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Teaching German Words and Verbs in Motion: A Quasi-Experimental Study with Swiss French-Speaking Secondary School Students

Magali Descoeudres[1,*] and Vincent Hagin[2]

[1]*Department of Teaching and Research Unit in Physical Education and Sport, University of Teacher Education of Vaud, Switzerland*

[2]*Department for Sports Education, Swiss Federal Institute of Sport, Switzerland*

Abstract: The theory of Embodied Learning is founded on the notion that the body and mind are inextricably linked during the learning process and encourages active student engagement both inside and outside the classroom. A daily challenge for many French-speaking students in Switzerland is learning German words and verbs. Teachers can support students in overcoming this challenge by offering active learning opportunities seen as Embodied Learning activities. This quasi-experimental study tests the following hypotheses: (a) students memorize more vocabulary in motion, (b) words or verbs learned in motion are memorized in the longer term than those learned traditionally, and (c) movement-based learning does not have a significant influence on spelling. A total of 73 French-speaking Swiss secondary school students (M_{age} = 13.1 years) participated in this study. The participants were exposed to both traditional and embodied teaching methods for a period of three months. The results of this study highlight the benefits of Embodied Learning, including (i) long-term vocabulary memorization, (ii) short- and long-term verb acquisition, and (iii) improved spelling of words and verbs. Notably, the findings underscore the potential of physical engagement to mitigate disparities between boys and girls, suggesting that it may serve as a catalyst for enhancing the efficacy of foreign language learning. The findings of this study call into question the effectiveness of traditional teaching and education methods while highlighting the potential benefits of Embodied Learning in foreign language education.

Keywords: active teaching and learning, Embodied Learning, movement-based learning, foreign language learning

1. Introduction

Switzerland, with its four national languages and long-standing policies promoting linguistic exchange across its regions [1, 2], provides a particularly rich context for the study of plurilingual learning. Plurilingualism, a concept introduced in the 1950s [3] and further developed by scholars such as de Mauro [4], has gained significant educational relevance in recent decades. The pedagogical intervention investigated in this quasi-experimental study is Embodied Learning, aimed at enhancing foreign language acquisition, specifically, the memorization and spelling of German words and verbs among Swiss French-speaking secondary school students. Furthermore, it explores whether movement-based learning strategies might mitigate gender disparities often observed in language learning outcomes and investigates whether physical movement enhances short- and long-term memorization compared to traditional sedentary methods [5–8].

2. Literature Review

Historically, educational systems were influenced by Cartesian dualism, which regarded the mind as superior to the body and positioned the body as a passive vessel [9, 10]. As a result, learning environments traditionally emphasized sedentary learning. More recently, the enactive perspective introduced by Varela [11] challenged this view, asserting that cognition is fundamentally rooted in embodied action. This paradigm shift laid the foundation for Embodied Learning, which recognizes the body as an active participant in cognitive processes. Embodied Learning is grounded in the idea that learning is an integrated process involving the body and the mind [11–13], and it encourages active student participation through physical engagement, gestures, and movement [2, 14]. Prior research suggests that this approach may support memory retention and motivation in second language learning [15, 16]. Embodied Learning has become increasingly relevant in foreign language education, where movement, perception, and cognition are deeply interconnected [17]. This theory emphasizes the integration of sensory perception and physical interaction into the learning process [12, 15]. According to Skulmowski and Rey [13], bodily engagement in learning can occur at different levels, including simple gestures, integrated movement within the learning task, and the use of embodied technologies. Haque et al. [18] add that such technologies include Kinect-based games, Wii, Leap Motion games, and exergames, all designed to facilitate physical interaction with content. Importantly, embodiment must be meaningfully connected to the learning process rather than being incidental [13].

***Corresponding author:** Magali Descoeudres, Department of Teaching and Research Unit in Physical Education and Sport, University of Teacher Education of Vaud, Switzerland. Email: Magali.Descoeudres@hepl.ch

Empirical studies support the efficacy of Embodied Learning in improving learning outcomes. For example, Brooks and Goldin-Meadow [19] demonstrate that congruent gestures enhanced mathematical learning in children. Asher's [14] Total Physical Response (TPR) approach simulates first language acquisition through physical responses to commands, reinforcing memory through sensorimotor activity. These findings suggest that physical engagement can significantly strengthen cognitive processes involved in language learning.

Despite over thirty years of research on vocabulary acquisition [20], no universally optimal method has emerged [21]. Nevertheless, strategies such as gesture use [22], contextual learning [13], and multisensory techniques [23] have shown promise. Vocabulary acquisition remains complex, especially in foreign languages, and requires tailored strategies to accommodate varied learner profiles.

