Consequently, researchers agree on the fact that pedagogical adjustments are needed in such contexts (Jiménez-Muñoz, 2016). Macaro et al. (2018) claim for example that 'we need to understand what kind of "accommodation" needs to be made' (p. 38) when students have to learn academic content in a second language to ensure their successful following of the course content. In this paper, we argue, in line with other researchers of the field (Dafouz & Smit, 2014; Gabillon & Ailincai, 2016), that the construction of pedagogical adjustments has to be tackled through theoretical analysis and discussion. In addition, data based on randomized controlled trials is essential.

Learning subject content through a second language

Research on EMI and Content and Language Integrated Learning (CLIL) agrees that changing from L1 to L2 as the medium of instruction is a critical research question (Macaro et al., 2018) and that proof of the efficacy of that change is required (Jiménez-Muñoz, 2014). An assumption of EMI and CLIL is that while teaching in a second language is very likely to decrease content learning, that disadvantage will be compensated for by the acquisition of increased knowledge of the second language. However, Macaro et al. (2018) concluded in their systematic literature review of the field, 'that the research evidence to date is insufficient to assert that EMI benefits language learning nor that it is clearly detrimental to content learning'. (p. 36). Macaro et al. (2018) indicated that there have been only a few studies measuring the impact of learning academic content through a second language. Of the 83 studies the authors considered, seven have measured the impact on language learning (see e.g., Aguilar & Muñoz, 2014; Hu & Lei, 2014; Yang, 2015) and of those seven papers, the review authors indicate disparities in the language tests being used, with some of them measuring general English proficiency and others specific academic English proficiency. Some longitudinal studies demonstrated positive effects of learning content through a second language in higher education (Aguilar & Muñoz, 2014;

Yang, 2015) but used quasi-experimental designs rather than full, randomized, controlled trials, leading to possible issues concerning control of variables.

Methodological biases

There is a critical need for at least some fully randomized, controlled studies in this area. Major decisions with real-world consequences are being made based on studies, some of which with severe methodological biases. Valid control of variables is a major issue in CLIL and EMI studies (Bruton, 2013). The current debate in CLIL (see Bruton, 2013 and the reply of Hüttner & Smit, 2014; or Cenoz, Genesee, & Gorter, 2013 and the reply of Dalton-Puffer, Llinares, Lorenzo, & Nikula, 2014) has indicated potential methodological biases associated with selection bias (Feddermann, Möller, & Baumert, 2021; Martinez Agudo, 2020; Pérez Cañado, 2020), variable control such as time exposure to the second language, the economic status of CLIL students, pedagogical settings, and student and teacher motivation. While it is possible to run fair, quasi-experimental studies, all of the above points can be most easily eliminated by proper use of randomized, controlled studies.

The same is true for EMI. As one example, Rivero-Menéndez, Grande, Sánchez, and Camacho-Miñano (2018) indicate that undergraduate students who study in a second language are likely to be higher achieving students than those who learn the same content in their first language. Firstly, the students' initial second language proficiency level should be taken into account. Secondly, other factors, such as the students' 'academic performance, socio-economic status and motivation which are usually higher among the students in bilingual than in mainstream programmes' (Gablasova, 2014, p. 154) have to be controlled. In other words, if students perform better in CLIL and EMI classrooms than their counterparts, who are not participating in these programmes, it is possibly because they are more competent, more motivated and particularly because they are more proficient in their second language (see Dallinger et al., 2016; Opdenakker, VanDamme, DeFraine, VanLandeghem, & Onghena, 2002). In some cases, students are selected on all such selective criteria to gain access to EMI programmes. The most obvious way of eliminating these potential problems is to use randomized, controlled trials.

In this paper, we argue that empirical research using randomized, properly controlled trials (Perez Cañado, 2013; Shohamy, 2012), even though necessarily restricted in their scope, are an important addition to longitudinal, quasi-experimental studies that necessarily cannot provide full control of variables. Cognitive load theory, which is based on randomized, controlled studies, can provide a theoretical context.

