Exploring the Role of Facilitator Talk Moves in Online Game-Based Grammar Training

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***Abstract*—In light of the limited research on native learners' game-based grammar learning, this exploratory study examined the use of facilitator talk moves during synchronous online game-based grammar training for native English-speaking learners. A total of ten native high school learners participated in a 60 to 90-minute synchronous online grammar-based grammar training session while facilitator supporting their training with different facilitator talk moves. We focused on types of facilitator talk moves in each training session and examined the impact of these talk moves on the learners' grammar score improvement. Using content analysis, we found twelve different talk moves employed in the training sessions. Chi-squared tests for independence revealed that greater use of "checking" talk moves was associated with grammar score improvement, while the greater use of "procedural" talk moves was associated with no score improvement and, by implication, an adverse impact on grammar score improvement.**

***Keywords*—online learning, game-based learning, online tutoring, grammar teaching**

I. Introduction

Online synchronous learning afforded by video conference platforms offers great learning potential for language tutoring. The medium provides a unique environment for instructors to facilitate immersive digital learning experiences, with tools like voice chat, screen sharing, and on-screen annotation. Facilitation for game-based interventions in particular has shown great promise for enhancing language grammar skills [1].

The Scholastic Aptitude Test (SAT), a test in the United States for college admission, incorporates many grammar questions in its writing and language sections, though grammatical knowledge is often neglected and misunderstood by high school students [2]. Students with learning deficits from primary school can have trouble supplementing this knowledge gap when preparing for standardized tests, such as the SAT and American College Training (ACT), while socioeconomically privileged students often resort to "shadow education," educational activities outside of formal schooling, which strongly emphasize these exams [3]. To meet the need for complementary learning material for high school students' grammar, and thus help build a more equitable community, we developed a game named 'Syntence' using the Role-Playing Game (RPG) maker MV engine. This freely available game allows learners to travel back to the 1950s and immerse themselves in gameplay where clause analysis, and ACT/SAT-level punctuation execution, is intrinsic to the game mechanics and plot. This game intends to provide an immersive experience for students who need additional training on identifying one of the most confusing grammatical concepts on standardized tests.

While prior research has broadly explored gamified language learning for teaching English to non-native speakers [4, 5], less focus has been placed on gamified grammar learning for native English speakers who intend to take a high-stakes exam. In the English as a Foreign Language (ESL) context, gamified language training is reported to be motivating students [6] and helping them learn more vocabulary [7]. Also, Hashim and colleagues [8] have confirmed the effectiveness of gamified training in improving ESL learners' grammar knowledge. Purgina and colleagues [9] examined the effectiveness of a mobile application called 'WordBricks' on natural language grammar acquisition. Based on the Scratch interface, WordBricks provides learners with sentence making exercises according to several sentence structures. As it aims to enable learners to produce grammatically correct sentences in general, it divided grammar exercises into four types: jumbled sentence, fill in the gap, find errors, and rephrase. Though these studies were conducted in similar contexts, they did not explore the dynamics of facilitator-student interactions.

Yet, there has been longstanding emphasis on the role of facilitators in online learning to promote students' engagement, achievement, involvement, and satisfaction [10]. Thus, online tutors are expected to adaptively scaffold the online learning experience of students [11]. Specifically, Yusuf [12] pointed out that the knowledge that has not been obtained at school can be obtained in online tutoring. In one-on-one tutoring, the tutor can adaptively provide instruction considering the learner's individual characteristics. There are some studies that have attempted to prove the effectiveness of online tutoring in learning math and improving writing skills. Chappell and colleagues [13] suggested that increased individualized progress monitoring helps students with mathematical difficulties. However, there is no panacea for supporting online learning; students need individual tailoring from their tutors to perform better in any context. While there has been consensus on the necessity and promising future of online tutoring, more exploration is needed to measure its effectiveness in various contexts. Previous studies on online tutoring have focused on math and writing, while, in fact, all learning experiences require some extent of instructional support. Thus, this study offers a meaningful case of investigating the dynamics and effects of the interaction between the tutor and the student in gamified grammar learning.