In addition to strategy-based approaches, researchers have also examined gender-based differences in vocabulary learning. Huang [6] indicates that there are significant binary differences between males and females in vocabulary learning strategies, which stem from variations in motivation [24], behavior, and personality. Girls, for example, tend to use more metacognitive strategies, such as planning and repetition, leading to more effective vocabulary and sentence structure retention [25]. In contrast, boys often prioritize meaning over form and are less likely to plan or review. These distinctions imply that vocabulary instruction should consider students' gender to maximize effectiveness and promote equity in language acquisition.

Further evidence supports the role of embodiment in vocabulary learning. Macedonia [2] finds that gesture-enhanced learning led to better vocabulary retention compared to audio-visual methods. Neuroscientific research confirms that gesturing during learning activates extensive neural networks, facilitating memory storage. Aden's work underscored the power of theater and Drama, what Luo et al. [26]—describe as "living and embodied speech" [27]—to integrate language and body movement. Filipini Cearon and Pedroso de Moraes Feltes [28] further argue that social interaction enhances the conversion of short-term to long-term memory, emphasizing the value of multisensory learning tasks.

Studies such as those by Skoning et al. [29] demonstrate statistically significant improvements in vocabulary through movement and creative activities. Embodied methods not only enhance memorization and motivation but also provide enjoyable learning experiences. Techniques like cooperative learning [30], emotion-focused approaches [31], and teacher-assisted repetition [32] have been integrated successfully into embodied practices. Multimedia tools (text, audio, visuals, captions) [33] and performance gestures [34] also enhance vocabulary acquisition. Venzin [35] argues for incorporating small, discreet bodily actions—like maintaining posture or using stress balls—as part of learning to support emotional and cognitive engagement.

However, Tran et al. [36] note that high levels of body engagement do not always lead to better outcomes, suggesting that not all physical movement is equally beneficial. The effectiveness of embodiment depends on the quality and relevance of physical engagement.

Educational environments often lack the immersive exposure found in foreign language settings abroad. In most schools, language instruction is limited to three short weekly sessions, placing pressure on vocabulary and verb acquisition [37]. The Common European Framework of Reference for Languages (CEFR) Companion Volume [38] promotes an action-oriented, communicative approach [39] in which vocabulary is embedded within meaningful social action. Nevertheless, many classrooms continue to emphasize decontextualized vocabulary and orthographic control, falling short of CEFR guidelines [38, 40].

Despite theoretical advances, Thornbury [41] observes that translating new approaches into classroom practice remains difficult. Teaching vocabulary and verbs in a foreign language continues to be a challenge for both learners and teachers across all levels. Switzerland, with its plurilingual context, offers a unique setting for investigating these issues. Large-scale assessments have revealed a gender gap favoring girls, particularly in vocabulary acquisition [5]. Embodied, active instruction may help address this disparity by enhancing male students' engagement and retention.

This study builds on the existing literature by exploring the differential impact of traditional versus movement-based instruction on vocabulary and verb learning. It specifically investigates the effect of movement-based learning on memorization, the gender differences in learning outcomes, and the potential influence of movement on spelling [42]. Despite abundant research on vocabulary acquisition and Embodied Learning, few studies have examined how these two areas intersect—particularly with attention to both gender and spelling outcomes. This gap highlights the need for the present study.

This quasi-experimental study focuses on a specific action: learning words and verbs in German in a French-speaking context. The focus is on intentional learning from study, as opposed to incidental learning [21]. The objective is to examine several methods of active and movement-based learning to ascertain their efficacy in promoting the memorization of words[1] and verbs in a foreign language. The following research questions have been formulated to guide this study:

1) How does learning words or verbs in motion impact the effectiveness of student memorization?
2) In what ways does learning words and verbs through movement affect memorization compared to traditional methods?
3) What differences exist between boys and girls in the memorization of verbs and words using both learning methods?
4) How does movement-based learning influence spelling proficiency?

The following hypotheses can be formulated:

a) Students memorize more vocabulary in motion [2].
b) Words or verbs learned in motion are memorized in the longer term than those learned traditionally.

The literature review did not identify any specific findings related to spelling. As writing while moving is inherently difficult, movement-based learning tends to be implemented primarily through verbal activities. However, encouraging students to use hand gestures that represent the meaning or spelling of words may enhance spelling proficiency by reinforcing the connection between physical movement and language acquisition [43]. These findings stem from research in first language instruction rather than in foreign language teaching contexts [24]. Although orthographic correction might seem less relevant in the German language, the quasi-experimental study seeks to propose a third hypothesis that aligns as closely as possible with the local educational context: (c) Movement-based learning does not have a significant effect on spelling.