Theoretical contribution of cognitive load theory to the design of a learning task

The basic question of this study is: Should we learn a language implicitly by simple immersion and exposure (an assumption of most integrated approaches), rather than being taught explicitly? To this question, many current theories of second language acquisition such as constructivism (Bruner, 1978; Vygotski, 1978) input theory (Krashen, 1985), the interactionist (Gass & Mackey, 2007) and naturalistic approaches (Krashen & Terrell, 2000), answer that the best way of acquiring a second language is through immersion. According to this view, the best learning conditions should be similar to those of native language acquisition. Consequently, learning academic content through a second language is seen as an excellent way of reproducing a 'natural' learning context. It is assumed that by attending a course in a second language, students will learn the

language implicitly, without explicit instruction, in the same way they learn their native language. The implicit assumption of that view is that while there may be a cost due to reduced content acquisition, that cost should be neutralized by increased language skills. Other second language acquisition theories (see Long, 1991; Robinson, 2003) largely underline that in contexts where academic content is taught in a second language, it might be necessary to guide the attention of the learners on linguistic forms (Long, 1991), otherwise those linguistics feature may go unnoticed, unprocessed, and unlearned (see also Robinson, 2003). More controversial is the nature of the pedagogic technique that intervention should adopt in order to be optimally effective (Doughty & Williams, 1998).

Cognitive load theory casts doubt on the view that a second language should be taught primarily by immersion. Recent work (Roussel et al., 2017) testing French students reading text in English or German showed that cognitive load theory can provide insights into presenting an academic subject in a second language. In this research, the text to read was presented in L1 only, in L2 only and in a bilingual version. In this last version, the sentences were alternated between the two languages and some critical words and phrases were underlined, highlighted in bold or, linked with corresponding translations by arrows. The attention of the learners was consequently explicitly guided to linguistic forms. The results of that study showed that the best performances were obtained in this condition of alternating the two languages both for content and language learning.

Cognitive load theory uses Geary's distinction between biologically primary and secondary knowledge (Geary, 2012; Geary & Berch, 2016; Sweller, 2016; Sweller et al., 2011; Sweller, van Merriënboer, & Paas, 2019). Acquiring primary knowledge such as learning to speak or listen to our L1, tends to be effortless, automatic, unconscious, and does not require explicit tuition. It occurs by simple adaptation to our environment. In contrast, acquiring secondary knowledge such as learning to read and write in our first language or learning a second language as an adult is needed for cultural reasons, requires conscious effort and must be assisted by explicit tuition (Sweller, Kirschner, & Clark, 2007). Cognitive load theory argues that we have not evolved to acquire multiple, biologically secondary skills simultaneously. Consequently, because content learning in a second language aims to have learners acquire two categories of secondary knowledge simultaneously, the academic content and a second language, it is likely to overload working memory and decrease students' performance in the absence of appropriate pedagogical support. For example, in one recent study in the field of CLIL, Piesche, Jonkmann, Fiege, and Keßler (2016) explained the low performances of CLIL students by suggesting a working memory overload.

When processing biologically secondary information, human cognitive architecture can be described by five basic principles (Sweller, 2015; Sweller et al., 2011, 2019) that are shared by evolution by natural selection. New information can be obtained by a random generation and test process during problem solving using the *randomness as genesis principle* or it can be obtained from other people when listening, reading, or imitating using the *borrowing and reorganizing principle*. There are severe restrictions to how much novel information can be obtained at any given time due to the *narrow limits of change principle*. Working memory with its limited duration and capacity provides the relevant structure that deals with novel information and working memory is restricted both in capacity and duration. This principle explains the difficulty of simultaneously processing novel content and novel linguistic information. Once processed in working memory, the *information store principle*, allows information to be stored in long-term memory which has no known capacity or duration limits. Lastly, the *environmental organizing and linking principle* can transfer unlimited amounts of information back to

working memory to generate action that is appropriate to the current environment. Unlike when dealing with novel information, working memory has no known capacity or duration limits when dealing with stored information from long-term memory. The transformative effects of education derive from this principle. Of course, when learners are provided novel content in a novel language, this principle cannot provide assistance. The principle only applies once learning has occurred and so this principle provides the purpose of instruction.

This cognitive load theory structure can be applied to learning a second language by immersion in the following manner. Attempting to learn content in a second language, which has not been mastered, creates an excessive cognitive load as the focus is on translating the text, rather than understanding and learning the new content. With respect to learning content, presentation in a second language constitutes extraneous cognitive load because if the content was in the first language, the cognitive load associated with translation is eliminated. Because of limited working memory capacity, having to translate will lead to reduced learning. Similarly, having to learn the content will interfere with L2 acquisition. Since we know that explicit instruction reduces extraneous cognitive load (Kirschner, Sweller, & Clark, 2006; Sweller et al., 2019), explicitly providing a translation of the content should facilitate learning of both the content and L2.

