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Can clicker use support learning in a dual-focused second language German course?

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Abstract

This study investigated clicker-use impact in a legal German lecture, given to 65 French students of Law in which the learning focus was both language and content. 36 participants who attended the entire course were tested. Upon their introductory session, students took a preliminary two-fold multiple-choice questionnaire involving 16 questions on legal terminology and 16 on course content. Throughout the 10-week semester, the lecturer administered all questions during regular courses. Each weekly session was conducted alternately with or without clickers. Students answered half of the questions about language and content using clickers, whereas the remaining half involved standard conditions with volunteers raising their hands to answer. At the end of their term, students took the same initial questionnaire as a post-test. A quantitative analysis was performed to assess (a) the enhancement of the acquisition of legal terminology and course content through clicker use and (b) the impact of learners' pre-test scores on learning gains regarding terminology and content with or without clickers. The clicker group outperformed the non-clicker group with regard to a post-test concerning legal terminology. The findings demonstrate that clicker use alleviates the cognitive load induced by learning both new terminology and content.

Introduction

An ever-increasing number of studies on clicker use demonstrates the impact of individual voting system technology within a wide range of learning contexts (Blasco-Arcas, Buil, Hernandez-Ortega, & Sese, 2013; Chien, Chang, & Chang, 2016; Lantz & Stawiski, 2014). Clickers come in the shape of individual, small box-like devices handed out to students prior to the lecture course. Each device is electronically connected to the lecturer's computer system. Course material is delivered using a slide show involving interactive multiple-choice (MC) questions. Meanwhile, the lecturer receives immediate computer access to a graphic rendering of the students' answers, thus allowing for immediate feedback and discussion with the students based on their answers. Hence, the lecturer is able to provide them with additional key information whenever needed, so as to spare them from any possible course-content misappropriation. Substantial research into the effect of this device on learning has been carried out over the past decade in several fields, such as educational psychology (Brady, Seli, & Rosenthal, 2013), nursing (Patterson, Kilpatrick, & Woebkenberg, 2010), social sciences (Blasco-Arcas et al. 2013), and management (Rana, Dwivedi, & Al-Khowaiter, 2016). However, few papers dedicated to the use of electronic voting systems have concentrated on second language learning (Cutrim Schmid, 2008).

The present study focused on language and content learning in the context of a German second language lecture course attended by 65 first-year French Law students. Students enrolled in higher-level education programs are increasingly required to attend second language courses within their major field of studies

(Haswell & Lee, 2013), law being a case in point. The lecture, which was given by one of the authors of the present study, involved the following two goals: (a) to foster and improve the mastery of legal terminology and (b) to enhance comprehensive understanding of German legal institutions with regard to their specific historical and cultural settings. Given the number of students attending the course, and considering its dual-focus pedagogical approach, we chose to integrate technology into our instructional design. Our goal was thus to determine whether the use of clickers could enhance the learning of both language and content. Consequently, the course was designed as a series of 30-minute oral lectures on legal matters (fundamental rights, basic law, constitutional court decisions). To facilitate understanding of both language and content, students took a legal terminology MC test prior to each lecture in order to alleviate cognitive load due to their lack of knowledge regarding the specific legal terminology that was to be used in the subsequent presentation. At the end of the lecturer's presentation, the students took an additional MC test to evaluate and promote their understanding of the legal content of the presentation and to promote top-down listening comprehension processes. Every other session, students answered questions through clicker use. Consequently, over the 10-week semester, five sessions were conducted with clickers and five sessions without, alternating. To measure learning gains concerning both language and content, both with and without clickers, all the participants took the same MC test involving 32 questions about legal terminology and content at the beginning (pre-test) and at the end (post-test) of the 10-week semester.

Prior to presenting protocol and results, we wish to review the literature concerning second language learning with technology and the use of clickers and to delineate the theoretical foundations on which we base the following research hypotheses: (a) The use of clickers is likely to improve learners' upgraded understanding and memorization of both specific terminology and cultural content. (b) The efficiency of clickers depends on the learners' initial levels and on the nature of the questions raised, be they content- or terminology-related. Since such key pedagogical issues have seldom been considered in relation to implemented clicker use, we contend that a German second language lecture course provides an appropriate experimental field to further probe such research issues. Indeed, the fact that teachers have to design MC questions, which are at the same time adapted to their learning objectives and tailored to audience electronic response systems, is seen as one of the most difficult challenges teachers face whenever they choose to use this device (Kay & LeSage, 2009).

Literature Review

Supporting Language Learning With Technology

Supporting language and learning with technology remains congruent with numerous publications to date (Chun, 2016). Within the scope of our French higher-level educational environment, languages are consistently included as an integral part of students' curricula, even though they may follow different tracks such as sciences or law, for instance. However, the relevance of implementing language major lecture courses addressed to a sizeable number of students (about 50 for German and sometimes over 100 for English as a second language) remains a subject of debate (Brudermann & Poteaux, 2015), insofar as it is hardly prone to fostering interactive practice per se—a key feature in terms of efficient language learning. Moreover, the number of students tends to prove somewhat inhibiting in terms of individual practice allowing for active production of answers—known as *the generation effect*. It is indeed noteworthy that generating an answer fosters active memory enhancement, rather than simply choosing one of a given set of options (Lutz, Briggs, & Cain, 2003).

We fully endorse the need for adjustments to lecture courses relying on integrated clicker use and for evaluation of their induced learning benefits. In one of her latest publications, Chun (2016) underscores the crucial issue that needs to be addressed: "under what conditions and for whom" (p. 98) is technology-based instruction effective? In keeping with recent papers, we claim that technology-based adjustments to German lecture courses are both relevant and highly valuable insofar as appropriate technological tools are selected "to achieve sound pedagogical processes and outcomes" (Felix, 2003, p. 9). We therefore implemented a clicker-use practice, since earlier generations of students failed to grasp the intricacies of the German legal

system offered to them in German for two reasons: (a) the German system was new to the students as well as complex in its workings, and (b) the learners lacked mastery of its distinctive legal idioms.