[1] Every other part of speech (nouns, pronouns, articles, adjectives, etc.)

3. Research Methodology

3.1. Research design

This quasi-experimental study used a within-subjects quantitative design to examine vocabulary memorization in the context of German as a foreign language. The inclusion of a distinction between vocabulary and verb memorization—though not standard in scientific literature—was introduced to align with local teaching practices and the instructional preferences of foreign language teachers.

Over a three-month period, ninth-grade students experienced both traditional and movement-based instructional approaches, each applied over six weeks with identical learning objectives and content. Standardized checklists were used to assess memorization before and one week after each instructional block. This design allowed for a direct comparison of learning outcomes between the two pedagogical methods, while also ensuring equitable access for all participants.

3.1.1. Participants

A sample of $N = 73$ French-speaking Swiss secondary school students, all voluntary ($M_{age} = 13.1$, $SD = 1.1$ years, $n = 38$ males, and $n = 35$ females) from five different classes, participated in this quasi-experimental study. At the time of data collection, the students were in the ninth-grade mainstream class and received 3 hours per week of German instruction. No exclusion criteria were applied. To ensure the participants' confidentiality and anonymity, all identifying information was removed from the transcripts, and the participants were referred to using identification codes. These codes included the unique participant (P) and the focus group (FG) number in which they participated (e.g., P1, FG1). The parents' written consent has been obtained.

3.1.2. Procedure

The ninth-grade students were taught German three times a week (45 minutes each). For three months, the students were exposed to two different teaching methods: six weeks of traditional teaching and six weeks of movement-based teaching, with 18 German lessons in each method. Lessons 3, 6, and 9 were partly devoted to the verb checklist (10 minutes) and lessons 12, 15, and 18 to the vocabulary checklist (10 minutes). All other lessons were used for both teaching and as part of the checklist lessons. The decision not to have a control group that only studied German in the traditional way was ethical and allowed in order to give the student an equal opportunity to engage in active learning. Article 79 of the Context County Scholarship Act states that "decisions shall respect the principles of proportionality, equal treatment, and transparency"[2]. The first method was a traditional teaching method where students sat on a chair behind a table. The teaching method used was Geni@l Klick[3]. The teacher followed the guidelines of the method in both teaching methods. In traditional teaching, words and verbs were repeated on lists while seated, whereas in active learning, they were repeated in motion, each lesson lasting 20 minutes. Students read a book to learn words and verbs related to writing skills. The words and verbs were checked twice using a checklist: once before the test and one week after the test using the traditional teaching method. The second teaching method was movement-based. The same procedure was followed for active and movement-based learning. The objectives were the same as in the traditional teaching method, but the students were not sitting while learning words and verbs. Words and verbs were the focus of five active and movement-based workshops.

Movement-based learning with cards. Verbs and words were written on cards (French on the front, German on the back) and placed on a table. The students started at the back of the classroom, quickly passing some chairs to get to the table with the cards. They took a card, thought about the translation, and checked their answer. They then walked around again before picking up a new card.

Learning with a ball. Students worked in pairs with a ball. One student had a list of words/verbs and the ball. He threw the ball to his partner and at the time asked him to translate a French word into German. The student responded by throwing the ball back. The student with the list corrected his classmate if necessary.

Learning verbs from the bottom to the top of the stairs. Two or three students were together; one student had a list of verbs, and the others were at the bottom of the stairs. The student with the list said a verb in French, and the students at the bottom of the stairs translated it into German. If the answer was correct, the student went one step further and conjugated the verb in the present tense. If the answer was again correct, the student went to the next step and conjugated it in the past tense. If the student made a mistake, he went back down the stairs and started again with a different verb.

Dictation. Each student was given an index card with a list of words or verbs to complete. The answers were placed around the classroom (on the walls, windows, or blackboard). When a student needed an answer, he stood up, looked for it, memorized it, and returned to his seat to complete the card again.

Movement-based learning *der/die/das*. This activity was done with the whole class or in small groups. A word was said in German by the teacher or a student holding a checklist. The students moved in response to the word: words with the article *der* required squatting and touching the ground; words with the article *die* required doing a jumping jack; words with the article *das* required standing on a chair. The students attended five workshops over the course of six weeks, with sessions held three times per week for a duration of 20 minutes each. This pedagogical approach, which emphasizes active and hands-on learning, was implemented to facilitate students' engagement and comprehension of the subject matter.

