The Effects of a LEGO® Intervention on the Writing Performance of Seventh Graders with Special Needs

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In this pilot single-case study, we evaluated the effects of using LEGO® as a tool for students identified with disabilities to improve their expressive writing performance. We applied a simple ABA reversal design to test whether the intervention was effective with four seventh graders. Social validity data were also obtained. Findings indicate that all four participants received a substantial benefit from playing with LEGO® as they tried to come up with ideas for their essays. The length of texts considerably increased once they started using LEGO® materials. Social validity feedback from the students suggests that, overall, they held a positive view of the intervention, but they also voiced some critical opinions. This paper ends with a discussion of limitations and possible further extensions to the novel approach presented.

Keywords: **expressive writing, ABA reversal design, LEGO® intervention, essay planning**

INTRODUCTION

Writing is the backbone of the modern world. The ability to organize, document, and edit one's written thoughts is essential in academic, private, and professional environments. Individuals who do not demonstrate adequate competence in writing are largely excluded from participation in economic and social life (Graham et al., 2013; Graham et al., 2018).

According to the well-known model by Kellogg (1996), text production consists of three distinct processes that operate in conjunction with the working memory functions (the visuospatial sketchpad, the central executive, and the phonological loop). The first process, called *formulation*, involves planning and goal setting; the second process, called *execution*, consists of actually translating thoughts into written sentences; and the third process, called *monitoring*, is devoted to editing and revising. All these activities operate concurrently and

affect the capacity of our working memory. Writing is generally presumed to be the most exacting, arduous, and complex language skill, as it strains one's ability to store and mentally manipulate memory contents. This is, in part, the reason why many students try to avoid this task and why it is so challenging for them to write an essay or any other type of paper (Santangelo, 2014).

Fortunately, most children and teenagers acquire sufficient text production skills during their elementary and secondary education. However, many of them do not. This is especially true for students identified with disabilities. Roughly 60% of this population scores below proficiency on standardized tests (US Department of Education, 2011). Among those most affected by writing difficulties are those identified with speech disorders and severe learning problems (Graham et al., 2020). These students are at a particularly high risk of experiencing social and societal exclusion (Gerbig et al., 2018).

An especially promising starting point when planning and devising writing support for students with speech and learning impairments is the *planning* stage. Respective meta-analyses suggest that struggling children and youth more effectively plan and conceptualize texts in their minds when provided with proper strategies and tools (e.g., Cook & Bennett, 2014; Datchuk et al., 2020; Gillespie Rouse & Sandoval, 2018).

One interesting and novel approach to fostering the ability to plan a text is through the use of play, specifically using the building toys LEGO® (Whitebread & Basilio, 2016). LEGO® is a line of construction toys. They consist of different colored interlocking plastic bricks, accompanied by a whole range of different figurines, gears, and miscellaneous other elements. LEGO® has been used in various educational and therapeutic settings, mostly to foster social skills in children with autism (e.g., Huskens et al., 2015; Narzisi et al., 2021; Owens et al., 2008; Ramalho & Sarmento, 2019).

The ubiquity of LEGO® today makes it an interesting medium for investigating the effectiveness of its use in the classroom. There are approximately 80 pieces of LEGO® on average per person on the planet, and it is estimated that there are more LEGO® minifigures in the world than there are people (Dyckhoff, 2014). From one perspective, this building toy can focus on the stepwise construction of an end product (a dinosaur, the Eiffel Tower, a spaceship, etc.). LEGO® can also provide an experience of an improvisatory process, which is creative and iterative by meaning-making through building and rebuilding.

However, the benefits of playing with LEGO® as a means of text planning and writing have not yet been empirically tested. The only scholarly paper that we were able to identify on this topic through a systematic search of relevant databases is by Wright and Kitson (2020), which carries the title "A way into writing: Using LEGO® as a stimulus." In it, the authors relate their experiences

with letting middle-years learners act out scenarios with these toys in preparation for producing stories without having to worry about grammar, spelling, or any other conventions. They conclude that "LEGO® offers a way to support a range of opportunities for students to create literary texts. . . . Allowing students to play around with their ideas physically helps them to get their thoughts in order, and 'making' the stories becomes a powerful way of being and learning" (p. 8).

The present study aims to progress from these assumptions and test them empirically. Since this is the first research on this topic, we decided to conduct a small feasibility project in the form of a single-case analysis with a very limited number of middle-years students identified with speech and learning problems. Thus, the purpose of this study was to evaluate whether playing with LEGO® as a planning procedure for writing stories would actually enhance performance in struggling seventh graders.