The present study

Based on the above literature, we hypothesize that the extraneous cognitive load of a listening task in a second language, which aims at acquiring new knowledge in a specific field can be considered as a challenge for the limited capacity of working memory (Baddeley, 2002). When designing the current experiment, our aim was to reproduce on a smaller scale the condition of an academic lecture in a second language. We used a randomized, controlled trial with a strict control of variables in order to prevent methodological biases.

This study advances Roussel et al. (2017)'s work, with oral rather than written presentations of the material. Previous work on learning to understand oral communication in a second language has found that paradoxically, learning to listen can be facilitated more by reading practice than listening practice due to the transient nature of oral communication (Jiang, Kalyuga, & Sweller, 2018; Moussa-Inaty, Ayres, & Sweller, 2012). The transience of oral communication combined with having to learn content may overwhelm working memory (see also Singh, Marcus, & Ayres, 2017).

The experiment compared four experimental conditions in which French students of law and political sciences listened to an audio document about the role and functioning of the European Court of Human Rights. They were divided randomly into four groups with similar average scores on a language pre-test and listened to a subject specific audio document either in: (1) the first language (French) twice; (2) in the second language (German) twice; (3) in the first language initially and then in the second language; (4) in the second language initially and then in the first language.

First, we expected the results to indicate that the two bilingual conditions providing the French version of the soundtrack would reduce extraneous cognitive load and so be helpful in learning both content and language. Accordingly, our major hypothesis is that exposure to German alone (the second language) would not result in a sufficient increase in language knowledge to compensate for the decrease in content knowledge expected by attempting to learn content in a second language.

Second, we also expected that listening initially in the first language will help learners to understand the content and to better concentrate on the language during the second listening task (listen in the second language), compared with listening initially in the second language. We expected that result because of the limited capacity of working memory when processing novel information. When listening initially in the second language, students will not be able to maintain the German language in working memory and to compare German language features with the French equivalent they subsequently listen to, in the French version.

Third, we checked the effect of prior knowledge in German, because the question of what level in the second language is needed to be able to follow a lecture in the second language is a crucial issue in the field of CLIL and EMI (Dearden, 2015; Erling & Hilgendorf, 2006). Based on the suggestion of selection bias in CLIL and EMI-research using quasi-experimental designs, it can be hypothesized that initial levels of language competence may be a critical factor with more language competent students better able to handle second language conditions. This result would be coherent with the expertise reversal effect in cognitive load theory (Kalyuga et al., 2003; Sweller et al., 2011) in which the relative effectiveness of instructional procedures reverses with increased expertise (Jiang et al., 2018). Accordingly, based on the expertise reversal effect, it may be argued that the pattern of means might vary depending on the participants' prior language knowledge.

Method

Participants

Seventy-nine French law and political science students (56 female) from the University and the Institute of Political Sciences of (Bordeaux) participated in the experiment. They were between 17 and 20 years old, enrolled in Year 1 to Year 4 of the course. Their initial level in German was pre-tested using the listening comprehension part of an official B2 Certification exam of the Goethe-Institute (http://bfu.goethe.de/b2_01/hoeren.php). The average performance (M = 14.1/25) corresponded to the B2 level (Vantage) according to the Common European Framework of Reference for Languages (Council of Europe, 2001, pp. 23–24). At this level, the learner is considered as an independent user, who 'can understand the main ideas of complex text on both concrete and abstract topics, including technical discussions in his/her field of specialization' (Council of Europe, 2001, p. 24). All students attended German courses related to law, European institutions, and political science. After these pre-tests, the students were divided into four experimental groups with equal, average scores on the pre-tests. Other than the requirement of equal average scores on the pre-tests, assignment to groups was random. Consequently, the groups were comparable, with skilled and less skilled second language learners in each group.