3.2. Measures

Prior to and one week after the words or verb graded assessments, checklists were used to measure memorization on two separate occasions. Each teaching method incorporated a word and a verb list (traditional or movement-based). The results obtained for a standard vocabulary list (comprising different types of words) and the verb lists were compared independently. Students were given 4 minutes to translate a set of words or verbs selected from designated checklists, assessing short-term memory. The same task was administered again one week after the graded assessment to evaluate long-term memory retention. It was possible to count the number of words or verbs memorized, as well as the number of words or verbs spelled correctly, for both the pre- and post-assessment periods. The checklists were anonymous, but each student indicated their gender.

3.3. Data analysis

Two criteria were employed to rectify each checklist: first, did the word or verb possess lexical validity? Second, was the word or verb spelled correctly?

[2]Loi sur l'enseignement obligatoire (LEO)," État de Vaud, August 01, 2013, https://www.vd.ch/fileadmin/user_upload/themes/formation/sante_scolaire/fichiers_pdf/Loi_sur_l_enseignement_obligatoire__LEO_.pdf

[3]Ernst Klett Sprachen DigiEd, "Geni@L Klick," accessed October 15, 2023. https://genialklick.ch/autoren

The findings could thus be compared with movement-based learning versus traditional learning in different learning areas (words or verbs), at different times (prior to or one week after the test), and for different groups (boys and girls). However, only the number of words or verbs that were correctly spelled was calculated for the entire group. The statistical analyses were performed using Excel.

Means and standard deviations were calculated for each checklist, and a Student's *t*-test was conducted to compare the effectiveness of the two teaching methods. In all analyses, statistical significance was set at $p < 0.050$.

4. Results

Table 1 shows a summary of the overall results obtained and presents the mean (*M*), standard deviation (*SD*), and the statistical significance. Our results revealed a significant impact of movement-based learning for verbs that were known before the test ($M_{traditional} = 6.70$, $M_{motion} = 8.25$, $p < 0.001$).

Does incorporating movement into learning activities enhance words acquisition and improve spelling skills over time? The results show the overall average number of words memorized prior to and after the test. A preliminary analysis indicates that, prior to the test, students, on average, memorized more words with traditional learning (7.59 words) than with movement-based learning (6.89 words). However, the difference is not large enough to be significant ($p = 0.078$). The spelling results similarly demonstrate the overall average number of words correctly spelled prior to and after the test. In terms of spelling, prior to the test, the average is 5.59 words spelled correctly with traditional learning as compared with 5.44 words spelled correctly with movement-based learning. One week after the test, the average number of words spelled correctly with traditional learning is 5.69 as compared with 6.09 words with movement-based learning. Prior to the test, the discrepancy between the two learning methods was minimal, with a mean difference of 0.20 words, marginally favoring the traditional approach. However, this disparity widened to 0.40 words in favor of movement-based learning one week later. Nonetheless, these effects were too negligible to demonstrate a statistically significant difference, as evidenced by $p = 0.381$ and the secondary $p = 0.265$. While the numbers for traditional learning remain stable, positive results regarding long-term spelling memory are once again observed for movement-based learning. None of the three conditions showed a significant difference between traditional and movement-based learning for vocabulary learning in the short versus long term. The findings suggest that incorporating movement into learning activities can enhance vocabulary acquisition and improve spelling skills over the long term, as physical engagement supports cognitive processes and memory retention.

This pedagogical approach, which involves the use of motion in conjunction with language instruction, was found to facilitate superior short-term and long-term verbs acquisition, both in spoken and written forms. The findings of this study underscore a substantial discrepancy between the efficacy of verbs taught through motion and those taught via traditional means. Verbs taught through motion were significantly more readily recalled prior to the evaluation period compared to verbs taught through traditional means, both in terms of spoken and written production. This differential in recall was evident both prior to and following the test administration (see Table 1).

Table 1 reveals that prior to the test, the average number of memorized verbs was 6.70 in the traditional learning condition and 8.25 in the motion learning condition. This indicates a significant difference of 1.55 verbs ($p = 0.001$) in favor of movement-based learning. Furthermore, the average number of verbs memorized one week after the test was 6.34 in the traditional learning condition and 8.14 in the movement-based learning condition. The difference increases to 1.80 verbs in favor of learning in motion ($p = 0.029$).