Methods

Four seventh-graders from a German school for students identified with speech disorders participated in the study. All of them were officially classified as having special needs. According to their classroom teacher, they struggled with writing in general and text production in particular. Each student is described below in greater detail. (All names were altered to protect their privacy.) The classroom teacher served as the interventionist. She had 3 years of experience teaching students with special needs.

Alena was a 14-year-old female identified with Asperger's syndrome and selective mutism, in addition to having a learning disability and a speech disorder. She had no migration background and spoke fluent German at home with her mother and friends. Based on the results of a widely used German spelling test, Hamburg Writing Samples (Hamburger Schreib-Probe [HSP], 2018), administered at the beginning of the seventh grade, Alena's total number of correct words and punctuation corresponded to the third percentile, which is considered "far below average" compared to her same-aged peers.

Benno was a 13-year-old male with a Russian migration background. He was diagnosed with reading and spelling difficulties as part of a generalized speech disorder, and his percentile ranks for the total number of correct words and punctuation on the HSP were below the first percentile.

Colin was 13 years old. He did not have an immigrant background and was diagnosed with high-functioning autism, a speech disorder, and dyslexia. His percentile ranks on the HSP for the total number of correct words and punctuation were below the first percentile.

Dario was a 13-year-old male diagnosed with a learning disability and a speech disorder. He lived with his German-speaking father and his Portuguese-

speaking mother and was raised bilingually. His percentile ranks on the HSP for the number of correct words and punctuation were measured at the second percentile and considered "below average."

Our study employed a single-subject reversal design (ABA) across participants (Morgan, 2018). It included a three-day baseline phase, a four-day intervention, and a three-day return-to-baseline phase (with daily probes). This design is the simplest of the experimental analysis strategies that enables the detection of functional relationships between the introduction of a treatment and its subsequent removal. Initially, we had planned for a fifth measurement during the intervention. However, the students had just been introduced to their new trainee teacher that day. Shortly thereafter, they were still unsettled by this change when it was time to attend to the LEGO® materials. It was very apparent that they were unable to engage in the training in the same manner as in previous sessions. Therefore, we did not feel that the results of this session probe were an accurate and indicative measure of their ability, so we omitted the last B-phase probe, finishing with a total of four instead of five.

We used the total number of words written (TWW) in response to a prompt as an indicator of students' performance. The interventionist presented the participants on each day of the study with a simple heading for an essay (e.g., "Home alone at night," "A bitter disappointment," "Shards bring luck"). Each student was given a different prompt that was drawn randomly from a pool. They were then asked to write a story about the respective heading. There were no time limits for finishing the task. A word was defined as a series of letters separated from another series of letters by a space. Incorrectly spelled, nonsense, or illegible words all counted toward the score. TWW can be considered a reliable and valid measure for capturing writing ability, especially for learners at the elementary level (Troia et al., 2019). A research assistant evaluated every text. Subsequently, a randomly selected 20% of the stories were independently evaluated by another rater. Their appraisals agreed 100% of the time.

We also used a short survey as a means to capture social validity data from students. It was conducted by the interventionist and included the following questions:

1. Did you enjoy playing with LEGO®?
2. Did playing with LEGO® help you better plan your stories?
3. Did you come up with more ideas for your stories after playing with LEGO®?
4. Did playing with LEGO® help you write better stories?
5. Do you enjoy writing stories more now than before?
6. Did you like the feedback that you received for your stories?
7. Would you like to continue playing with LEGO® before writing stories?

8. Would you recommend playing with LEGO® to your classmates before writing a story?

All questions were multiple-choice ones with three options to select from: "Yes," "A Little," and "No."

Each day, the students gathered at a table in the corner of their classroom. The only difference between baseline (A1 and A2) and intervention sessions (B) was how participants spent the 15 minutes before producing a story (see above). During baseline sessions, the students engaged in a board game; during intervention sessions, they played with LEGO® and created scenarios related to the respective writing prompts.

The materials consisted of about 500 LEGO® pieces containing little figures, objects of utility, animals, vehicles, and base plates. Our participants were free to use any materials they liked. During the first two treatment sessions, the interventionist engaged in the playing process by asking questions about the scenarios the students had developed and helping them remember that each story had a beginning, a middle, and an end. After the second session, she ceased to comment on the students' endeavors. However, she provided positive feedback on the finished text products (e.g., "I can see that you included a lot of details in your story that were part of your earlier LEGO® act – that's great!"). After the last treatment session, the interventionist conducted the social validity survey with each participant individually.