Instruments

The audio document from which students had to learn was about the European Court of Human Rights and is the soundtrack of a descriptive video describing the court (see Appendix A). This material is available in French, German, and English on the website of the court (https://www.echr.coe.int). The document described the court, its links with the Council of Europe, and the European Convention on Human Rights, the way in which the court came into being in 1959, reflecting the Member States desire never again to

experience the atrocities committed in the mid-twentieth century, the number of the states who signed up, its mission, number of judges and the way they are chosen, the way applications are selected and the reasons why they can be rejected. The main difficulty for learners lies in remembering this information. Generally speaking, learning the new specific law vocabulary in German and retrieving it for the language post-tests is a demanding task. Learners were asked to listen to the document and try to learn as much of the language and content as possible.

The participants were asked to listen to the audio file according to the procedures of the four groups into which they were randomly allocated: (1) French twice; (2) German twice; (3) French first and then German; (4) German first and then French. Before the listening task, we informed participants that they would have to answer questions testing their knowledge of the second language and of the content of the audio document. Computer headsets were used to listen to the audio files.

The post-test required participants: (1) to listen to words and phrases from the learning materials, which were recorded on a separate audio file, and to write down their translation into French (see Appendix B); (2) to provide written answers to content questions asked in French (see Appendix C).

Procedure

The pre-test, learning phase and post-test took place during the German course. The German teacher was the experimenter. The pre-test duration was about 40 min, one week before the experiment itself. The participants were not informed about their performance. The learning phase was seven minutes long. Learners were given seven minutes to listen to the two files. Next, the participants immediately were asked to complete the two post-tests. The total duration of the post-tests was 15 min. The two post-tests were scored with one point per correct answer.

Results

There was no significant difference between the pre-test means, $F(3, 75) = 0.002$, $MSE = 0.064$, $p = .999$, $\eta_p^2 = 0.003$). The language post-test means and standard deviations may be found in Table 1.

ANCOVAs with the language pre-test as a co-variable on the language and content post-test scores showed an effect of the experimental condition on both the language post-test, $F(4, 74) = 10.060$, $MSE = 198$, $p < .001$, $\eta_p^2 = 0.187$ and the content post-test, $F(4,$

Table 1. Means (*M*) and standard deviations (*SD*) for post-test (language, content) score results

	Language (max = 30)		Content (max = 15)	
Post-test	*M*	*SD*	*M*	*SD*
Audio in French twice ($N = 19$)	6.237	4.569	10.632	2.191
Audio in German twice ($N = 20$)	8.050	5.509	4.475	2.029
Audio in French and then in German ($N = 20$)	13.325	6.740	9.675	2.375
Audio in German and then in French ($N = 20$)	11.375	6.700	8.550	3.340

74) = 23.850, $MSE = 145$, $p < .001$, $\eta_p^2 = 0.474$. Following the ANCOVA results, *post-hoc* tests (least significant differences) were carried out with the results indicated in Tables 2 and 3. For the language post-test, performance was better for listening first in French, then in German compared with listening in French only or in German only. The difference between the French only and German only conditions in learning the language was not significant, as well as the difference between listening first in French, then in German compared with listening first in German, then in French. Listening first in German, then in French also lead to significantly better results than listening twice in German.

For the content post-test, as is of course to be expected, performance was significantly better listening in French only twice compared with German only twice but not significantly different from listening first in French and then in German or from listening first in German, then in French. Listening in German only twice led to lower results compared with all other experimental conditions.

The correlation between language prior knowledge and language post-test is strong ($r = 0.596$, $p < .001$) but language prior knowledge is not significantly correlated with content post-test ($r = 0.185$, $p = .103$). These two correlations indicate that while language prior knowledge explains a large part of the language performance, its contribution to content comprehension is very limited.

In order to determine whether the general pattern of results varied depending on learners' levels of expertise, we divided our sample of participants into two groups around the median of the scores in the pre-test: Low language prior knowledge group ($M = 10.051$, $SD = 3.440$) and High language prior knowledge group ($M = 18.050$, $SD = 2.430$). Means and *SD*s may be found in Tables 4 (language post-tests) and Table 5 (content post-tests).

We found no interaction between the experimental conditions and prior language knowledge on the language post-test, $F(7, 71) = 0.491$, $MSE = 12.300$, $p = .690$, $\eta_p^2 = 0.011$), nor on the content post-test, $F(7, 71) = 0.826$, $MSE = 0.69$, $p = .484$, $\eta_p^2 = 0.017$.