We observed some students improving their grammar performance through gameplay, while others did not. Based on the argument that the interaction patterns are often indicated to be a significant factor influencing learner motivation and achievement [14], this study hypothesizes that the difference in grammar improvement can be attributed to facilitators' talk move strategies. Identifying these meaningful patterns in talk moves can help improve models of facilitation for many valuable resources in the online learning sphere, including online tutoring, conversational agents, intelligent tutoring systems, and adaptive game-based learning. This study thus aims to analyze the talk moves of the facilitator during learners' gameplay by asking the following two research questions:

RQ 1. What talk moves does a facilitator adopt during synchronous online game-based grammar training?

RQ 2. How are facilitator talk moves associated with sessions yielding positive or no score improvement?

II. Methods

A. Participants and Contexts

The ten participants (five female, five male) in the research were high school students in the United States in grade 10 and 11. All participants were planning to take either the SAT or ACT within one year of their participation in the intervention. Participants completed the intervention within a single 60–90-minute session on one day, including the pre-test, gameplay, and post-test, in their individual homes, participating via Zoom. The facilitator (the third author) remained on the Zoom call for the entirety of each session, with webcam on, accessible to learners for questions or comments during the intervention.

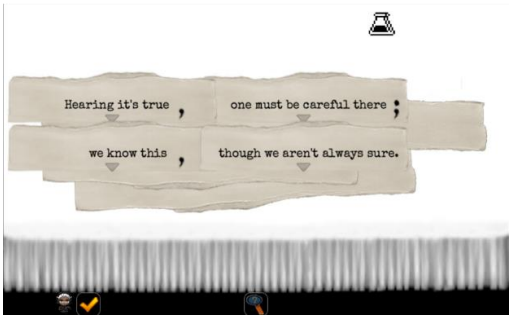
B. Syntence

The learning intervention, Syntence, is a web browser-based game for training English punctuation skills tested on the ACT/SAT standardized exams. The game is a HTML5 Web application built using the RPG maker MV engine and the Javascript coding language. Structure for the back-end data collection and storage was built using the Python language and Flask framework. The game was built by making design and content improvements to a previous punctuation training game, also developed by the third author, and underwent iterative design and user experience updates prior to this study.

Learners create a virtual character and participate in an "intelligence agency" as a "decoder." They accomplish their in-game mission by joining sentence parts together through assigning correct punctuation to "decode encrypted messages." On each game level, players view the 4 parts of a sentence, with 3 punctuation points which they can edit, choosing between "," ";" "—" and ":" (Fig. 1(a)). Each level involves analyzing these four sentence parts and selecting the appropriate punctuation to yield a grammatically correct sentence (Fig. 1(b)).

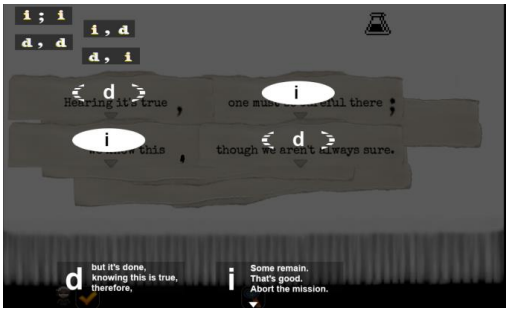
Learners also have access to in-game support such as pop-up text hints (Fig. 2(a)), and an organizer tool displayed as a screen overlay where subjects can label sentences and see common punctuation patterns as a reference while solving each level (Fig. 2(b)). The Syntence web application can be accessed through most computers, Chromebooks, tablets, and smartphone devices supporting a web browser. The first 3 game levels serve to familiarize learners with the core mechanics of the game, with the first level being a demonstration. After the 3 training levels, each learner must complete 18 game levels to reach the post-test and finish the intervention covering 5 punctuation concepts (semicolons; parentheticals delineated by commas; m-dashes; colons; lists of independent clauses). Learners achieve greater rewards (in the form of in-game currency) when completing levels with fewer mistakes, fewer punctuation changes, and lower completion time. In-game currency can be spent on decorating the virtual office space.