The average number of verbs correctly spelled prior to and after the test is shown in Table 1. Students correctly spell an average of 5.50 verbs with traditional learning, while with movement-based learning, this number increases to 6.60 verbs. The results of this

Table 1
Summary of overall results

Measure	Traditional learning		Movement-based learning		
	M	*SD*	*M*	*SD*	*p*
Words known[a]	7.59	2.81	6.89	3.00	0.078
Words known[b]	7.61	2.93	7.39	3.37	0.365
Words spelled correctly[a]	5.59	3.18	5.44	2.92	0.381
Words spelled correctly[b]	5.69	3.16	6.09	3.27	0.265
Verbs known[a]	6.70	3.10	8.25	2.87	0.001*
Verbs known[b]	6.34	3.36	8.14	2.54	0.029*
Verbs spelled correctly[a]	5.50	3.14	6.60	3.51	0.001*
Verbs spelled correctly[b]	5.03	3.43	6.19	2.56	0.020*

Note: Each student had to memorize 12 words and 12 verbs for the tests by condition.
This table reveals that on average movement-based learning seems to be beneficial for verbs but not for words, as verbs are systematically better recalled in the movement-based learning condition (*p = < .001; .029). The results obtained in the series with verbs are therefore statistically significant, which is not the case in the words series. This table also shows that in the standard vocabulary series, the number of words memorized or spelled correctly is greater one week after the test than prior to the test. In the verb series, on the other hand, the number of verbs memorized or spelled correctly is lower one week after the test. This is true for both traditional and movement-based learning.
a Words, verbs, known or spelled correctly prior to the test (short-term memorization).
b Words, verbs known or spelled correctly one week after test (long-term memorization).
* Statistical significance was set at $p < .050$

Table 2
Gender effect linked to traditional learning or movement-based learning

Measure	Traditional learning		Movement-based learning		
	M	*SD*	*M*	*SD*	*p*
Words known before test					
Boys	7.80	2.85	7.22	3.15	0.415
Girls	7.28	2.76	6.42	2.76	0.024*
Words known after test					
Boys	6.92	3.21	7.90	2.86	0.157
Girls	8.33	2.45	7.20	3.63	0.127
Verbs known before test					
Boys	5.85	3.38	9.24	2.08	0.001*
Girls	7.68	2.80	6.90	3.28	0.237
Verbs known after test					
Boys	6.55	3.67	8.08	2.35	0.010*
Girls	6.17	3.13	8.19	2.78	0.035*

Note: $N = 73$ ($n = 38$ males, and $n = 35$ females) $M_{age} = 13.1$, SD 1.1.
If we analyze the results by gender, we see that both groups memorized more words with traditional learning prior to the test than with movement-based learning. However, the difference is more pronounced for girls (0.89 words) than for boys (0.58 words). We can also observe that the number of words memorized in the traditional method is higher for boys than for girls (7.80 versus 7.28 words) prior to the test. Our results highlight a significant difference ($p = 0.024$) between the two conditions: words presented in a traditional way prior to the test for the girls ($M = 7.28$, $SD = 2.76$) were more remembered than words that were taught in motion ($M = 6.42$, $SD = 2.76$).
* Statistical significance was set at $p < 0.050$.

study indicate that in movement-based learning, there is a significant increase of 1.10 verbs in the number of correctly spelled verbs ($p = 0.001$). The average number of verbs spelled correctly with traditional learning is 5.03, while with movement-based learning, it increases to 6.19. The gap between these two numbers remains stable and continues to favor movement-based learning with an increase of 1.16 verbs. However, a week after the test, the results show a decline in verb spelling for both learning methods ($p = 0.020$). This decline is approximately similar in both cases: -0.50 verbs for traditional learning and -0.40 verbs for movement-based learning. Our results indicate no additional significant difference between traditional and movement-based learning.

Movement-based learning reduced the gender gap, as illustrated in Table 2, which presents the averages obtained prior to and after the test for words and verbs, separated according to gender.

One week after the test, the trend appears to be reversed, with a higher number of words memorized with movement-based learning (+0.98 words). Boys seem to benefit from movement-based learning with an average of 7.90 words memorized, compared with 6.92 words with traditional learning. The results for girls indicate a higher number of words memorized through traditional learning (8.33 words) compared to movement-based learning (7.20 words), indicating a difference of 1.13 words. Furthermore, active learning does not appear to reduce the gender gap one week after the test, with the gap decreasing from 0.8 words with traditional learning to 0.7 words with movement-based learning. However, these effects are too small to show a statistically significant difference.

Furthermore, a difference was identified between the two conditions: verbs presented in a traditional way prior to the test ($M = 5.85$, $SD = 3.38$) were significantly less remembered than verbs that were taught in motion ($M = 9.24$, $SD = 2.08$, $p < 0.001$). Boys benefit from movement-based learning with the series of verbs. It is noteworthy that the gender disparity is pronounced, with boys demonstrating a significant advantage in verb memorization, exhibiting an average of 3.39 more verbs. The efficacy of movement-based learning verbs prior to the test appears to be limited for girls, as evidenced by a narrowing of the gender gap (0.78 fewer verbs memorized by girls with movement-based learning).