Despite the lack of an interaction between experimental conditions and the prior language knowledge, we conducted simple effects tests of prior language knowledge on the post-tests: there was a significant effect of prior language knowledge on the language post-test, $F(1, 77) = 23.500$, $MSE = 745.8$, $p < .001$, $\eta_p^2 = 0.234$, but not on the content post-test, $F(1, 77) = 0.653$, $MSE = 7.72$, $p = .422$, $\eta_p^2 = 0.008$. These results are coherent with the correlations presented above. Based on these results, the pattern of means for the high and low prior language knowledge students was identical.

Table 2. Least significant differences for language performance

	French twice	German twice	French then German	German then French
French twice	0	1.813 $p = .338$	7.088 $p = .002$	5.138 $p = .039$
German twice		0	5.275 $p = .029$	3.325 $p = .286$
French then German			0	1.950 $p = .721$
German then French				0

Table 3. Least significant differences for content performance

	French twice	German twice	French then German	German then French
French twice	0	6.157 $p < .001$	0.957 $p = .644$	2.082 $p = .059$
German twice		0	5.200 $p < .001$	4.075 $p < .001$
French then German			0	1.125 $p = .503$
German then French				0

Table 4. Means (*M*) and standard deviations (*SD*) of language post-test scores for low and high language prior knowledge participants

	Low language prior knowledge		High language prior knowledge	
Language post-test	*M*	*SD*	*M*	*SD*
French twice	4.350	2.001	8.333	5.750
German twice	4.555	1.648	10.909	5.957
French then German	10.045	5.275	17.333	6.344
German then French	6.679	3.401	14.727	6.354

Table 5. Means (*M*) and standard deviations (*SD*) of content post-test scores for low and high language prior knowledge participants

	Low language prior knowledge		High language prior knowledge	
Content post-test	*M*	*SD*	*M*	*SD*
French twice	10.000	2.211	11.330	2.062
German twice	3.440	1.845	5.318	1.834
French then German	9.909	2.300	9.389	2.571
German then French	7.944	3.729	9.045	3.078

Discussion

These results indicate that for language learning, a combined French and German version of the audio document provided the best test scores with the worst scores obtained by the German language only group and not surprisingly, by the French language only group. In contrast, for content learning, the best scores were, again not surprisingly, provided by the native French language only group with the worst scores again obtained by the second language, German only group. Listening to academic content in German as a second language, without any support, decreased both language and content learning. This

conclusion is in line with previous research work (Roussel et al., 2017) using written text rather than the spoken text of the current experiment.

These results are critical. Many jurisdictions around the world recommend and practice presenting content in a foreign language on the assumption that while the procedure would obviously reduce content knowledge, that reduction would be compensated for by an increase in second language skill. There was no evidence whatsoever that this procedure would result in a compensatory, increased second language facility. Instead, the results indicated decreased rather than increased language skills.

There was some support for our other hypothesis, that listening first in the French language will help learners to understand the content and to better concentrate on the language during the second listening task in the German second language. For second language learning, the French-German group had significantly better results than the French only and German only groups, but it was not significantly better than the German-French group, whereas the German-French group was only significantly better than the French only group.

For content learning, listening first in French or first in German led to comparable performance with no significant deterioration compared with listening in French only. A very large deterioration occurred for the German only group. As is to be expected, presenting the information in the second language only resulted in substantial content learning losses compared with all other conditions. Our results contradict Macaro et al.'s (2018) conclusion concerning the lack of evidence that learning content through a second language is clearly detrimental to content learning. Our results clearly indicate a decrease in learning by the L2 only group.

The pattern of our results was identical for high and low language prior knowledge learners. Even the highest-level students obtained poorer results in the second language condition compared with the bilingual conditions.

These results are in accord with cognitive load theory. Adults do not learn a second language in the same manner as a first language is learned by infants. Infants learning their native language use the biologically primary system which is designed to obtain relevant information via immersion. Accordingly, a first language does not need to be explicitly taught. It will automatically and unconsciously be acquired simply by immersion in a culture because we have evolved to learn a first language in this manner. In contrast, we have not evolved to learn a second language as adults. Second languages are learned by adults via the biologically secondary, not the biologically primary system. The human cognitive system associated with the biologically secondary system is now well-known. Knowledge is consciously acquired by learners and when dealing with biologically secondary information, working memory that needs to process that information is extremely limited. To acquire a second language as an adult requires explicit tuition by instructors and specific effort by learners. It will not be acquired automatically during immersion (e.g., Roussel et al., 2017).

