Institute of Education
Centre for Inclusive Education

Scoping Study
June-September 2019

Kate Bradley & Dr Amelia Roberts

LIFT LESSONS

Executive Summary

What did we want to find out?

We used this scoping study to ask the following questions

1. Does watching the animations affect the progress students make on vocabulary acquisition? Consider the effect of year group and the type of question (direct recall, use in context, use in a sentence, exam question).
2. Do repeated attempts practicing a question over time affect progress on vocabulary acquisition? Consider the effect of year group and the type of question (direct recall, use in context, use in a sentence, exam question)
3. What are the students' views on using technology to help learn vocabulary?
4. What are the teachers' views on using technology to help learn vocabulary?

What did we do?

Working with students in Years 7-10 in three schools in London and East Anglia, a two-week pilot of Lift Lessons was undertaken. Spaced Learning was the strategy deployed by the programme and bespoke animations are utilised to support the subject specific vocabulary learning. A pre-test and post-test were completed to understand the progress that the children made with vocabulary acquisition. Questionnaires were sent to teachers and students to find out their views on the programme.

What did we find out?

The finding from this initial scoping study are positive. All groups made progress and 92% of students reported that the programme was easy to use. The students would also recommend this to their friends and peers.

It is suggested that a longer study take place in order to monitor progress over time and to ascertain how teachers can interact with the dashboard to monitor progress.

Message of Thanks from the Founders

Supporting students is our driving passion, and we are committed to ensuring that all the resources Lift Lessons creates will enhance vocabulary learning using the most effective evidence-based approach. We want to employ a research-led development process, and only move forward with resources that are optimised to benefit students and their learning.

To ensure this, we collaborated with the UCL Centre for Inclusive Education as it is a world-leading centre for the development and implementation of evidence-informed, inclusive pedagogy, and educational policy.

We are very grateful to the amazing schools, students and educators who shared their time and feedback with us during this scoping-study. The participating students provided very helpful, considered, and creative feedback which we will use to improve our resources.

The wonderful educators and headteachers who supported this study went above and beyond to share their time and highly valued expertise for this research. The feedback that they provided will be used to refine our content and approach.

We would also like to offer a special thanks to Katherine Bradley of the UCL Centre for Inclusive Education for leading this research project and for her invaluable insights and recommendations, and to Dr Amelia Roberts for supporting the research process.

We also appreciate the technical assistance and development from the innovative team at Synap, and all of the ongoing support from advisors and mentors who have generously shared their time and expertise with Lift Lessons.

Andrea and Caroline

In the interest of transparency, the following has been declared.

Dr Amelia Roberts discloses a potential conflict of interests as having received reimbursement from Lift Lessons for previous consultancy services. Dr Roberts' involvement in this report is minor and did not include the collecting or analysis of data, nor the drafting of recommendations or conclusions.

Contents

Tables

Introduction

Andrea Silani and Caroline Schaal are former science teachers from a secondary school in London. They are seeking to conduct a pilot of their product 'Lift Lessons' which is a series of videos and animations that are embedded within Synap (a web based programme) to provide tailored learning of science vocabulary. The learning utilises a spaced learning approach (Ebbinghaus, 1885). This scoping study will focus on students in secondary schools. "Student self-assessment using computer based quizzes has been shown to increase subject memory and engagement while decreasing mind-wandering" (Witchel, et al. 2018). UCL Centre for Inclusive Education were appointed as consultants to guide the design of the pilot, analyse the data provided by the team and compile a report.

Method

Three schools, enrolling students in Years 7-10, agreed to take part in the initial pilot of the 'Lift Lessons' programme. Consent was obtained from all participants / parents / teachers and school headteachers. The Lift Lessons team were responsible for engaging with the schools and the students, for creating logins for each user and supporting teachers and students with logging in and using the programme.

At the start of the programme, a short quiz was presented to the students in order to create a baseline of results. The intervention consisted of each student having two weeks of access to the programme, it was envisaged that the students would carry this out as homework. However, the pilot took place in the last weeks of term, and it was anticipated by the team that this was a factor that could impact the project.

Four types of question were presented to the students throughout the study. These were: direct recall, use in context, use in a sentence and exam-type questions.

After the completion of all the activities and at the end of the two weeks, the students completed an end of pilot quiz in order for the team to gain an understanding of strengths and areas of development for the programme.