After the test, one week later, the benefits of movement-based learning persist, albeit to a lesser extent, for both genders. The study's findings underscore a substantial disparity between the two conditions: verbs presented in a conventional manner ($M = 6.55$, $SD = 3.67$ for boys and $M = 6.17$, $SD = 3.13$ for girls) were notably less remembered compared to verbs taught in motion ($M = 8.08$, $SD = 2.35$, $p = 0.010$ for boys and $M = 8.19$, $SD = 2.78$, $p = 0.035$ for girls).

The observed discrepancy is particularly pronounced among girls, who demonstrate an average memorization of 2 additional verbs, while the gap for boys is 1.53 verbs. Our results show no further significant difference between traditional and movement-based learning related to gender differences.

The impact of movement on spelling outcomes. The study's findings underscore the significance of movement on spelling. The results highlight a significant difference between the two conditions: verbs that were presented in a traditional way and spelled correctly before the test ($M = 5.50$, $SD = 3.14$) were spelled significantly less correctly than verbs that were taught with movement ($M = 6.60$, $SD = 3.51$, $p = < 0.001$). The results also show a significant difference in verb spelling after the test. Verbs presented with movement and spelled correctly post-test ($M = 6.19$, $SD = 2.59$) were significantly more correctly spelled than verbs taught in the traditional way ($M = 5.03$, $SD = 3.43$, $p = 0.020$). The data demonstrate a marked increase in the number of correctly spelled verbs following movement-based learning. The outcomes were favorable both prior to and one week following the test, thereby refuting the initial hypothesis that movement-based learning would not have a significant impact on spelling. The results show no further significant difference between traditional and movement-based learning on spelling.

5. Discussion

The results of the present quasi-experimental study show that short-term (prior to the test) and long-term (one week after the test) verbs are better memorized in speaking and spelling, which is consistent with the findings from Macedonia [2] and Skoning et al. [29], who reported that physical engagement enhances vocabulary retention. However, given the absence of prior research that systematically examined the differential impact of movement-based learning on various lexical components, it remains challenging to ascertain the precise reasons underlying the enhanced efficacy of learning verbs through this method. The present results show significant benefits of movement-based learning for German verbs. The task, which involved students ascending stairs while memorizing verbs, may have emotionally engaged them, aligning with previous findings that highlight the role of emotion in learning through physical engagement [31]. It is important to note that this workshop has been exclusively utilized for the purpose of verb memorization. The physical engagement in our study, such as climbing stairs while memorizing verbs, likely increased emotional engagement and memory retention, especially for action-oriented vocabulary such as verbs. This may explain why this study found that verbs, which are often action-oriented, were better memorized through movement-based learning. Verbs typically involve action, making them more appropriate for TPR activities [14].

Furthermore, the present study demonstrates that the number of words memorized before or after a test is lower with movement-based learning compared to traditional learning methods. This outcome is in contrast with the findings of Kosmas et al. [16], where students improved their cognitive abilities in short-term memory skills. This difference in results may be due to the difference in study design, particularly the fact that the latter used movement-based games (e.g., Kinect-based games, Wii, Leap Motion games, and exergames).

Various factors, independent of the movement, can be attributed to this decline in results. Primarily, attention should be directed toward the contents of the two word lists. The two sets were quite different. The first list comprised vocabulary pertinent to the domain of food ordering, while the second focused on more general vocabulary. The students were well-acquainted with this subject, and many of the words had been previously utilized. In contrast, the second set encompassed a variety of subjects, which hindered the process of memorization. The second list was likely more challenging to commit to memory, which had a deleterious effect on the outcomes. Furthermore, according to the findings of Örün and Akbulut [25], there is a risk of cognitive overload when high levels of physical engagement are required of students. Students were initially exposed to German vocabulary prior to the introduction of verbs, a sequencing that may have exerted an influence on the observed effects of movement-based learning. The temporal structure of the intervention required students to first acquire and adapt to new movement routines before applying them in more complex tasks. As a result, their cognitive resources may have been split between learning content and mastering physical coordination. Moreover, it is possible that the gestures used were incidental rather than meaningfully integrated into the learning content, as suggested by Yoo and Loch [10] and supported by other researchers [36], which could have further limited their effectiveness. At that point, it was assumed that active and movement-based learning had no effect on the correct spelling of verbs and words. A review of the extant literature [24] yielded no pertinent information regarding spelling. Given the challenges associated with writing while in motion, learning through movement is predominantly achieved through oral means. The third hypothesis of the present study is not validated by the results, which show a significant positive influence on spelling. The underlying assumption is that students cannot accurately spell a word if they do not know it. Consequently, it stands to reason that an increase in the number of verbs memorized through movement-based learning would be accompanied by an increase in the number of verbs spelled correctly. This phenomenon is particularly salient in the context of German, a language that has few spelling concerns. However, this increase is not linear. The students increased their word count by 13% prior to the test and by 15% after the test due to the movement-based workshops. In comparison, spelling only improved by 9% prior to the test and by 10% after the test. This finding suggests that spelling enhancement is predominantly driven by memorization rather than movement-based learning. However, recent findings by García-Gámez and Macizo [44] and Skoning et al. [29] indicate that when physical actions—such as gestures—are meaningfully linked to word form and orthography, they can support not only memorization but also spelling performance. These results therefore suggest that movement, when directly tied to language form, may enhance spelling, partially challenging the idea that memorization alone drives orthographic improvement.