The instructional consequences of this cognitive architecture are clear. We should not expect learners to automatically acquire a second language just by immersion in that language. While immersion may be beneficial when added to explicit instruction in the language, it is not a substitute for instruction. The current data support this theoretically generated hypothesis. Learning to listen to a second language without the assistance of the native language limited the acquisition of both language and content knowledge with no evidence that the expected decrease in content knowledge was compensated for by an increase in second language skills.

The current work was based on a short-term, randomized, strictly controlled experiment. Such experiments are needed to establish basic scientific facts. They should not be seen as contradicting or replacing, previous work using long-term, ecologically valid studies. It is difficult or impossible to control all variables when running long-term experiments under realistic classroom conditions. While such studies are important, if only long-term, ecologically valid studies are carried out, we run the risk of accidentally biased results. Long-term studies need to be balanced by others that are able to use a strict control of variables to test and establish scientific constructs.

In conclusion, based on the current results, we argue that providing content in a first language before or to a lesser extent, after a content lecture in a second language, is likely to better support the learning of language and academic content simultaneously, compared with immersion in a second language without language support. Our results are in line with other research works which suggest that 'students can be allowed to adopt some strategies such as asking the lecturer the content of the course in L1 (e.g., Airey & Linder, 2006; Tarnopolsky & Goodman, 2014)' (Soruç, Dinler, & Griffiths, 2018, p. 281). Our results also confirm previous findings (Roussel et al., 2017), in this case using spoken rather than written language, that a policy of immersion in a second language without explicit language instruction when acquiring content may be misguided when applied to novice, adult learners.

Conflicts of interest

All authors declare no conflict of interest.

Author contribution

Stéphanie Roussel: Conceptualization (equal); Data curation (equal); Formal analysis (equal); Methodology (equal); Supervision (equal); Validation (equal); Visualization (equal); Writing – original draft (equal); Writing – review & editing (equal). **André Tricot:** Conceptualization (equal); Data curation (equal); Formal analysis (equal); Methodology (equal); Supervision (equal); Validation (equal); Visualization (equal); Writing – original draft (equal); Writing – review & editing (equal). **John Sweller:** Conceptualization (equal); Data curation (equal); Formal analysis (equal); Methodology (equal); Supervision (equal); Validation (equal); Visualization (equal); Writing – original draft (equal); Writing – review & editing (equal).

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APPENDIX A:

Transcript of the audio file on the European Court of Humans Rights in German and French and English. https://www.echr.coe.int

Jedes Jahr wenden sich unzählige Menschen, die glauben, in ihren Grundrechten verletzt worden zu sein, an den europäischen Gerichtshof für Menschenrechte. Was macht dieser Gerichtshof, der seit über 50 Jahren, Einzelpersonen ermöglicht, Staaten zur Verantwortung zu ziehen und dessen Arbeit sich auf unser tägliches leben auswirkt? Nach dem

zweiten Weltkrieg beschlossen einige Länder 1949 den Europarat zu gründen, um Menschenrechte, Demokratie und Rechtsstaatlichkeit in ganz Europa zu fördern. Sie verabschiedeten die europäische Menschenrechtskonvention und errichteten so ein damals einzigartiges System mit einem rechtsverbindlichen Überwachungsmechanismus. So entstand 1959 der Gerichtshof, der dem Willen der Mitgliedstaaten Nachdruck verleihen sollte, Gräueltaten, wie sie Mitte des zwanzigsten Jahrhunderts verübt wurden, künftig zu verhindern. Ursprünglich beteiligten sich zwölf Staaten. Heute sind es fast 50. Der Gerichtshof hat seinen sitz in Straßburg. Er setzt sich aus je einem Richter pro Mitgliedsstaat des Europarates zusammen. Die Richter werden von der parlamentarischen Versammlung des Europarates gewählt. Sie sind vollständig unabhängig und vertreten keinerlei nationale Interessen. Die Richter werden von der Kanzlei des Gerichtshofs unterstützt, die qualifizierte Mitarbeiter aus allen Mitgliedstaaten beschäftigt. Täglich gehen am Gerichtshof hunderte Briefe und Anrufe ein. Die Beschwerden werden vorsortiert und an die zuständigen Abteilungen der Kanzlei weitergeleitet, die die Fälle für die Richter vorbereitet. Alle Entscheidungen werden von den Richtern getroffen, die als Einzelrichter, Ausschuss von drei Richtern, Kammer von sieben Richtern oder aber, in ganz wichtigen Fällen, als große Kammer mit 17 Richtern entscheiden. Das Verfahren verläuft schriftlich. In einigen wenigen fällen hält der Gerichtshof öffentliche Anhörungen ab. Diese werden gefilmt und sind im Internet abrufbar. Der Gerichtshof erhält jedes Jahr eine große Anzahl von Beschwerden. Die überwiegende Mehrzahl der Fälle wird jedoch als unzulässig zurückgewiesen, weil die Voraussetzungen, um den Gerichtshof anzurufen nicht eingehalten wurden. So müssen Beschwerdeführer zum Beispiel erst den nationalen Rechtsweg vollständig ausschöpfen.