(a)

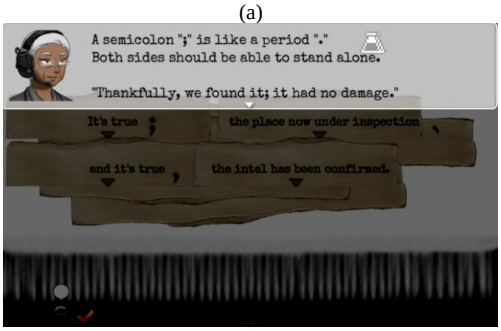


(b)

Fig. 1. Screenshots of (a) in-game virtual office (top) and (b) problem solving space for a single game level (down).



(a)



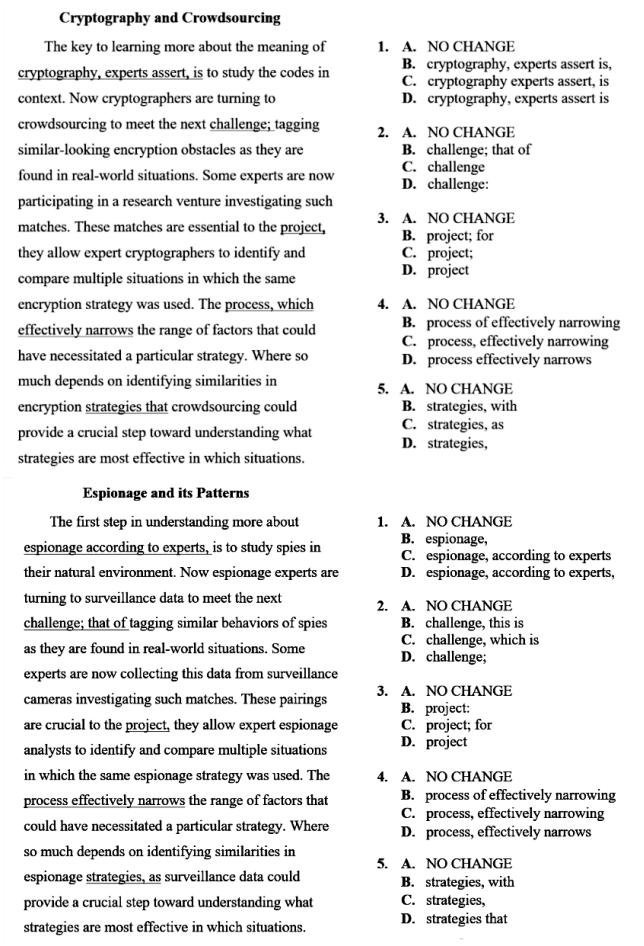
(b)

Fig. 2. In-game support in showing (a) on-screen organizer overlay (top) and (b) pedagogical agent help text (down).

C. Data Collection Procedure

All learners were required to complete the intervention on a computer, Chromebook, or tablet to ensure a more consistent experience with the software across learners. All sessions took place remotely using the Zoom video conference software, with the facilitator clearly visible and audible and the learner sharing screen. Sessions lasted 70.9 minutes on average and were continuous except for a single 5-minute break halfway through the game levels if the learner chose to. In-game time spent directly on problem solving during the 21 game levels was an average of 40.6 minutes per learner. The facilitator and learner remained on the same continuous video call for the duration of the session, and both the learner and facilitator could ask a question or make a comment at any time. Both facilitator and learner could also use the Zoom on-screen annotation tools, to draw, write, or type on the learner's shared screen. Learners were instructed to explore the game freely, at their own pace, and learners were allowed to ask for help or clarification at any point.

The primary data collected was audio recording of the full verbal interaction between facilitator and learner for each session, as well as a pre-test and post-test. The pre- and post-test included 10 punctuation questions which emulate the ACT/SAT in format, question style, and content (Fig. 3).



Cryptography and Crowdsourcing

The key to learning more about the meaning of cryptography, experts assert, is to study the codes in context. Now cryptographers are turning to crowdsourcing to meet the next challenge; tagging similar-looking encryption obstacles as they are found in real-world situations. Some experts are now participating in a research venture investigating such matches. These matches are essential to the project, they allow expert cryptographers to identify and compare multiple situations in which the same encryption strategy was used. The process, which effectively narrows the range of factors that could have necessitated a particular strategy. Where so much depends on identifying similarities in encryption strategies that crowdsourcing could provide a crucial step toward understanding what strategies are most effective in which situations.