Clicker Use Applied to Standard Lecture Courses and Language Lectures

Numerous schools of arts and sciences have implemented clicker use to promote student–lecturer interactive learning processes. With reference to the latest statistical findings, Chien et al. (2016) underscore that "tens of thousands of courses worldwide are now being conducted with the addition of clickers" (p. 2). In a literature review on classroom response systems, Fies and Marshall (2006) observe that the exploration of this technology deserves to be more rigorous and that audience response systems "promote learning when coupled with appropriate pedagogical methodology" (p. 106). Since their literature review, several well-designed studies have substantiated the effectiveness of such an audience response system (e.g., Blasco-Arcas et al., 2013; Lantz & Stawiski, 2014; Morling, McAuliffe, Cohen, & D'Lorenzo, 2008; Patterson et al., 2010). However, in their meta-analysis, Chien et al. (2016) also call for extended empirical studies measuring students' learning gains, reaching beyond the scope of self-reported measures.

Lamine and Petit (2014) analyzed the impact of electronic voting devices in lecture courses conducted in Physics. They probed teaching-learning concept acquisition as well as students' cognitive involvement. Moreover, they ran a cross-analysis of learners' performances among different pools of students while the same course was being taught with and without clickers. They measured the normalized learning gains of students' performances between the pre-test and the post-test. In the present study, we adopted the same method to measure learning gains. Lamine and Petit observed that "teacher–learner as well as peer-to-peer interactions enhance effective in-depth material acquisition" (p. 144, translated). Such results are congruent with the constructivist approach, whereby learners must actively learn new material and relate it to previously acquired knowledge (Lantz & Stawiski, 2014). Moreover, another study by Kay and LeSage (2009) substantiated earlier conclusions about the effectiveness of clickers. The authors reported incremental benefits drawn from extensive clicker use, namely high course attendance rates, improved concentration, greater course involvement, peer interaction, a collaborative approach to knowledge expansion, optimized exam performances, and acquisition enhancement. Overall, clicker use has been shown to improve student cognition. Some researchers have even hypothesized that meta-cognition (i.e., learning task self-regulation processes during the lecture course) can also be influenced by the use of this technology (Mayer et al., 2009).

Researchers in psychology have demonstrated additional benefits of testing students frequently (Roediger, Putnam, & Smith, 2011). Among other advantages, students who take regular tests are likely to display easier memory-retrieval processes, a feature that leads to better performance on later tests:

> Quizzes also enable students to discover gaps in their knowledge and focus study efforts on difficult material; furthermore, when students study after taking a test, they learn more from the study episode than if they had not taken the test. (Roediger et al., 2011, p. 2)

As underscored above, few studies concerning clicker use have been carried out in the field of second language learning. Cutrim Schmid's (2008) paper is particularly interesting in the context of the present research, even though it focuses on learning English as a foreign language rather than German. She used a variety of questions "to support a wide range of classroom activities … to find out what students already know about the theme … or foster their curiosity about a certain topic" (p. 344). In her case, clickers were also used to launch discussions and stimulate debate or to evaluate students' level of understanding before implementing pedagogical decisions. In keeping with investigations conducted in other fields, she concluded that the voting system was "an important pedagogical tool which allowed the students to check their performance and their standing amongst peers" (p. 132). She further stressed the need for extended research to assess the pedagogical value of clickers in language courses. Insofar as we chose to probe clicker-use-dependent question-design requirements, our aim was therefore to show that both content and language could be taught efficiently by using clickers.

Theoretical Framework

Simultaneous Second Language and Content Learning

Legal German lectures for native students of French Law aim to provide learners with specific cultural knowledge about the German legal institutions and system while simultaneously fostering specific legal language competencies. Learners are expected to grasp the main features of the German political and legal establishment, acquire a thorough appreciation of major cross-cultural differences (i.e., German vs. French), master legal terminology, and exhibit aural and oral comprehension skills while developing extended cultural knowledge. With the consent of Law School language faculty, we left out advanced-level language practical workshops as they provide scope for further improvement in the second- and third-year programs based on the teaching of other language competencies such as oral and writing skills. As previously stated, the participants to the present study were first-year students.

Furthermore, content and language integrated learning (CLIL) is to be differentiated from language for specific purposes (LSP). In theory, the distinction seems straightforward enough: CLIL is defined as a dual-focused educational approach whereby additional language is dedicated to learning and teaching both content and language (Mehisto, Marsh, & Frigols, 2008). In contrast, LSP lays greater emphasis on language per se, as it focuses on students' linguistic needs. Yet, with respect to earlier findings, we believe that, under educational conditions such as ours, "this distinction is considerably obscured by the fact that learners, who are relatively proficient in the target language, are also pre-service and lacking in subject knowledge" (Poręcka, 2011, p. 1). Moreover, we contend that students "have a strong and fully understandable expectation for a highly contextualized and cognitively demanding language instruction, which would contain a considerable subject content component related to … legal systems" (Poręcka, 2011, p. 1).

Consequently, content-based language instruction exceeds merely stockpiling specific language and content learning. Indeed, both components are interwoven and inseparable insofar as "an additional or foreign language, for both the teachers and the learners, is used as the medium for instruction" (Pérez-Vidal & Roquet, 2015, p. 81). However, for pedagogical and experimental reasons we adopted a shortcut, namely the distinction between *legal terminology* and *cultural content* learning, respectively, in order to design test protocols accordingly: questions concerning legal terminology (10 minutes) presented to the students prior to the teacher's short (30 minutes) course content delivery, and questions on course content right after the lecture (10 minutes). Moreover, such a practical split-protocol further complied with the following observation by Haswell and Lee (2013):

> The difficulties second-language learners have in lecture situations stem from the fact that they are not simply burdened with content, they are also dealing with several tasks that require linguistic and cognitive skills to interpret lecture contents, and choose what to record and what to ignore—all of this done throughout a real-time monologue (Thompson, 2003). (p. 17)

A Cognitive Challenge

In keeping with cognitive load theory (Paas & Sweller, 2014; Sweller, Ayres, & Kalyuga, 2011), we argue that simultaneously learning two sets of "secondary knowledge" (Kyun, Kalyuga, & Sweller, 2013, p. 387) areas (i.e., foreign language and domain-specific content knowledge) is prone to overloading working memory (Geary, 2008; Roussel, Joulia, Tricot, & Sweller, 2017). We wish to highlight the relevance of a clicker-based teaching practice to promote both language and content acquisition. Cognitive load may hence be alleviated by eliminating extraneous load through pedagogical engineering while preserving intrinsic load (i.e., learning goals). We therefore contend that technology—and notably clicker use—is likely to alleviate the overall cognitive load induced by simultaneous processing of both language and content acquisition.