This assertion is further supported by the observation that most of the proposed workshops did not include writing activities, which precluded the opportunity for targeted refinement and therefore did not work on verb spelling. A further objective of the present study was to investigate the similarities and differences that exist between boys and girls. For boys, learning verbs in motion appears to be slightly beneficial. In addition, we observe that movement-based learning reduces gender disparities one week after the test. In terms of verb memorization, boys benefit from movement-based learning beyond the immediate test period, with improvements persisting even after the test has been administered. In contrast, the benefits for girls are only observed after the learning process. This finding supports the hypothesis that Embodied Learning may contribute to narrowing the actual and international pro-girl gap in academic achievements during the obligatory school years [5]. Furthermore, one week after the test, the benefits of movement-based learning persist for both genders.

At the very least, the present study does not provide a conclusive answer to the research questions. Our results, consistent with some authors, do not support the notion that higher levels of physical participation lead to better learning outcomes in all cases compared to instructional designs with less physical participation [36]. However, the study's findings indicate that for both genders, increased physical participation during the learning process has the potential to enhance engagement and enjoyment in the task. Consistent with the findings of Descoeudres [45], even teachers engaged in an active and dynamic learning process experienced emotions (e.g., enthusiasm [46]) that contributed to students' development and well-being. During the workshops, both teachers and researchers subjectively noted a greater sense of involvement and enjoyment among students. While these classroom observations are anecdotal and not based on systematically collected data, they suggest that movement-based learning may positively influence student engagement. This impression aligns with existing research showing that physical activity can enhance concentration, reduce stress, improve memorization, and foster motivation [24], attentiveness, and on-task behavior among students [47]. These preliminary insights could serve as a valuable starting point for future empirical studies aimed at objectively examining the impact of movement-based learning on student engagement. Recent research highlights the positive impact of physical movement on student engagement and emotional response during learning activities, particularly in language acquisi-

tion contexts. Movement-based learning—often framed within the concept of Embodied Learning—suggests that integrating bodily actions into cognitive tasks can enhance motivation [24], focus, and memorization [48]. In language learning, activities involving movement not only support memory through sensorimotor encoding but also tend to increase learners' enjoyment and willingness to participate, especially among students who may struggle with more traditional, sedentary approaches. This aligns with the results of the present study, in which students reported greater enjoyment and were more actively involved in vocabulary tasks when these were embedded in movement-rich activities. It is therefore crucial to consider physical engagement not just as a motivational tool but as a core pedagogical strategy in foreign language instruction.

These results suggest that the two-method learning process offers clear advantages over vocabulary memorization alone, though a direct comparison of efficacy is not possible due to the non-equivalent word lists. The disparity in content likely influenced outcomes, yet the superior performance associated with the integrated approach points to its educational potential. Movement-based workshops appear particularly well-suited to embody the principles of Embodied Learning [13] and may even benefit from Kinect-based educational games that support academic gains in math and language. Taken together, the findings challenge conventional methods and highlight the value of embodied strategies in foreign language instruction.

6. Limitations

Despite these encouraging results, the study acknowledges several limitations and suggests directions for future research. A persistent challenge pertains to the integration of words and verb usage within the broader context of language learning. To this end, isolated words and verbs exercises should be integrated into meaningful contexts that reflect the comprehensive use of the language, whether through traditional or movement-based methods. Bridging this gap is essential for the efficacious acquisition of a foreign language. Additionally, emphasizing communication skills over rigid grammatical precision can foster greater confidence in students' verbal expression. Moreover, consistent exposure to the language through engaging media such as movies, music, or podcasts can reinforce learning in a natural and enjoyable way. In alignment with this perspective, Filipini Cearon and Pedroso de Moraes Feltes [28] further contend that social interaction plays a pivotal role in facilitating the consolidation of short-term knowledge into long-term memory.