Future Opportunities

There are future potential opportunities to increase the scope of the study. They include looking at comparisons between students having allocated time in class to carry out the tasks, rather than home learning and exploring this in primary schools in guided reading sessions as a tool for teaches to monitor and ensure effective vocabulary teaching and learning. A third option could be to look at different groups of pupils within a specific age range, such as pupils with SEN, EAL, and differing attainment levels.

Literature Review

Spaced Learning

In 1885, Hermann Ebbinghaus discovered the “spacing effect” which stated that repetitions of the same learning content following a certain amount of time improves the retention of the content by flattening the ‘forgetting curve’ (Ebbinghaus, 1885). "There are more than 1000 published experiments that have observed a spacing effect in human memory, making the spacing effect the most highly replicated learning phenomenon in psychological science" (Vlach, et al. 2019). As can be seen, there is a long history of research on memory, and a key finding from this body of work is “the timing of learning events contributed to learners’ ability to remember information” (Vlach, et al. 2019).

In a trial looking at spaced learning and the acquisition and generalisation of science concepts, the results found that spacing lessons and content resulted in higher performance in both the retention of simple and more complex concepts (Vlach and Sandhoefer, 2012). Looking at long term memory acquisition, Kelly and Watson (2013) concluded that learning at an increased speed and in a way which involved deliberate distraction, produced significantly higher scores. This echoes the work of Kerfoot (2010) who studied learning in medical students. The study used a randomised control trial of using spaced learning as a technique and found an increased learning efficiency of 38%.

Sobel et al. “taught 39 children unfamiliar English words using both massed and spaced learning. Five weeks later, we tested vocabulary recall. One-week spacing produced superior long-term retention compared to massed learning” (2011). This study found that learning vocabulary through spaced learning resulted in a 35% higher recall 4 days later. As well as recall, spaced learning has also been credited with limiting mind wandering (Metcalf and Xu, 2016) and keeping learners on task.

“When it comes to optimising the relation between time spent learning and learning success, the spaced repetition approach is a widely accepted method” (Schimanke, et al. 2014). Utilising technology along with this spaced learning approach is a move away from the traditional flash cards method of delivery typically seen. Studies are looking at the place that technology has in this, and systems such as Synap (Witchel, et al. 2018) are utilising this approach. Additionally, Schimanke et al. (2014), alongside many others, advocate a learning by doing approach as being more immersive rather than just reading from a book.

Rationale for the creation of Lift Lessons (complied by Caroline Schaal)

The Lift Lessons approach uses evidence-based strategies including explicit vocabulary instruction, dual coding and computer-assisted vocabulary instruction. There is scope for additional research on the effectiveness of these strategies, especially when regarding the particular application for students with learning differences (Bryant et al, 2003). However, the studies which have been published have demonstrated these techniques to be effective in supporting students to acquire new vocabulary. This is particularly important in the science curriculum, which typically introduces large quantities of unfamiliar vocabulary at a fast pace (Clark & Paivio, 1991).

The first strategy discussed is explicit vocabulary instruction. This type of teaching, compared to direct teaching, has a larger positive impact on students, even when used in small, regular amounts, or over a short period of time (Maurulis & Neuman, 2014). Examples can include modelling sentences with the word, exposure to the word used in context and allowing students multiple practice opportunities with guidance (Bryant et al, 2003).

The explicit teaching of academic vocabulary is highly important for students as these are words which are not frequently used in conversation (Lesaux et al, 2014). This is particularly crucial for students with learning differences such as memory and

language deficiencies, as well as those without many independent word learning strategies. Such students ‘need explicit instruction and opportunities to practice’ (Bryant et al, 2003).

Research shows that many students need explicit vocabulary instruction before they are able to access textbooks in science and more traditional methods of vocabulary acquisition such as dictionaries (Kamel et al, 2008). These methods have been relied on and used by independent students but do present a barrier to others, such as students with learning differences. The main challenge with dictionaries, for example, are that they can contain multiple definitions for one word, and definitions may rely on unknown words (Bryant et al, 2003). Explicit vocabulary instruction supports students to be able to overcome these challenges.

The second strategy which Lift Lessons attempts to use is dual coding. Dual coding approaches present information which simultaneously activates both the verbal and nonverbal channels in the brain. Both of these channels are used to recognise and process information but studies have shown that their combination is particularly helpful (Clark & Paivio, 1991, Hall & Dougherty Stahl, 2012).

Dual coding theory looks at the concreteness, or the tangibility of the reference, and the imagery value of language, the degree to which it activates a mental image. Academic vocabulary can often rely on abstract concepts with low concreteness and imagery value. Studies have shown that this can make it more difficult to memorise and comprehend (Clark & Paivio, 1991, Lesaux et al, 2014).