To solve the pedagogical issue of learning new specific legal terms with optimal efficiency, we refer to Mayer's (2014) multimedia principle. Mayer claims that people succeed in achieving in-depth knowledge

acquisition from the oral and visual forms combined, rather than from either the visual or oral form alone. We therefore infer that graphically displaying the breakdown of students' answers helps them to retain the correct meaning of a given legal term, while enabling them to appreciate both its oral and written features and to visually memorize the correct answer. One of the principles of Mayer's theory is *the redundancy principle*. If students have enough time to process a visual presentation and if a related oral form of the answer is difficult for the learner to understand (as with foreign language learning), the visual text should help learners construct the meaning of legal terms. We thus argue that the use of clickers can promote student–teacher interactivity (see Blasco-Arcas et al., 2013) while backing up the multimodal presentation of course items. Provided there is no evidence of any redundancy in terms of information displayed through several means (Kalyuga & Sweller, 2014) and as long as the technology (i.e., the clicker device) is easy to use and does not overload working memory, there is a potential learning gain. However, when computer-based devices require intricate strategic decision-making of the learners, they are likely to overload the cognitive resources used for learning (Roussel, 2011). We wish to highlight such potential problems within the scope of our teaching–learning double track research: the use of voting devices is primarily aimed at easing the dual tasks of simultaneous legal terminology and German course content acquisition. Hence, we suppose that clicker use will enhance learning gain among students.

Inasmuch as our pool of law students was expected to process an oral German lecture on distinctive German legal matters, the issue of the cognitive load was brought up, due to the fact that low-level listening processes do not occur automatically enough. As previously evidenced (Vandergrift & Goh, 2012), the development of second language listening comprehension skills involves both bottom-up processes (i.e., direct manipulation of language, such as segmentation or mental translation) and top-down processes (i.e., activation of prior knowledge and integration of new information in long-term memory) to build meaning. In order to achieve successful understanding of a talk delivered in a second language as a prerequisite for learning, bottom-up processes have to occur automatically because of the limited capacity of working memory (Baddeley, 2002). If bottom-up processes require considerable attention to process small units of meaning, the activation of top-down processes is likely to be impaired. This may, in turn, considerably alter the construction of meaning. In other words, our claim implies that second language listeners who do not process the lecturer's talk swiftly enough are unable to process meaningful information units in working memory; nor can they adequately activate efficient top-down processes. Hence, we formulated the first hypothesis that clicker use will lead to higher learning gain than no clicker use (H1). We also wanted to investigate if clicker use would lead to higher learning gains with reference to legal terminology acquisition (H1.1) and to effective course content appropriation through the process of constructing global meaning (H1.2).

According to Sweller and Chandler (1994), "a heavy cognitive load is imposed when dealing with material that has a high level of element interactivity" (p. 185). In other words, it is easier to learn separate information items (e.g., specific legal terms) than to learn a substantial amount of interrelated elements (i.e., content of the course). Chen, Kalyuga, and Sweller (2015) also suggest that the active production of answers (i.e., the generation effect) is applicable for low-element interactivity materials, whereas the worked example effect occurs for complex, high-element interactivity materials that impose a heavy working memory load. Hence, we hypothesize that the impact of clickers will be affected by the nature of the question focus areas (i.e., language- or content-related). We contend, therefore, that focus areas (i.e., terminology or content) will moderate clicker-use impact (H2). Since learning individual language items is likely less demanding than learning highly interactive content material, we further speculate about the added benefits to be drawn from clicker use for legal terminology questions (H2.1) as opposed to content (H2.2).

Differences in listening strategies between higher-skilled and lower-skilled learners have also been widely investigated (Chamot & Küpper, 1989; Field, 2001; Vandergrift, 2003). Studies have shown that less-skilled students resort to cognitive strategies that rely more on top-down processes than their counterparts, who tend to use listening meta-cognitive strategies. Skilled learners "focused on important upcoming content (selective attention) while continuing to use relevant information (elaboration) to help them understand, confirming and, if necessary, revising their predictions (monitoring) as they went along"

(Vandergrift, 2003, p. 466). Therefore, we argue that students' pre-test results will account for level discrepancies, a point we chose to address under the following hypotheses: Students' initial level (preliminary test score) will exert a distinctive impact over learning processes, either with or without clickers (H3), and likewise, over learning terminology and content, either with or without clickers (H3.1).

The Study

Research Hypotheses

We chose to differentiate two distinctive question-focus areas: (a) MC questions dedicated to legal terminology whereby students were presented with four alternative legal definitions to choose from (see Table 1) and (b) MC questions focusing on course content (see Table 2). The items related to legal terminology were disclosed prior to the teacher's presentations to allow for easier processing of the course material. The items related to legal content were presented after the lecture to assess and encourage proper understanding. The course involved ten 2-hour long sessions (each lesson lasted 50 minutes). Every other session, students used voting clickers, whereas in all other sessions questions were presented as an integral part of the lecturer's slideshow; students were then free to volunteer answers orally.

Since our aim was to improve students' knowledge of legal terminology and course material acquisition, our hypotheses were as follows:

> H1: Clicker use will lead to higher learning gain than no clicker use.
>
> H1.1: Clicker use will lead to higher learning gain on questions relating to legal terminology than no clicker use.
>
> H1.2: Clicker use will lead to higher learning gain on content-related questions than no clicker use.
>
> H2: Question focus area (i.e., terminology vs. content) will moderate clicker-use impact.
>
> H2.1: Clicker use will lead to better gain of legal terminology than of content.
>
> H2.2: Terminology and content learning gain will level off without clicker use.
>
> H3: Students' initial level of knowledge (preliminary test score) will exert a distinctive impact over learning processes, whether with or without clickers.
>
> H3.1: Students' initial level (preliminary test score) will exert a distinctive impact over terminology and content acquisition, whether with or without clickers.

Context

Among 65 Law School students and German language learners (Levels B1–C1 according to the Common European framework of reference for languages; Council of Europe, 2001) who had signed up for the lecture course, 36 attended the entire course over a full semester. During the first lecture, they were required to take a preliminary MC questionnaire including all 16 questions on specific legal semantics (Table 1) and 16 questions on the cultural course content (Table 2) to be covered subsequently (i.e., during the 10 weeks of lecture; see Appendix A).