1. A. NO CHANGE
   B. cryptography, experts assert is,
   C. cryptography experts assert, is
   D. cryptography, experts assert is
2. A. NO CHANGE
   B. challenge; that of
   C. challenge
   D. challenge:
3. A. NO CHANGE
   B. project; for
   C. project;
   D. project
4. A. NO CHANGE
   B. process of effectively narrowing
   C. process, effectively narrowing
   D. process effectively narrows
5. A. NO CHANGE
   B. strategies, with
   C. strategies, as
   D. strategies,

Espionage and its Patterns

The first step in understanding more about espionage according to experts, is to study spies in their natural environment. Now espionage experts are turning to surveillance data to meet the next challenge; that of tagging similar behaviors of spies as they are found in real-world situations. Some experts are now collecting this data from surveillance cameras investigating such matches. These pairings are crucial to the project, they allow expert espionage analysts to identify and compare multiple situations in which the same espionage strategy was used. The process effectively narrows the range of factors that could have necessitated a particular strategy. Where so much depends on identifying similarities in espionage strategies, as surveillance data could provide a crucial step toward understanding what strategies are most effective in which situations.

1. A. NO CHANGE
   B. espionage,
   C. espionage, according to experts
   D. espionage, according to experts,
2. A. NO CHANGE
   B. challenge, this is
   C. challenge, which is
   D. challenge;
3. A. NO CHANGE
   B. project:
   C. project; for
   D. project
4. A. NO CHANGE
   B. process of effectively narrowing
   C. process, effectively narrowing
   D. process, effectively narrows
5. A. NO CHANGE
   B. strategies, with
   C. strategies,
   D. strategies that

Fig. 3. The first screen of the (a) pre-test (questions 1–5 out of 10) (top) and (b) post-test (down).

D. Data Analysis

To examine how the facilitator supported game-based grammar learning, we conducted a deductive content analysis as suggested in Mayring's work [15] on video-recorded data. Specifically, we tried to reveal what type of talk moves were employed by the facilitator and based our analysis on Wei and colleague's framework [16], which is a systematically developed talk move taxonomy that teachers employ when facilitating classroom interactions. Assuming that facilitators in grammar classrooms might employ similar talk move facilitation, we adopted all twelve talk moves defined in the original framework with minor modifications and matched each facilitator utterance onto the modified framework. For example, as our tutoring occurred in the context of game-based grammar learning, while the original framework was developed in text-based learning, we replaced the word "text" with "grammatical content knowledge" when defining the *checking* talk move in our study. Each modified facilitator talk move used in our study is listed with excerpts in Table 1.

The 10 sessions produced a total of 266.7 minutes of audio data, which included all verbal discourse that occurred during the sessions. We first transcribed the ten video-recorded class sessions using Otter.ai, a speech-to-text speech recognition application. To ensure accuracy, the third author, the facilitator of all ten sessions double-checked each transcription by carefully reading the transcript while listening to the original video-recorded files. Next, we separated each sentence in the transcription using the period (full stop) punctuation marker, which yielded a total number of 2,059 utterances from facilitator-student discourse. Then, to minimize potential bias, the first, second, and fourth authors met multiple times to collaboratively code each utterance. Any discrepancies or vagueness were resolved by continuous discussion of all four authors and checking by the first author. The inter-rater reliability was calculated by dividing the number of agreements made on each coded utterance by the total number of coded utterances and multiplying 100 [17], which was as high as 84.43 for the first session.

We found that some utterances included multiple talk moves and we coded these as separate talk moves, yielding a total number of 960 talk moves. For example, in session 3, we coded the utterance, "Yeah, the other first one's good, and then "one judgement" and then how do you complete that sentence "one misjudgement" using four matching talk moves, which are backchanneling (Yeah), checking (how do you complete that sentence), debriefing (the other first one's good), and reading ("one judgement", "one misjudgement"). This utterance was counted as having four separate talk moves.