RESULTS

Table 1 presents key descriptive data for each student and each phase.

Table 1. *Descriptive Statistics for TWW*

|	M			Min			Max		
Name	A1	B	A2	A1	B	A2	A1	B	A2
Alena	50.00	399.75	409.67	44	142	258	57	902	708
Benno	71.33	249.75	182.00	59	119	128	86	415	273
Colin	37.67	390.75	133.33	33	163	69	43	712	174
Dario	33.67	236.75	89.67	21	69	74	42	424	105

Figure 1 shows the results of the measurements during phases A1, B, and A2 in the form of a line diagram.
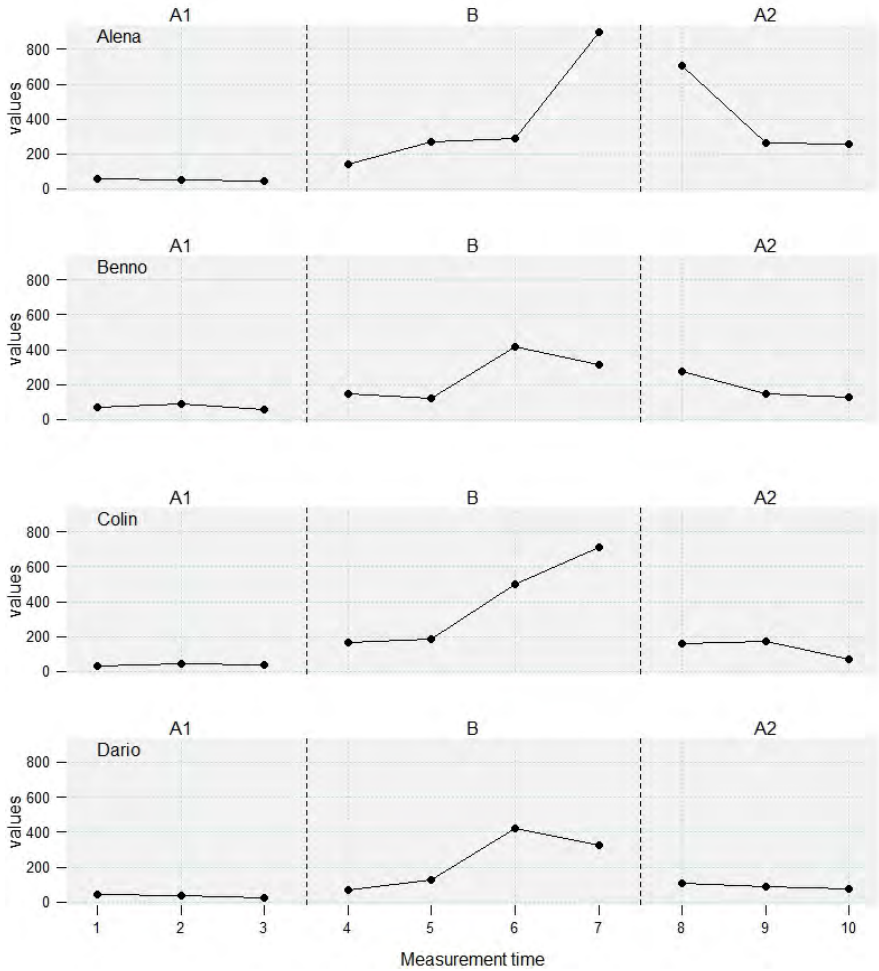
Figure 1. **TWW per Participant for Each Treatment Condition**

As can be clearly seen, the first baseline was relatively stable. As soon as the intervention was introduced, performance increased dramatically. In the case of Alena, the mean gains from A1 to B were 699.50%; for Benno, 250.13%; for Colin, 937.30%; and for Dario, 603.15%. Especially impressive was the fact that Alena produced one essay during the B-phase that consisted of more than 900 words (even though her high score during the A1-phase was only 57).