Chaque année des dizaines de milliers de personnes s'estimant victimes de violations de leurs droits fondamentaux s'adressent à la Cour Européenne des Droits de l'Homme. Quelle est cette cour, qui depuis plus d'un demi siècle permet à des individus de faire condamner des états et dont les décisions peuvent affecter nos vies de tous les jours? Après la seconde guerre mondiale, quelques pays décidèrent de créer, en 1949, le Conseil de l'Europe afin de promouvoir les droits de l'homme, la Démocratie et l'Etat de droit dans toute l'Europe. Ils ont adopté la Convention Européenne des Droits de l'Homme, mettant en place un système unique à l'époque, avec un mécanisme de contrôle contraignant. C'est ainsi que la cour a été créée en 1959 exprimant la volonté des Etats de ne plus jamais vivre les atrocités commises au milieu du XXème siècle. A l'origine, ils étaient douze Etats à s'engager, ils sont aujourd'hui près de cinquante. La cour siège à Strasbourg. Elle est composée d'un juge par Etat membre du Conseil de l'Europe. Les juges sont élus par l'assemblée parlementaire du conseil de l'Europe. Ils sont totalement indépendants et ne représentent aucun intérêt national. Pour le traitement des affaires, ils sont assistés d'un greffe composé d'un personnel qualifié provenant de tous les Etats membres. La cour reçoit chaque jour des centaines de lettres et appels téléphoniques. Lorsqu'elles arrivent à la cour les requêtes sont triées puis envoyées à l'une des unités du greffe qui prépare les dossiers pour les juges. Toutes les décisions sont prises par les juges, ils siègent en formation de juge unique, en comité de trois juges, en chambre de 7, ou en grande chambre de 17 pour les affaires les plus importantes. La procédure est écrite. Dans des cas exceptionnels la cour tient des audiences publiques toutes filmées et retransmises sur internet. La cour reçoit chaque année un nombre considérable de requêtes. La grande majorité d'entre elles sont rejetées au stade de la recevabilité, les conditions pour saisir la cour n'étant pas remplies. C'est le cas par exemple lorsque l'affaire n'a pas été portée devant les juridictions nationales.

Each year, thousands of people who consider that their fundamental rights have been breached turn to the European Court of Human Rights. What is this Court, which for over half a century has allowed individuals to have states held to account and whose decisions may ultimately affect our everyday lives? It was in 1949 in the aftermath of the Second World War that a number of countries joined forces to set up the Council of Europe in order to promote human rights, democracy, and the rule of law across Europe. They adopted the European Convention on Human Rights, setting up a system that was unique at that time including a binding supervisory mechanism. That was how the court came into being in 1959, reflecting the Member States desire never again to experience the atrocities committed in the mid-twentieth century. Twelve states signed up initially and now there are almost 50. The court is based in Strasbourg in the Human Rights building. It is composed one judge for each member state of the Council of Europe. The judges who are elected by the Parliamentary Assembly of the Council of Europe are fully independent and do not represent any national interests. In dealing with cases the judges are assisted by the registry, which employs qualified staff from all the Member States. The court receives hundreds of letters and phone calls every day. When applications arrive at the court they are sorted and then dispatched to one of the units of the registry, which prepare the files for the judges. All the decisions are taken by the judges sitting as a single judiciary formation consisting of a three-judge committee, a seven judges' chamber, or a grand chamber of 17 judges for the most important cases. The procedure is conducted in writing but in a very few cases the court also holds public hearings all of which are filmed and can be viewed via webcast. The court receives a huge number of applications every year. However, the vast majority of them are rejected at the admissibility stage because the criteria for applying to the court have not been met, for example because the applicants have not first raised their case before the national courts.