Finally, the ethics committee decided not to work with a control group to ensure that all students could experience and benefit from movement-based learning, but a future double-blind study with qualitative data, a control group, and an additional language to reduce bias should help to advance the topic of foreign language vocabulary of movement-based learning. Such a study could combine quantitative data on learning outcomes with qualitative insights from student and teacher interviews to provide a comprehensive understanding of the impact of movement-based learning on engagement and enjoyment.

7. Conclusion

This quasi-experimental study employed a quantitative design to examine the impact of movement-based learning on the memorization of German words and verbs among French-speaking Swiss secondary school students. The research aimed to determine whether physical movement improves vocabulary acquisition and spelling compared to traditional sedentary methods, and whether such effects differ by gender.

The findings revealed that while movement-based learning did not significantly enhance short-term vocabulary memorization, it contributed positively to long-term retention and spelling skills, particularly for verbs. Students recalled and spelled significantly more verbs when they were learned through physical activity than through traditional methods. Moreover, the approach showed promise in mitigating gender disparities, especially benefiting boys who typically perform less well in language learning assessments.

Importantly, the study uncovered an unexpected benefit of movement-based learning: improvements in spelling accuracy. Although the intervention did not directly target spelling through writing tasks, enhanced memorization of verbs likely facilitated more accurate spelling, suggesting a transfer effect from oral memorization to written accuracy.

Enactivism [11] provides a compelling theoretical framework for interpreting these findings. It posits that cognition emerges from the organism's dynamic interaction with its environment. In this context, movement-based learning activates sensorimotor processes that support memory encoding and retrieval. By physically interacting with content, students experience learning through both cognitive and bodily engagement, which may contribute to the observed improvements in performance.

Furthermore, movement-based learning exerts a dual impact: it increases student engagement by immersing them in novel and unexpected learning situations, and it enhances cognitive processing through embodied reinforcement. This combination of emotional and sensorimotor stimulation likely accounts for the observed gains in memorization and spelling. The students' enjoyment and active involvement during the movement-based sessions indicate that such learning environments may also promote motivation and sustained attention, both critical components of effective language acquisition.

In light of these findings, the study questions the sufficiency of conventional, sedentary teaching methods in foreign language education and underscores the pedagogical potential of Embodied Learning. Integrating physical activity into vocabulary instruction, especially for action-oriented language like verbs, can serve not only as an engaging classroom practice but as a cognitively effective strategy for long-term learning.

Recommendations

Considering the findings, several recommendations emerge for both pedagogical practice and future research: Teachers are encouraged to incorporate structured physical activities (such as role-play, vocabulary games, and gesture-based drills) into the teaching of foreign language vocabulary, especially for verbs and action-related content. These methods not only enhance memorization and spelling but also foster emotional engagement and classroom participation.

Educational strategies should move beyond passive memorization techniques and embrace a holistic view of learning that connects mind and body. Embodied Learning, grounded in enactivist theory, supports the integration of sensorimotor experiences with cognitive processing. Activities involving movement can act as embodied anchors that help students internalize and recall new language structures more effectively.

Isolated word and verb lists should be embedded within meaningful communicative contexts. Movement-based or traditional vocabulary activities are most effective when learners understand how and why the words are used, enhancing both pragmatic competence and retention.

As the study suggests, movement-based learning can help reduce gender disparities—particularly by benefiting boys. Therefore, educators should consider implementing differentiated

instruction that accommodates diverse learner profiles and preferences. Movement-based approaches can serve as effective tools for promoting inclusion and equity within the language classroom. In conclusion, future studies should involve control groups, larger and more diverse populations, and mixed-method approaches. Collecting qualitative data (e.g., interviews, focus groups) alongside quantitative results would offer deeper insight into how students perceive and experience movement-based learning, particularly regarding motivation, emotional engagement, and metacognitive awareness.

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Ethical Statement

The research was conducted in accordance with the principles of international ethical guidelines. Permission to conduct the study was granted by the ethics board of the host university[4] and the president of the secondary school involved in this exploratory project. Students were made aware of the study's voluntary nature, the confidentiality of their answers, and their right to withdraw at any time. The participants provided written informed consent.

Conflicts of Interest

The authors declare that they have no conflicts of interest to this work.

Data Availability Statement

The data that support this work are available upon reasonable request to the corresponding author.

Author Contribution Statement

Magali Descoeudres: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Writing – review & editing, Visualization, Supervision, Project administration. **Vincent Hagin:** Validation, Formal analysis, Writing – original draft, Writing – review & editing, Visualization.

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