Students further took a questionnaire akin to standard technology acceptance model (TAM; Davis, 1989) intended to appraise pedagogical relevance as well as electronic clicker ease of use. Its goal was mainly to assess whether clicker use would generate any cognitive cost for the learners.

Table 1. *Example of a Legal Terminology-Related Question*

Question in German	Translation in English
Die Sukzessivadoption ist:	Successive adoption is:
a) die Adoption eines Kindes, das der andere Partner bereits adoptiert hat	a) the adoption of a child who has already been taken on by the other partner
b) die Adoption mehrerer Kinder	b) the adoption of several children
c) die Adoption des leiblichen Kindes des Partners	c) the adoption of the partner's biological child
d) die Adoption eines Kindes im Ausland	d) The adoption of a child in another land

Table 2. *Example of a Content-related Question*

Question in German	Translation in English
Welche Gerichtsbarkeit ist in Deutschland für Konflikte über Elterngeld zuständig?	Which jurisdiction is responsible for conflicts over parental allowance in Germany?
a) Die Arbeitsgerichtsbarkeit	a) The labor jurisdiction
b) Die Sozialgerichtsbarkeit	b) The social jurisdiction
c) Die ordentliche Gerichtsbarkeit	c) The ordinary jurisdiction
d) Die Verwaltungsgerichtsbarkeit	d) The administrative jurisdiction

As stated above, all of the questions were addressed by the lecturer throughout the entire semester. Every other session, students used voting clickers, whereas in all remaining sessions they were given the opportunity to answer orally in keeping with standard lecture course conditions. Questions were designed to both ease and check learners' language as well as their structural grasp of the legal establishment and relevant proceedings covered throughout the lecture course. The final exam consisted of a post-test in which students were required to answer the same questions about legal terminology and content raised in the pre-test taken 5 months earlier: the post-test was exactly the same MC test as the pre-test. This was done to preclude any *novelty effect* bias (see Chien et al., 2016).

Methods

Following Hake (1998) and Lamine and Petit (2014), we measured knowledge acquisition by assessing normalized gain (g) as follows: $g = (\%Post - \%Pre) \div (100 - \%Pre)$ where $\%Pre$ and $\%Post$ represent the percentage of correct answers displayed in the pre- and post-tests, respectively. The numerator represents the gross gain figure whereas the denominator precludes any bias induced by initial level differences. Hence, the normalized gain measures "the course material acquisition portion relative to pre-course lack of knowledge" (Lamine & Petit, 2014, p. 134).

As stated above, the same students participated in both experimental modalities, providing us with paired samples and allowing a mean comparison. Each question from the post-test was addressed to all students one week with and one week without clickers, alternately. Such a protocol enabled us to avoid any item exposure bias. Chien et al. (2016), referring to Anthis (2011), emphasize that "the positive results of clicker-integrated instruction may be merely caused by unequal exposure to test items between experimental (i.e., clicker-integrated instruction) and control (i.e., conventional lectures) groups" (Chien et al., 2016, p. 4).

Results

Preliminary Tests

Prior to exploring our hypotheses, we wished to ensure the reliability of our test and also ensure that the findings were not affected by the experimental conditions. Internal reliability was computed with a Split-

Half Spearman-Brown procedure. Results ($r = .66$; $p < .000$) showed the good reliability of our MC test. A means statistical test (paired samples *t*-test) conducted on pre-test scores of the questions to be addressed with clickers (W)[1] and without clicker (N) did not show any significant difference between scores in experimental cells ($M_W = 8.31$, $SD_W = 2.82$; $M_N = 8.92$, $SD_N = 2.93$; difference: 0.61; $t = 1.56$; $p > .05$). We further investigate whether clicker ease-of-use had an effect on learning gain efficiency. Using clickers could indeed generate some additional cognitive load induced by the mere handling of such an electronic device and hence affect acquisition processing. The TAM model (see Appendix B) could therefore be used in such a setting. Using this model, criteria such as usefulness and ease-of-use perceptions were applied in a French-speaking setting involving the implementation of computer resources within university-level curricula (Galan, Giraud, & Meyer-Waarden, 2013). Such criteria had been successfully tested previously in order to assess their reliability in a context like ours: results yielded heretofore substantiate their relevance.[2] A multiple regression analysis demonstrated that the sense of *perceived ease-of-use* and *usefulness* exerted no impact over learning gain among clicker-based answers. It is indeed noteworthy that with only 3.80% explained variance, there appeared to be correlation neither between ease-of-use and acquisition gain ($p > .05$), nor between perceived clicker usefulness and acquisition gain ($p > .05$). The findings demonstrated that even though a given learner may be responsive to clicker usefulness or ease-of-use, he or she learned neither more nor less than a student who would be adverse to it. Learners were requested to evaluate clicker ease-of-use: scores exhibited high-ranking results (i.e., 4.81 out of 5.00). Thus, one may legitimately infer that conditions for clicker use induced no additional cognitive cost.

Validation of Hypotheses Probing

H1. Clicker Use Will Lead to Higher Learning Gain Than No Clicker Use

The test scores were analyzed using a series of means comparison analyses of learning gains yielded with clicker use versus without, considering the distinctive question fields (legal terminology-related and content-related). Findings are presented in Table 3. Analyses reveal a narrower distribution of the data relative to means of the gain (*g*) achieved in the context of clicker use throughout the entire set of questions raised, whether legal terminology- or content-oriented. Answers provided through clicker use appear less prone to individual variations.

Table 3. *Acquisition Gain With Clickers Versus Without Clickers*

	W		**N**		**Difference**		
	M	*SD*	*M*	*SD*	*t*	*df*	*p*
Questions (entire set)	46.70%	0.36	18.84%	0.46	3.64	35	.001***
Legal terminology-related questions	59.35%	0.53	15.60%	0.86	3.12	35	.004**
Content-related questions	37.81%	0.38	13.48%	0.72	1.76	35	.086

**p < 0.01, ***p < 0.001

As regards the entire set of questions, figures for clicker-based gain far exceeded results obtained without clicker use (H1): W = 46.70%, N = 18.84%, resulting in a $p < .001$ significant difference. These results confirmed our hypothesis about acquisition gain due to clicker use. Likewise, congruent evidence was found regarding legal terminology acquisition (H1.1): W = 59.35% gain, N = 15.60% gain. This resulted in a $p < .01$ significant difference. However, with reference to content-oriented questions, results revealed higher gains with clicker use (H1.2): W = 37.81% gain, N = 13.48%. Still, there was no significant difference ($p > .05$). Thus, our results supported hypotheses H1 and H1.1; hypothesis H1.2 was rejected.