APPENDIX B:

Language post-test with correct answer

POST-TEST (1) Ecoutez les mots et expressions allemands suivants. Quel est leur équivalent en français? *(Listen to the following German words and phrases. What is the equivalent in French?) 1 point if correct.*

1.	Sich an den Gerichtshof wenden: **s'adresser à la cour**
2.	In seinen Grundrechten verletzt werden: **être lésé dans ses droits fondamentaux**
3.	Staaten zur Verantwortung ziehen: **mettre les Etats face à leurs responsabilités**
4.	Sich auf unser tägliches leben auswirken: **avoir un impact sur notre vie**
5.	Gründen: **fonder**
6.	Die Grundrechte: **les droits de l'homme**
7.	Die Rechtsstaatlichkeit: **Etat de droit**
8.	Die europäische Menschenrechtskonvention verabschieden: **adopter/voter la Convention Européenne des droits de l'Homme**
9.	Ein System errichten: **ériger un système**
10.	Rechtsverbindlich: **juridiquement contraignant**
11.	Gräueltaten verüben: **commettre des atrocités**
12.	Verhindern : **empêcher**
13.	Unabhängig: **indépendant**

Continued

14. Der Gerichtshof setzt sich aus je einem Richter pro Mitgliedsstaat zusammen: **la cour se compose d'un juge par Etat membre**
15. Die parlamentarische Versammlung: **l'assemblée parlementaire**
16. Interessen vertreten: **représenter des intérêts**
17. Eine Kanzlei unterstützt die Richter : **un greffe soutient les juges**
18. Die Beschwerde: **le recours**
19. Eine Entscheidung treffen: **prendre une décision**
20. Der Einzelrichter: **le juge unique**
21. Der Ausschuss: **le comité**
22. Der Kammer: **la chambre**
23. Das Verfahren verläuft schriftlich: **la procédure se déroule à l'écrit**
24. Öffentliche Anhörungen abhalten: **tenir des audiences publiques**
25. Eine Beschwerde als unzulässig zurückweisen: **rejeter une plainte pour irrecevabilité**
26. Die Voraussetzungen einhalten: **ne pas remplir les critères**
27. Den Gerichtshof anrufen: **en appeler à la cour**
28. Der Beschwerdeführer: **le requérant**
29. Der Fall: **le cas**
30. Den nationalen Rechtsweg vollständig ausschöpfen: **épuiser les recours devant les juridictions nationales**

APPENDIX C:

Content post-test with correct answer

(2) Répondez en français aux questions suivantes : (Answer the following questions in French). 1 point if correct.

1. Quelle institution est présentée dans le texte? **La Cour Européenne des Droits de l'Homme**
2. A quoi sert-elle de manière générale? **À mettre les Etats face à leurs responsabilités / condamner les Etats qui ne respectent pas les droits de l'homme**
3. Quelle autre institution a été créée en 1949? **Le Conseil de l'Europe**
4. Dans quel but? **Promouvoir les droits de l'homme la démocratie et l'Etat de droit**
5. Quel texte les Etats ont-ils signés? **La Convention Européenne des Droits de l'Homme**
6. Ils ont alors mis en place un mécanisme de contrôle **contraignant** de conventionnalité.
7. En quelle année l'institution sur laquelle porte le document a-t-elle été créée? **1959**
8. Quelle était la volonté des Etats? **Ne plus vivre les atrocités commises au XXe siècle**
9. Combien d'états se sont engagés à l'origine? **12**. Combien sont-ils aujourd'hui? **50**
10. De combien de juges est-elle composée? **Un juge par État membre du conseil de l'Europe**
11. Comment le deviennent-ils? **Ils sont élus par l'Assemblée Parlementaire du Conseil de l'Europe**
12. Ils sont assistés par un **greffe**

13. Comment siègent-ils? **En formation de juge unique**, **en comité de trois juges, en chambre de 7, ou en grande chambre de 17**

14. A quelle stade les requêtes sont-elles rejetées? **Au stade de la recevabilité**

15. Pour quelle raison, par exemple? **Les conditions ne sont pas remplies (ex : Les recours nationaux n'ont pas été épuisés)**