Video can effectively use a dual coding approach in order to demystify some abstract concepts by making tangible links to definitions and invoking mental images. Videos can also provide verbal and nonverbal information at the same time, another key aspect of dual coding theory. Hall and Dougherty Stahl support the use of video in vocabulary instruction and call for more studies in their review of a selection of the

current research, ‘Devillainizing video in support of comprehension and vocabulary instruction’ (Hall & Dougherty Stahl, 2012). In one study, video was assessed in its ability to support students with understanding word meanings, concepts and reading contexts in a Special Education setting. Students who had watched the videos outperformed those that had received more traditional explicit vocabulary instruction when tested after just six weeks (Xin & Reith, 2001).

The most effective use of dual coding is to ask students to produce the mental image themselves. Some students are able to ‘image’ without much trouble but others will use this technique rarely and will struggle to do so. Signs that students find imaging difficult seem to range from a tendency not to remember the mental pictures brought to mind through reading imagery-heavy texts such as some poetry, as well as problems visualising geometric proofs, to a difficulty with spelling words or printing letters. Therefore, scaffolding and modelling is required to teach students to do this (Clark & Paivio, 1991).

The third strategy in the repertoire of communication friendly strategies to be discussed is vocabulary instruction assisted by technology. This is hampered by a lack of research available on computer-based vocabulary learning instruction. Its effectiveness has been investigated as early as 1987 by Johnson, Gersten and Carnine, but other studies into vocabulary teaching often overlook it (Moody et al, 2018).

The Johnson, Gersten and Carnine study assessed the effect of presenting written definitions in various formats and assessing students’ understanding using multiple choice questioning on the computer. It found that students with learning difficulties responded well to the multiple-choice questions in the intervention, but that this was not reflected in ‘transfer measures’, including an open-ended oral test of word recognition and passage comprehension (Johnson, Gersten & Carnine, 1987). Instead, a review of the research found ‘if the goal of vocabulary instruction is to teach word meaning, which can also transfer to reading comprehension, interactive

interventions that feature associative learning, conceptual relationships, and prior knowledge, should be selected' (Bryant et al, 2003).

'Vocabulary Instruction: A Critical Analysis of Theories, Research, and Practice' (2018) suggests that there may be benefit in further investigation into technology's potential to motivate students by helping them to develop self-efficacy and autonomy in vocabulary learning. The review of the research in this paper indicates that the main gains from computer-mediated instruction supported by current research appear to be the ability to give students multiple exposures and meaningful context (Moody et al, 2018).

However, Rahimi and Allahyari, in their paper 'Effects of multimedia learning combined with strategy-based instruction on vocabulary learning and strategy use', go further in the discussion of the benefits of computer-based vocabulary learning instruction. They found that it 'gives learners more control over the learning content… This affordance caters to individual differences and learners' needs' Rahimi and Allahyari, (2019). This also allows the learner some element of control over the cognitive load, increasing the capacity of the working memory. Their study also found that video could effectively be used to teach vocabulary learning strategies (Rahimi and Allahyari, 2019).

In addition, an enthusiastic review of research around gamified vocabulary learning, 'Gamified vocabulary; online resources and enriched language learning', found a lot of students to be motivated to practice with online learning tools which use components usually associated with recreational gaming (Abrams & Walsh, 2014).

There appears to be promising impact on learning across all of the aforementioned evidence-based strategies; explicit vocabulary instruction, dual coding and computer-assisted vocabulary instruction. The benefits can range from improved memorisation and processing of new vocabulary, to the suggestion that students could experience

greater independence in their word learning. It should be noted that all would benefit from further research and evaluation of related pedagogical techniques and resources.

Study Findings

Question 1: Does watching the animations affect the progress students make on vocabulary acquisition? Consider the effect of year group and the type of question (direct recall, use in context, use in a sentence, exam question).

Table 1 results showing the % gain between pre-intervention and post watching the videos

Year Group	Pre-intervention quiz average % score for year group	Post-video quiz average % score for year group	% difference between the two quizzes
7 & 8	49%	85%	+ 36%
9	48%	71%	+ 23%
10	45%	69%	+ 24%

There were 28 Year 7 and Year 8 students who participated in the pilot. The reason that these two-year groups are combined are that the groupings were often taught as mixed year groups. The average score for the pre-quiz for this group was 49%, the average score post-quiz following watching the videos was 85%.

The 'use in a sentence' type question saw the highest percentage change following the videos with it going from 38% to 97%. There were positive increases in scores for each of the question sets from these year groups.