Even though the data provided clear-cut evidence of overall clicker-use efficiency, optimal gains were obtained with legal terminology acquisition, whereas content learning gain was not as great. Whether the discrepancy in legal terminology and content gain was significant is addressed in our next section.

H2. Question Focus Area Will Moderate Clicker-Use Impact

Since our investigation used paired samples, we compared mean gains. Under clicker-use conditions (H2.1), terminology acquisition gain (59.35%) exceeded content gain (37.81%), resulting in a $p < .05$ significant difference. Whenever clickers were not used (H2.2), legal terminology acquisition gain (15.60%) and content gain (13.48%) were not significantly different ($p > .05$). Hence, hypothesis H2 was confirmed. Our findings also showed that question focus area moderated clicker-use impact. Indeed, the gains in terminology were superior to the gains in content when clickers were used and these same gains were comparable when the clickers are not used.

H3. Initial Level of Knowledge Will Exert a Distinctive Impact Over Learning Processes

Our remaining hypotheses focus on the importance of students' initial level of knowledge as reflected in their pre-test scores. Our aim was to assess whether clicker use promoted incremented content learning gain over legal terminology acquisition when the initial level of knowledge rested within the lower-range segment. We established two separate groups on the basis of pre-test score means: Group 1 (G1) pre-test mean results revealed 13.31 correct answers out of 32 MC questions, whereas Group 2 (G2) produced 21.58 correct answers out 32 questions. We duplicated our cross-analyses conducted in the context of hypotheses H1 and H2, within each group. Data are presented in Table 4.

Table 4. *Learning Gain Cross-Analyses With and Without Clickers per Level*

		W		N		Difference		
		M	**SD**	**M**	**SD**	**t**	**df**	**p**
Questions (entire set)	G1	50.09%	0.26	29.81%	0.30	3.65	18	.002**
	G2	42.92%	0.46	6.58%	0.58	2.43	16	.027*
Legal terminology-related questions	G1	60.35%	0.39	33.51%	0.41	2.64	18	.017*
	G2	58.24%	0.66	4.41%	1.10	2.30	16	.035*
Content-related questions	G1	41.99%	0.30	23.71%	0.38	2.10	18	.049*
	G2	33.14%	0.46	2.06%	0.97	1.11	16	.281

*$p < 0.05$, **$p < 0.01$

Findings revealed a significant discrepancy between legal terminology acquisition results per level of knowledge and content learning. In the case of legal terminology acquisition, performances with clickers revealed an incremented gain over those without clickers across the entire pool of students within each level. As regards content acquisition, however, there was a distinct gap between G1 and G2 performances. G1 subjects had enhanced post-test performances with clicker use compared to those without, whereas clickers had no impact on G2 results. Thus, our hypothesis H3 was not totally supported by our data. Table 5 addresses the specific issue of content and legal terminology discrepancy (H3.1).

There was no evidence whatsoever of any acquisition gap between legal terminology and content learning based on students' initial levels of knowledge. Both G1 and G2 members displayed similar across-the-board performances.

Table 5. *Cross-Analyses of Legal Terminology and Content Acquisition Gains per Level*

		Legal Terminology		Content		Difference		
		M	**SD**	**M**	**SD**	**t**	**df**	**p**
With Clickers	G1	60.35%	0.39	41.99%	0.30	1.81	18	.086
	G2	58.24%	0.66	33.14%	0.46	1.46	16	.163
Without Clickers	G1	33.51%	0.41	23.71%	0.38	0.85	18	.404
	G2	4.41%	1.17	2.06%	0.97	0.18	16	.854

Discussion

Although the research was carefully prepared, this study had some unavoidable limitations and shortcomings. First, because German was studied by a minority of French students and because our 65 law students did not all attend every session, the research could be conducted on only 36 participants. For further research, we suggest using the same design and protocol with more participants. Second, the fact that clickers were used alternatively throughout the semester implied that the course material, and consequently the questions, were concerned with different legal matters. However, we tested the effect of the focus areas of the questions (related to language or to the content) independently from the topic and found that the calculation of normalized learning gains was likely to compensate for this limitation. Third, we were fully aware of the fact that, concerning MC questions, it was, of course, easier to recognize an answer among four items than it was to generate one. However, this problem was inherent to the clicker-technology; the aim of questions addressed to the students was to help them, not to confront them with additional difficulties.

Despite these limitations, our research provides first-hand evidence that clicker use promotes the acquisition of legal terminology in German as a second language. Indeed, using voting systems significantly improved learners' scores obtained on legal terminology questions, as shown by the comparison of pre- and post-test means. As regards course content acquisition, however, the findings are not significant, probably because the sample was too small. With regard to the impact of learners' initial level of knowledge on performances recorded with or without clickers, less-skilled students exhibited higher scores on the content section of the MC post-test whenever they relied on clickers throughout the course. Conversely, clicker use had no impact on higher-skilled individuals for content learning. This finding provided further legitimate grounds for implementing electronic voting devices across-the-board, even though better students could do without while learning content.

We therefore contend that the acquisition of legal terminology is less cognitively demanding than content learning. As underscored by Sweller and Chandler (1994), "the cognitive load associated with learning some vocabulary is low because the elements of the material to be learned do not interact with each other" (p. 188). In other words, every single legal term may be learned separately and isolated from the rest. Hence, clickers help alleviate the cognitive load induced by words unknown to all the students.

Regarding the learning of course content, the broad spectrum of information to be absorbed (i.e., terminology plus distinctive features of the German legal establishment) set a substantial working-memory challenge since all items were interwoven. Course content appropriation requires acquiring knowledge through the simultaneous processing of a sizeable amount of information along with its intrinsic interconnectedness. The content of the lecture can be considered as a material that involves a high level of interactivity between the elements that compose it. Clicker use thus offers valuable help to less-skilled students with respect to both terminology acquisition and adequate processing of complex, interconnected information pertaining to course content. Clickers offer less-skilled students easier understanding of course material during the semester while also securing improved exam content retention (post-test). Clearly, clickers do indeed alleviate the cognitive load induced by unknown terminology, which otherwise might

prove a real hindrance toward efficient course content appropriation. Higher-skilled learners seem to benefit from legal terminology questions but also seem to be able to process high-element interactive content without the help of content-related questions.