Then, to further unpack potential associations between talk moves and learner score improvement, we first grouped the 10 coded sessions into either improvement (i.e., learner achieved a 1 or more correctly answered questions out of 10 on the post-test; 6 sessions) or no-improvement (i.e., no post-test improvement; 4 sessions). Next, to explore the difference in facilitator talk moves in sessions where learners showed post-test improvement (group 1) versus none (group 2), we collected descriptive statistics and compared distributions of talk moves (tags 1–12) with two statistical questions: (a) is there a significant association between distribution of teaching moves and high- vs. low-scoring sessions, and (b) if so, which teaching moves contribute to the significant difference?

Table 1. Facilitator talk move description with excerpts (adopted from [16])

Code	Talk move	Description	Excerpts
1	Backchanneling	Teacher responds with a few words to show students that she is listening to the students	T: Oh, yeah.
2	Challenging	Teacher encourages students to provide a justification for their responses or to consider alternative points of views	T: So you're right, though, that is grammatically okay, but any difference if you put a comma?
3	Checking	Teacher makes sure that students have a basic, literal understanding of grammatical content knowledge	T: Would that be independent or dependent?
4	Clarifying	Teacher encourages students to provide a clearer response by asking questions that sometimes incorporate the teacher's refined version of the student response	T: You're absolutely right, grammatically, but where does the change in tone start?
5	Debriefing	Teacher gives summarized comments on students' performance with future goals	T: so you had the halves right.
6	Instructing	Teacher gives explicit instruction on grammatical content knowledge	T: so it's- whenever you have a list, then it could be a comma if it's part of the list.
7	Marking	Teacher attempts to draw attention to, or reinforce, specific aspects of a student's response by explicitly pointing it out	T: So for this one, I think you had the semicolon, comma, comma.
8	Modeling	Teacher exhibits an aspect of grammatical competency that students are expected to employ	T: Yeah. So I often remember that or I think about that as like someone being like, you know, "oh, by the way" like, "despite disagreements", and it is possible to say it that way
9	Procedural	Teacher manages the flow and the focus of the game play that sometimes incorporate technical support	T: Okay, and so now you can read click on the right side, so if you want "D" you can click on the right side you'll see that D option on the far right yeah,
10	Prompting	Teacher helps students construct an elaborate response and to probe deep and meaningful thinking	T: What's the issue with it?
11	Reading	Teacher's reading of the phrases/sentences on game screen aloud to the students for information as needed during the game play	T: And let's take the first part "one should be meticulous"
12	Summarizing	Teacher overviews a part of the student's problem-solving process to maintain coherence	T: So that means that independent dependent not quite there, so you're pretty confident about "learn from failure, mottos can help you, but it needs more"--that looks dependent, you said: what part made it dependent?

III. Results

First, to answer the first research question on which talk moves the facilitator adopted during synchronous online game-based grammar learning, a content analysis on each utterance was conducted. All twelve talk moves from Wei and colleague's framework [16] were found across ten sessions, though for each session, two to nine facilitator talk moves were not attested. For example, ten different talk moves (backchanneling, challenging, checking, clarifying, debriefing, instructing, marking, procedural, reading, summarizing) were found in session 1, lacking the other two talk moves from the framework; three different talk moves (backchanneling, debriefing, modeling) were found in session 2, without the other nine talk moves from the framework.

Overall, sessions yielding score improvement showed higher numbers of facilitator talk moves on average. The score improvement group (n=6) showed an average of 104 talk moves per session, while the no score improvement group (n=4) showed an average of 42 talk moves per session. For both sessions with and without score improvement, the distributions were similar for several talk moves as shown in Table 2. For both groups, the most prevalent talk move was backchanneling (group 1, n=249, average percentage of the session's talk moves = 40.4%; group 2, n = 74, 45.2%). The talk moves debriefing (group 1, n=76, 12.6%; group 2, n=20, 12.2%) were more prevalent than instructing (group 1, n=59, 9.7%; group 2, n=10, 4.8%), followed by marking (group 1, n=38, 5.9%; group 2, n=9, 4.3%). For both groups, the lowest talk move types were challenging (group 1, n=3, 0.3%; group 2, n=2, 0.6%), clarifying (group 1, n=3, 0.5%; group 2, n=1, 0.3%), prompting (group 1, n=2, 0.3%; group 2, n=1, 0.8%), and summarizing (group 1, n=3, 0.7%; group 2, n=1, 0.7%).