There were 23 year 9 students who participated in the pilot, with an average score following the pre-intervention quiz of 48%. After watching the videos and completing the post-quiz questions, there was an average correct answer rate of 71% showing an average increase of 23% in correct answers. Use in a sentence (average 68%) and use in context (65%) questions showed the biggest difference (29% and 30% increase

respectively) in scores for this group through watching the videos. Interestingly, the exam style questions showed minimal difference.

There were 13 year 10 students who participated in the pilot, with an average score after the pre-intervention quiz of 45%. Following watching the videos, this increased to an average score of 69%.

There was no change in the score for the exam style questions, but an increase from 49% to 70% in direct recall questions and an increase of 19% of correct answers in the ‘use in a sentence’ questions.

From the three groups, we can see that each group increased their average score from pre to post quiz after watching the videos. The programme seemed to have little effect on answering exam style questions but using vocabulary in sentences and context were improved from pre-quiz to the post quiz across all groups, with the biggest difference being seen with the younger students with an increase in average score of 36%.

We can see an increase in positive scores that the students were achieving. This can be triangulated with pupil views of enjoyment watching the videos and ‘Lift Lessons’ being helpful when content is provided in this way (see Q3). Conclusions can be drawn to suggest that the videos seem to have contributed positively to increasing the student’s vocabulary acquisition and use.

It should be noted, that for some of the post-test responses, a record of ‘no data’ was recorded. In these instances that averages have still been used to compare to the pre-test data, but the formulas adapted to represent the number of responses received with a score recorded.

Question 2: Do repeated attempts practicing a question over time affect progress on vocabulary acquisition? Consider the effect of year group and the type of question (direct recall, use in context, use in a sentence, exam question)

Table 2 average % of scores from pre-intervention to post-intervention and spaced learning

Year group	Pre-intervention quiz average % score	Post-intervention quiz average % score	Post spaced learning average % score
7 & 8	49%	70%	71%
9	48%	71%	64%
10	45%	65%	50%

From the 28 Year 7 and Year 8 students who participated in the pilot, there was an increase in score from the pre-test quiz (49%) to the final quiz attempt (70%) and the spaced learning quiz (71%). This demonstrates that for this group, the way that the material was presented, both through video animations and spaced learning, led to an increase in their vocabulary acquisition and use. When looking at direct recall questions, 5 students scored 100% on the final quiz, when no student had scored this prior to the start of the programme.

When analysing the year 9 data, we can see that at the pre-quiz test, an average score was 48%. At the final quiz attempt this went up to 71% and at the quiz after the spaced learning this settled at 64% showing an increase of 16% over time. Questions that required being used in context showed the greatest increase for this group, with an increase in average score of 28% between the pre-test and final quiz. This group did not show any difference positive or negative in answering exam style questions.

For Year 10 students, they showed the smallest percentage increase from the pre-test to the post-quiz following the spaced learning, at 5%. There was however a 20% increase from pre-test to final quiz. Similar to the Year 9 group, no change was shown in the exam style questions over time, but questions around use in context increased from 42% to 54% following spaced learning.

We can see from the results presented, that all groups have achieved an increase in their average scores, with some students now scoring 100% on questions when following a spaced learning method which involves repetition. Exam style questions do not appear to be having an effect during this type of learning experience for the groups.

Question 3: What are the students' views on using technology to help learn vocabulary?

A total of 49 students answered 14 questions about their experience of using Lift Lessons. Not all of the students answered all of the questions, but themes can be drawn from the responses that were received.

When asking the students about the main reason that they liked the videos, there were four emergent themes; ease of use, animations to help learning, lots of information provided and how the words were broken down. There was one negative theme and this was around the platform not working.

When asked what they didn’t like about the animations, 39% of the students responded ‘nothing’, whilst 18% of the students felt that the animations were designed for a younger audience. Interestingly, most of the 9 students who commented on this were in either years 9 or 10, so the oldest students involved in the study.

When asked about how easy Lift Lessons was to use, two students did not answer, but 92% responded with either easy or very easy.

23% of the students felt that they learned more than 11 new words, with 65% learning at least one new word.

Overall, 92% of the students would consider recommending Lift Lessons to a friend.

Question 4: What are the teachers' views on using technology to help learn vocabulary?

12 teachers responded to the questionnaire, with some of the answers being incomplete. One teacher responded, but her class did not take part in the trial, so those results are being discounted.