In summary, clicker use enhanced learning, as well as long-term retention of low interactive material (e.g., isolated legal terminology) in this group of students. The results indicate that clicker use reduced the cognitive load of the lower-ability group in the process of effective course content acquisition. We endeavored to scrutinize a posteriori, and without nurturing prior assumptions, any existing correlation between final terminology and content scores. Analyses revealed a significant correlation as follows: (r = .614) or 37.7% common variance ($p <$ .001). Therefore, enhanced terminology scores matched enhanced course content understanding performances. In other words, whenever legal terminology test scores exhibited a 1-point increase, course content test scores displayed a 0.42-point increase. Moreover, there was no evidence of any discrepancy whatsoever between the two levels of learners. In addition, we found less data dispersion around gain means under the clicker-use condition (involving terminology and content learning) than the without condition. Since MC questions relying on clicker use were less prone to individual variations, they tended to even out the differences between higher-skilled students. Such an outcome provided additional support for our hypothesis because clicker use induced a noticeable attention gain in class. It may help bridge the performance gap between higher-skilled and less-skilled learners. Our findings are congruent with those of other authors (Mayer et al., 2009; Roediger et al., 2011) who found that testing and questioning provide motivational leverage, which in turn enhances students' attention and, consequently, optimizes their learning performance. Hence, implementing across-the-board clicker use helps to optimize interactive teacher–learner processes within our German language teaching setting, thereby precluding any possible course content misappropriation by the students.

Conclusion

The findings of the present study demonstrate the value of clicker technology in the setting of language courses designed for specific purposes and having a dual focus. The use of clickers enhanced our students' effective grasp and retention of specific terminology and fostered their assimilation of complex content. In a second language class for specific purposes, unknown terminology and high-element interactive course content is likely to overload learner's working memory. We consequently believe that an instructional design that includes clicker use can help alleviate cognitive load and allow learners to meet the cognitively demanding learning challenge involved in such courses. In keeping with Cutrim Schmid's (2008) recommendation, we endorse the claim that clicker-based foreign language teaching and learning deserve extended investigation with a view to "opening possibilities for a deeper evaluation of the impact of the technology on language teaching practices and language learning processes" (p. 355).

Acknowledgements

Notes

1. We used the following codes: with clicker (W) and no clicker used (N).

2. Perceived usefulness: Cronbach α = .894, explained variance = 70.95%; perceived ease-of-use: Cronbach α = .906; explained variance = 78.79%.

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Appendix A. MC Questions in German With Translation Into English

The questions written in blue were the questions addressed with clickers. The questions written in black were those addressed without clickers. *TERM* indicates terminology-related questions.

Question in German	Translation in English
Das Recht auf das Fernmeldegeheimnis (TERM) a) Das Recht Informationen auszutauschen, ohne ausspioniert zu werden b) Geheime Kommunikationen der Polizei c) Vertrauliche Kommunikationen d) Das Amtsgeheimnis	**The right to the secrecy of telecommunications (TERM)** a) The right to exchange information without being spied on b) Secret communications of the police c) Confidential communications d) Professional secrecy
Die Unverletzlichkeit der Wohnung (TERM) a) Die Sicherheit der Wohnung b) Das Verbot, in eine private Wohnung ohne Erlaubnis einzudringen c) Die Privatsphäre d) Das Recht auf Privatleben	**The inviolability of the home (TERM)** a) Security of the home b) Prohibition on entering a private home without permission c) Personal privacy d) The right to a private life
Die Verfassungsbeschwerde (TERM) a) Die Verfassung b) Die Revision der Verfassung c) Das Recht, sich an das höchste Verfassungsgericht zu wenden d) Die Verfassungsmäßigkeit eines Gesetzes	**The constitutional complaint (TERM)** a) The constitution b) A constitutional amendment c) The right to appeal to the highest constitutional court d) The constitutionality of a law

Das Recht auf informationelle Selbstbestimmung (TERM)

a) Das Recht jede persönliche Information online zu stellen
b) Das Recht Informationen online zu stellen
c) Das Recht selbst zu entscheiden welche persönlichen Informationen online gestellt warden
d) Das Recht persönliche Daten eines Drittens online zu stellen

The right to informational self-determination (TERM)

a) The right to put all personal information online
b) The right to put information online
c) The right to decide for oneself which personal information can be put online
d) The right to put a third party's personal data online

Was ist die Online-Durchsuchung?

a) Ein Gesetz, das die Grundrechte im Internet garantiert
b) Ein Gesetz, das es der Polizei erlaubt, in privaten Computern Informationen zu suchen
c) Eine polizeiliche Methode, die es erlaubt, alle Menschen auszuspionieren
d) Ein Urteil des Bundesverfassungsgericht, das die Privatsphäre garantiert

What are online searches?

a) A law that guarantees fundamental rights on the Internet
b) A law that allows the police to search for information on private computers
c) A police method that allows them to spy on all people
d) A Federal Constitutional Court ruling that guarantees personal privacy

Welches dieser Argumente spricht gegen die Online Durchsuchung?

a) Die Polizei braucht die Online-Durchsuchung zur Bekämpfung des internationalen Terrorismus und der organisierten Kriminalität
b) Sie stellt einen massiven Eingriff in die Privatsphäre dar
c) Die Online-Ermittler müssen die selben Möglichkeiten haben, wie die kriminellen Hacker
d) Die Mehrheit der Menschen (99,9 Prozent) werden von dieser Maßnahme überhaupt nicht betroffen sein

Which of these is an argument against the use of online searches?

a) The police need online searches to fight international terrorism and organized crime
b) They represent a serious invasion of personal privacy
c) Online investigators must have the same possibilities as criminal hackers
d) The majority of people (99.9%) will not be affected at all by this measure

Welches dieser Argumente spricht für die Online Durchsuchung?

a) Ein von Ermittlern geöffneter Privat-PC zeigt auch die persönlichen Daten
b) Die Behörden können Computer komplett fernsteuern
c) Online-Durchsuchung erlaubt das Verändern von Dateien auf dem Computer
d) Die Polizei muss ihre Methoden modernisieren

Which of these is an argument for the use of online searches?

a) A private PC opened by investigators also shows personal data
b) Authorities can have full remote control of computers
c) Online-searches allow the modification of files on a computer
d) The police must modernize their methods

Welches dieser Grundrechte verletzt die Online-Durchsuchung nicht?