Figure 2 shows the mean performance for each day of the study across participants. The black columns represent measurements from the A-phases, while the light gray columns represent intervention measurements.
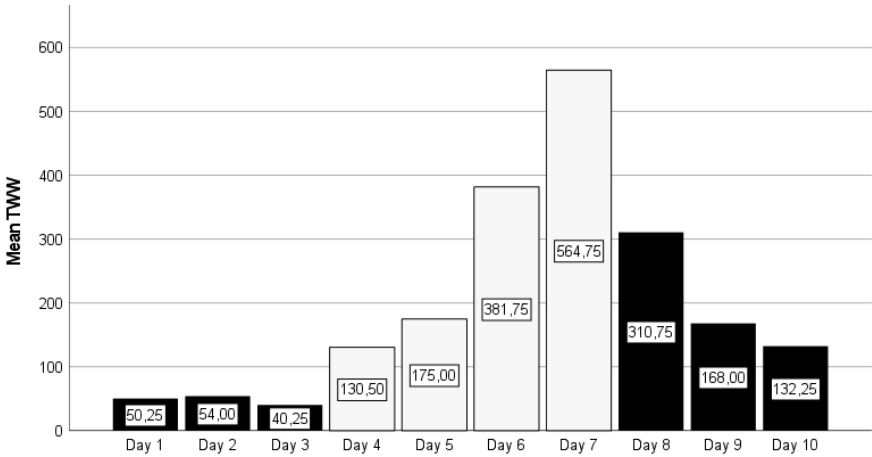
Figure 2. **Mean Performance for Each Day of the Study Across Participants**

This bar graph indicates that the mean number of TWW increased significantly after the treatment was implemented and continued to increase between days 4 and 7. The termination of the intervention was followed by a gradual decline in performance. All common overlap indices comparing phases A1 and B (PND, PEM, PEM-T, NAP, and PAND; see Alresheed et al., 2013) equaled 100%.

Alina responded positively to survey questions 1–7. However, she was unsure if she would recommend the intervention to her classmates. Benno stated that he liked the feedback he received. He did not find writing stories more enjoyable after training. In addition, after playing with LEGO®, he had no desire to write any more stories. He responded with "A Little" to all the remaining questions. Colin agreed to questions 1–4 as well as question 7. However, his interest in writing stories had only slightly increased. The same held true for his attitude toward feedback and his willingness to recommend the intervention to other students. Lastly, Dario enjoyed playing with LEGO®, stated that it helped him plan better stories, believed that he came up with more ideas after engaging with the materials, and wished to continue working with LEGO®. He responded with "A Little" to questions 4–6. However, playing with the materials was not something that he would recommend to his classmates.

DISCUSSION

The results of this pilot study indicate that our LEGO® intervention was indeed helpful in providing seventh graders with special needs with a framework for planning their writing products. Between the initial baseline and the intervention phase, performance improvements ranged from approximately 250 to over 900%. A visual analysis of the data suggests that the treatment resulted in a steady improvement in TWW. Surprisingly, despite these impressive results, the students' evaluations of the training were not uniformly positive, particularly Benno's. It is speculated that this was due to the fact that our participants were already in seventh grade, an age at which playing with LEGO® was likely no longer considered "cool." However, the responses to our survey questions still paint a rather encouraging picture of using LEGO® to assist struggling students in improving their overall writing performance.

Like any other empirical study, this research is also subject to certain limitations. First, we included only four seventh graders from only one school. Consequently, generalizing the results is impossible. In addition, our small group of participants consisted of students with writing difficulties from a special school focused on the needs of learners with speech disorders. The selection criteria were not particularly operational, as the identification of our subjects depended mainly on the classroom teacher's evaluations.

Another limitation pertains to the study design. We included only one B-phase. Although confounding variables can already be controlled within an ABA design, a second replication of the intervention effect would have greatly enhanced the internal validity of our research. In addition, there are ethical concerns associated with the use of a reversal ABA design, as in many cases, re-implementing a baseline phase means withdrawing an intervention that has already led to significant improvement. In a sense, this contradicts a fundamental goal of pedagogical action (Cooper et al., 2020). Lastly, we evaluated writing performance only on the basis of quantity, not quality. Even though both aspects are highly correlated when it comes to simple stories produced by students during the transition from elementary to secondary education, we could have put this to the test and evaluated the quality of the essays.

Despite its limitations, this study certainly provides preliminary support for the effectiveness of our simple LEGO® intervention. We were able to affirm that our approach has the potential to assist struggling writers in boosting their performance. It required little effort to implement the treatment and produce results. Finding ways to motivate learners with special needs to engage in the arduous work of writing remains a significant obstacle for many teachers. With the approach presented in this paper, they may now have another tool that can provide their students with the stimulation and support needed to generate ideas for their stories.

Further research is undoubtedly needed to confirm the effectiveness of our LEGO® intervention with a larger sample and investigate factors that will support wider implementation in school settings with different kinds of students. Moreover, future studies should not only focus on essay length as an indicator of performance but also take other outcome measures into account. Conducting further research on this topic appears generative and timely, as the effort to assist students in overcoming their reluctance to write and better construct mental outlines for their texts is more important than ever.

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