Table 2. Average counts per talk move per group (group 1: score improvement; group 2: no score improvement)

Talk move	Group 1	Per session		Group 2	Per session	
	Total	Avg.	%	Total	Avg.	%
1	249	41.5	40.4	74	18.5	45.2
2	3	0.5	0.3	2	0.5	0.6
3	47	7.8	7.5	3	0.8	0.9
4	3	0.5	0.5	1	0.3	0.3
5	76	12.7	12.6	20	5	12.2
6	59	9.8	9.7	10	2.5	4.8
7	38	6.3	5.9	9	2.3	4.3
8	8	1.3	1.3	0	0	0.0
9	119	19.8	18.1	49	12.3	29.5
10	2	0.3	0.3	1	0.3	0.8
11	19	3.2	2.6	2	0.5	0.6
12	3	0.5	0.7	1	0.3	0.7

Note. 1: Backchanneling, 2: Challenging, 3: Checking, 4: Clarifying, 5: Debriefing, 6: Instructing, 7: Marking, 8: Modeling, 9: Procedural, 10: Prompting, 11: Reading, 12: Summarizing

To answer the second research question, we investigated the association between facilitator talk moves and score improvement. A chi-squared test of independence including all coded talk moves (n = 960) showed that there is a significant association between the distribution of facilitator talk moves and whether a session involved a high- or low-scoring student (χ^2 (11, n = 960) = 34.474, $p < .001$). This suggests that the distribution of the facilitator's talk moves was significantly associated with whether a student improved from the intervention. Next, to understand which talk moves contribute to this significant association, we separated out the talk moves which showed noticeable disparity (Fig. 4): talk move 3 (*checking*) and talk move 9 (*procedural*).

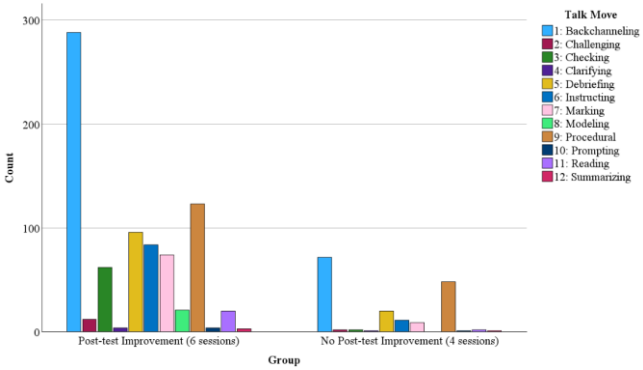


Fig. 4. Talk move frequencies (n = 960) across 10 tutoring sessions.

A Chi-squared test of independence of talk moves 1–12 excluding 3 and 9 showed no significant association (χ^2 (9, n = 724) = 12.272, p = 0.198), while including either talk move 3 (χ^2 (10, n = 788) = 20.874, p = 0.022) or talk move 9 (χ^2 (10, n = 895) = 23.771, p = 0.008) yielded a significant association. In sum, while the distribution of most teaching move types was similar for improvement and no-improvement students, *procedural* teaching moves were associated with low-scoring sessions, while *checking* teaching moves were associated with high-scoring sessions.

IV. Discussions

As one of the very few attempts that looked at the use of a synchronous online game to teach grammar for standardized test to native learners, this exploratory study aimed to examine what roles facilitator talk moves play in a 60 to 90-minute online game-based grammar training session. To achieve this aim, we used an in-house grammar game called 'Syntence' to teach how to identify the characteristics of clauses of a sentence, which is considered to be one of the fundamental misunderstandings associated with grammar in SAT. Ten high school learners in the United States who are native speakers of English participated in the study. The learners were asked to engage in the grammar game while the facilitator observed them and provided timely scaffolding. We grouped these learners into score improvement (group 1) and no score improvement (group 2) groups based on pre-test and post-test grammar accuracy scores.

We first investigated the types of talk moves the facilitator adopted while supporting the two groups' training sessions. A content analysis of the talk moves of the audio-recorded training session data revealed that all twelve teacher talk moves identified in Wei and colleague's framework [16] also appeared in our study. Each session showed different frequency of each talk move use, with *backchanneling* being the most frequently used talk move and *challenging* being the least used talk move in both groups. We also found that group 2, with higher score improvement, involved a bigger number of total facilitator talk moves than group 1.