a) Das Recht auf Unverletzlichkeit der Wohnung
b) Das Recht auf informationelle Selbstbestimmung
c) Das Fernmeldegeheimnis
d) Das Recht auf Meinungsfreiheit

Which of these fundamental rights is not violated by online searches?

a) The right to inviolability of the home
b) The right to informational self-determination
c) The right to secrecy of telecommunications
d) The right to freedom of expression

Der Verteidigungsminister (TERM) ist für die

a) Justiz zuständig
b) Armee zuständig
c) Umwelt zuständig
d) Bildung zuständig

The defense minister (TERM) responsible for

a) Justice
b) Military Affairs
c) Environment
d) Education

Ein gekapertes Flugzeug (TERM)

a) Ein entführtes Flugzeug
b) Ein abgeschossenes Flugzeug
c) Ein verlorenes Flugzeug
d) Ein verschwundenes Flugzeug

A captured airplane (TERM)

a) A hijacked airplane
b) A shot-down airplane
c) A lost airplane
d) A missing airplane

Ein Flugzeug abschießen (TERM)

a) Ein Flugzeug entführen
b) Auf ein Flugzeug mit einer Waffe schießen
c) Ein Flugzeug kontrollieren
d) Ein Flugzeug identifizieren

To shoot an airplane down (TERM)

a) To hijack an airplane
b) To fire at an airplane with a weapon
c) To control an airplane
d) To identify an airplane

Der übergesetzliche Notstand (TERM)

a) Ein Notfall, der nicht gesetzlich geregelt ist
b) Ein Notfall, der gesetzlich geregelt ist
c) Ein Notfall
d) Ein Notfall, um ein Gesetz zu verändern

A so-called emergency beyond law (TERM)

a) An emergency that is not ruled by law
b) An emergency that is ruled by law
c) An emergency
d) An emergency to modify a law

Terroristen wollen ein gekapertes Flugzeug voller Passagiere in ein AKW oder ein Stadion steuern. Darf der Staat den Jet abschießen lassen. Darf er Leben opfern, um Leben zu retten?

a) Ja, um das Leben der Personen im Stadion oder in der Umgebung des AKWs zu retten
b) Nein, der Staat darf die Personen im Flugzeug nicht töten, das verstößt gegen die Menschenwürde
c) Es ist eine zu schwierige Frage um einfach ja oder nein zu antworten
d) In Deutschland kann der Kanzler allein solche Entscheidungen treffen

Terrorists want to steer a captured aircraft full of passengers into a nuclear power station or a stadium. Can the State have the aircraft shot down? Can it sacrifice lives to save lives?

a) Yes, to save the lives of the people in the stadium or in the surrounding area of the nuclear power station
b) No, the government is not allowed to kill the people in the aircraft, as this violates human dignity
c) It is too difficult a question to simply answer yes or no
d) In Germany only the Chancellor can make such decisions

Welches Grundrecht der Passagiere ist in dieser Situation besonders in Gefahr?

a) Die Glaubensfreiheit
b) Die Menschenwürde
c) Die Religionsfreiheit
d) Die Meinungsfreiheit

Zwei dieser Argumente sprechen für einen sofortigen Abschuss des Flugzeuges? Welche?

a) Die Menschen am Boden (im Stadion, in der Nähe des AKWs) müssen gerettet werden
b) Der Staat darf die Terroristen nicht töten
c) Über unseren Tod darf der Verteidigungsminister (der Staat) nicht entscheiden können
d) Der übergesetzliche Notstand

Zwei dieser Argumente sprechen gegen einen sofortigen Abschuss des Flugzeuges?

a) Es gibt weniger Menschen im Flugzeug als am Boden (im Stadion)
b) Es gibt immer eine Chance, dass das Leben der Passagiere gerettet wird
c) Der Staat muss das Leben aller Bürger schützen
d) Der übergesetzliche Notstand

Das Elterngeld (TERM)

a) Das Geld, das die Kinder von den Eltern bekommen
b) Das Geld, das die Kinder von den Großeltern bekommen
c) Das Geld, das Eltern bekommen, wenn sie Kinder haben
d) Das Geld, das die Eltern nur dann bekommen, wenn sie mehrere Kinder haben

Die Vereinbarkeit von Beruf und Familie (TERM)

a) Die Möglichkeit zu Hause zu arbeiten
b) Die Schwierigkeit Karriere und Kinder zu haben
c) Die Unmöglichkeit Karriere und Kinder zu haben
d) Die Möglichkeit gleichzeitig Karriere und Kinder zu haben

Which fundamental right of the passengers is particularly in danger in this situation?

a) Freedom of worship
b) Human dignity
c) Freedom of religion
d) Freedom of expression

Two of these arguments plead in favor of the immediate shooting down of the aircraft. Which ones?

a) The people on the ground (in the stadium, near the nuclear power station) must be saved
b) The State is not allowed to kill terrorists
c) The defense minister (the State) is not allowed to decide upon our death
d) The so-called emergency beyond law

Two of these arguments speak against the immediate shooting down of the aircraft. Which ones?

a) There are fewer people in the aircraft than on the ground (in the stadium)
b) There is always a chance that the passengers' lives will be saved
c) The State must protect the lives of all citizens
d) The so-called emergency beyond law

Parental allowance (TERM)

a) Money that children receive from their parents
b) Money that children receive from their grandparents
c) Money that parents receive when they have children
d) Money that parents receive only when they have several children

The compatibility of work and family (TERM)

a) The possibility of working at home
b) The difficulty of having both a career and children
c) The impossibility of having both a career and children
d) The possibility of having a career and children at the same time

Die Elternzeit (TERM)

a) Eine Zeit zur Betreuung und Erziehung seines Kindes
b) Eine Urlaubszeit
c) Mutterschaftsurlaub
d) Vaterschaftsurlaub

Die Sozialleistungen (TERM)

a) Familienleistungen
b) Finanzielle Hilfe zur Verwirklichung sozialer Gerechtigkeit
c) Familienkasse
d) Sozialversicherung

Welche Gerichtsbarkeit ist in Deutschland für Konflikte über Elterngeld zuständig?

a) Die Arbeitsgerichtsbarkeit
b) Die Sozialgerichtsbarkeit
c) Die ordentliche Gerichtsbarkeit
d) Die Verwaltungsgerichtsbarkeit