Next, to delve into the roles each type of talk move plays in learners' grammar score improvement, we conducted a chi-squared analysis on the frequencies of each coded talk move type. While an overall greater number of facilitator talk moves was found in group 1, the results from the independent chi-squared test revealed that not all talk moves were equally beneficial in improving grammar test scores and that there exists a talk move that might have a detrimental effect on learners' grammar score improvement. On the one hand, the *checking* talk move was significantly and positively associated with learners' grammar score improvement. This finding aligns with Cullen [18] in that the *checking* talk move was effective in increasing learners' learning performance as one of the follow-up moves that occur after the student's response. In particular, the facilitator in our study used several *checking* talk moves by asking students if their answers to the problems in the grammar game were made using their gut feelings or based on concrete grammatical knowledge. Given that the learners in our study was native English-speaking high school learners who might have gut feelings on distinguishing independent and dependent clauses, we assume that this type of talk move was even more advantageous in concrete knowledge building, which might be necessary in standardized tests like SAT.

Meanwhile, *procedural* talk moves, the second most prevalent talk move type in both groups, was found to have a significant and unfavorable effect on learners' grammar score improvement. In Budde and colleague's findings [19], where *procedural* was also dominant among the different types of teacher-talk turns, the researchers suggested that this type of teacher talk could potentially limit sustained student talk during text-based learning. It is also plausible in our study that making learners actively observe the text of the game content while the facilitator is managing the flow and the focus of the gameplay might have increased learners' cognitive load, which has been repeatedly reported to negatively affect learning [20, 21]. Furthermore, some studies have reported that increased cognitive load negatively impacts flow experience (e.g., [22]), which is one influential aspect of successful game-based learning [23]. Furthermore, considering that technical support was given to learners regardless of how familiar they are with human-computer interaction, how much background experience they have about game-based learning, this type of facilitator talk move might have been redundant to some learners and thus hindered their learning. In sum, we suggest that facilitators of online game-based grammar training should consider ways to provide facilitation without increasing learners' cognitive load.

V. Conclusion

Our study aimed to close the gap in elucidating the

dynamics of facilitator interactions in synchronous online game-based grammar learning scenarios by examining the association between distinct types of facilitator talk moves and learners' score advancements on a standardized test. We first unearthed that all twelve facilitator talk moves were employed across sessions, with varying frequency. Notably, backchanneling emerged as the most prevalent talk move, while challenging was the least used, illustrating a broad spectrum of facilitator engagement strategies during the learning process. Furthermore, a substantial link was found between the distribution of facilitator talk moves and learners' score improvement. Specifically, the checking talk move was positively associated with higher scores, while procedural talk moves were correlated with lower scores, indicating a nuanced impact of facilitator interactions on learners' grammatical understanding.

Nevertheless, the conclusions made in this research should be interpreted with caution as our training context was limited to one-on-one tutoring sessions tailored to native English speakers' grammar learning and might not be applicable to other subject areas such as math and science or game-based learning designed for second language learners. Moreover, the small sample size in our study could potentially affect the generalizability of our findings. We suggest that future studies continue to explore the role of facilitator talk moves in online game-based grammar training that involves a larger sample, more diverse language learners with varying levels of grammar proficiency, and different learning objectives, such as online games for training beyond standardized test improvement, to enhance the generalizability of the findings to various educational contexts and learner demographics. Also, we did not rule out learners' individual characteristics while examining the relationship between facilitator talk moves and grammar improvement. Future studies might consider including individual learner characteristics such as gender and digital literacy in their exploration. Moreover, an exploration into the impact of learners' familiarity with game-based learning and cognitive load could offer a more nuanced understanding of learning outcomes in this context. Lastly, we highlight the need for a framework that better captures the nature of facilitating grammar games designed for native learners.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

All authors worked on conceptualization, methodology, investigation, original draft writing, reviewing, and editing. Luke A. West developed the intervention software. Hyangeun Ji, Chaewon Kim, and Jiabei Xu conducted data analysis.

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