"In Deutschland wird bis zu 14 Monate lang (inklusiv 2 Vätermonate) Elterngeld gezahlt." Welche Verteilung ist also unmöglich:

a) 12 Monate für die Mutter, 2 für den Vater
b) 7 Monate für die Mutter, 7 für den Vater
c) 14 Monate für die Mutter allein
d) 10 Monate für den Vater, 4 für die Mutter

Mit diesem Gesetz regelt der Staat die Organisation der Familie. Ist es:

a) Verfassungskonform: es ist die Rolle des Staates
b) Verfassungswidrig: es ist ein Eingriff in die Privatsphäre
c) Eine Frage, die mit der Verfassung nichts zu tun hat

Was ist kein Ziel des Elterngelds?

a) Die Väter dazu zu bringen, sich mehr um die Kinder zu kümmern
b) Den Frauen zu helfen, Kinder und Karriere zu vereinbaren
c) Die Wirtschaft neu zu beleben
d) Die Geburtenrate zu erhöhen

Parental leave (TERM)

a) A time for the care and upbringing of a child
b) Holiday time
c) Maternity leave
d) Paternity leave

Social benefits (TERM)

a) Family allowances
b) Financial support with the aim of achieving social justice
c) Family benefits office
d) Social security

Which jurisdiction in Germany is responsible for conflicts over parental allowance?

a) Labor jurisdiction
b) Social jurisdiction
c) Ordinary jurisdiction
d) Administrative jurisdiction

"In Germany, parental allowance is paid for up to 14 months, including 2 months paternity leave." Which distribution is not possible?

a) 12 months for the mother, 2 for the father
b) 7 months for the mother, 7 for the father
c) 14 months for the mother alone
d) 10 months for the father, 4 for the mother

Under this law, the State regulates the organization of the family. Is this:

a) Constitutional: it is the role of the State
b) Unconstitutional: it is an invasion of privacy
c) An issue which has nothing to do with the constitution

What is not an aim of parental allowance?

a) To encourage fathers to care more for their children
b) To help women to combine children and career
c) To revitalize the economy
d) To increase the birth rate

Das Bundesverfassungsgericht (TERM)

a) Das Gericht, das die Mörder verurteilt
b) Das Gericht, das das Grundgesetz schützt
c) Ein Amtsgericht
d) Ein Landgericht

The Federal Constitutional Court (TERM)

a) The court that sentences murderers
b) The court that protects the basic law
c) A local court
d) A district court

Die Gleichstellung der Homosexuellen Paare (TERM)

a) Die Diskriminierung gegen homosexuelle Paare
b) Die Gleichberechtigung
c) Die Gleichheit
d) Die Gleichbehandlung der homosexuellen Paare

The legal equality of treatment of homosexual couples (TERM)

a) Discrimination against homosexual couples.
b) Equal rights
c) Equality
d) Equal treatment of homosexual couples

Ein leibliches Kind (TERM)

a) Ein adoptiertes Kind
b) Ein biologisches Kind
c) Ein eheliches Kind

A natural child

a) An adopted child
b) A biological child
c) A legitimate child

Die Sukzessivadoption ist (TERM)

a) Die Adoption eines Kindes, das der andere Partner bereits adoptiert hat
b) Die Adoption mehrerer Kinder
c) Die Adoption des leiblichen Kindes des Partners
d) Die Adoption eines Kindes im Ausland

Successive adoption is: (TERM)

a) The adoption of a child who has already been taken on by the other partner
b) The adoption of several children
c) The adoption of the partner's natural child
d) The adoption of a child in another country

Die Lebenspartnerschaft ist

a) Die Homoehe in Deutschland
b) Die Zivilehe in Deutschland
c) Die Verpartnerung zweier Menschen gleichen Geschlechts

Civil partnership is

a) Homosexual marriage in Germany
b) Civil marriage in Germany
c) The partnership of two people of the same sex

Dass die Sukzessivadoption für homosexuelle Paare nicht möglich war, hat das Bundesverfassungsgericht für…

a) Das Bundeverfassungsgericht ist dafür nicht zuständig
b) Verfassungsmäßig erklärt
c) Verfassungswidrig erklärt
d) Nichtig erklärt

According to the Federal Constitutional Court, the impossibility of successive adoption for homosexual couples is:

a) Not the responsibility of the Federal Constitutional Court
b) Constitutional
c) Unconstitutional
d) Invalid

"Die Kinder würden von der sukzessiven Adoption profitieren, da beide Elternteile unterhaltspflichtig würden" bedeutet

a) Zwei Erwachsene sind für das Kind zuständig
b) Zwei Erwachsene sind für das Kind finanziell zuständig
c) Zwei Erwachsene sind für das Kind moralisch zuständig
d) Zwei Erwachsene sind affektiv für das Kind zuständig

"The children would benefit from successive adoption since both parents would be obliged to support them" means…

a) Two adults are responsible for the child
b) Two adults are financially responsible for the child
c) Two adults are morally responsible for the child
d) Two adults are affectively responsible for the child

"Sollte ein Elternteil sterben, hat das andere eine Rechtssicherheit, dass es als Vormund des Kindes bestellt wird."

a) Wenn ein Elternteil stirbt, kann die Frage der Betreuung des Kindes einfacher geregelt werden

b) Wenn ein Elternteil stirbt, geht das Erbe an das Kind

c) Wenn ein Elternteil stirbt, hat der überlebende Partner kein Recht auf das Kind

d) Wenn ein Elternteil stirbt, hat das Kind keine Familie mehr

"Should one parent die, the other will have the legal certainty of being appointed guardian of the child."

a) If one parents dies, the question of care of the child can be settled more easily

b) If one parents dies, his/her inheritance goes to the child

c) If one parent dies, the surviving partner has no right to the child

d) If one parent dies, the child no longer has any family

Appendix B. Psychometric Measurements of Perceived Ease of Use and Usefulness

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

Perceived Usefulness

Using clickers improves my performance in learning German	1 2 3 4 5
Using clickers in learning German increases my productivity	1 2 3 4 5
Using clickers enhances my effectiveness in learning German	1 2 3 4 5
I find clickers useful in learning German	1 2 3 4 5

Perceived Ease of Use

Interacting with clickers does not require a lot of mental effort	1 2 3 4 5
I find clickers easy to use	1 2 3 4 5
I find it easy to get clickers to do what I want them to do	1 2 3 4 5

About the Authors

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