When asked who was responsible for teaching English skills, including vocabulary, in schools, 100% of teachers who answered the question (10 total) responded that it was everyone's role, including parents. One teacher added that subject specific vocabulary should be taught by the relevant subject teacher.

When asked about the importance of subject vocabulary for the teaching and learning of the students, for those that answered the questions (10 respondents) 9 teachers reported that this was either important or very important. When probed further around the amount of times direct vocabulary teaching occurs in class, the majority of the respondents reported that this formed part of their teaching practice.

The teachers identified a range of teaching tools to teach vocabulary to their students, including repetition, loop cards, exam question practice and subject specific key words, many of these features appear in the Lift Lessons programme. Of the 10 respondents, when asked specifically about flipped learning as a teaching tool, 9 teachers reported this rarely being part of their regular teaching practice.

9 teachers reported that their initial thoughts on being able to use a computer programme to teach vocabulary was at least useful, with 9 also reporting that following the trial, they found this useful. One teacher reported initially a 4 (not very useful) and this improved to a 3 (could be useful).

Arising issues from the teacher's questionnaires are around there not being enough time in two weeks to be able to see progress, many of the teachers only encountered their students on a few occasions over this period. There were some technical issues also present, but on the whole, the teachers were positive of the programme and some were keen for a longer trial to look at the impact over a period of time. If a further study were to take place, a longer time frame and a different part of the school year could support mitigating these factors.

Conclusions

With 90% of teachers reporting a high importance on understanding of vocabulary on the teaching and learning of their subject, there demonstrates a need for a vocabulary teaching tool, which Lift Lessons provides. 92% of students reported that the programme was easy to use and students in years 7 and 8 made a 38% gain in test scores in a two week period.

The aim of teaching and learning vocabulary is for students to be able to learn and retain new words and use these in context. These preliminary results are promising in support of this goal. Each group showed a gain between the pre-quiz, final quiz and quiz after spaced learning. We would expect the quiz after spaced learning results to be a little lower than the final quiz due to the greater lapse of time without additional input. Year 10 students, whilst showing some positive gains, were at the lower end compared to other groups. When triangulating this with the pupil comments, Year 10 student comments around the programme included ‘being a little young’, and ‘aimed at younger students’. This opinion is consistent with our results showing lowest academic gains for Year 10. The younger year groups showed the greatest gains in average scores over the two week period.

The findings, as can be seen, from this initial scoping study are positive. It is suggested that a longer study take place in order to monitor progress over time and to ascertain how teachers can interact with the dashboard to monitor progress. Key groups can also be looked at, such as pupils with SEN, EAL, LAC and others to see which groups benefit most from this type of teaching intervention. A further consideration could be around adapting the questions and content delivery to suit a wider age range / ability.

References

Abrams, S., & Walsh, S. (2014). Gamified Vocabulary: ONLINE RESOURCES AND ENRICHED LANGUAGE LEARNING. Journal of Adolescent & Adult Literacy, 58(1), 49-58. Retrieved from http://www.jstor.org/stable/24034541

Bryant, D., Goodwin, M., Bryant, B., & Higgins, K. (2003). Vocabulary Instruction for Students with Learning Disabilities: A Review of the Research. Learning Disability Quarterly, 26(2), 117-128. doi:10.2307/1593594

Clark, J., & Paivio, A. (1991). Dual Coding Theory and Education. Educational Psychology Review, 3(3), 149-210. Retrieved from https://www.csuchico.edu/~nschwartz/Clark%20&%20Paivio.pdf

Ebbinghaus, H. (1885). Memory: A Contribution to Experimental Psychology , Dover, New York, NY in Schimanke, F., Mertens, R., & Vornberger, O. (2014). Spaced repetition learning games on mobile devices: Foundations and perspectives. Interactive Technology and Smart Education, 11(3), 201-222.

Hall, M., & Stahl, K. (2012). Devillinizing video in support of comprehension and vocabulary instruction. The Reading Teacher, 65(6), 403-406. Retrieved from http://www.jstor.org/stable/41853046

Johnson, G., Gersten, R., & Carnine, D. (1987). Effects of instructional Design Variables on Vocabulary Acquisition of LD Students. Journal of Learning Disabilities, 20(4), 206–213. doi: 10.1177/002221948702000402

Kamil, M. L., Borman, G. D., Dole, J., Kral, C. C., Salinger, T., & Torgesen, J. (2008). Improving adolescent literacy: Effective classroom and intervention practices. IES

practice guide. NCEE 2008-4027 National Center for Education Evaluation and Regional Assistance. Retrieved from http://eric.ed.gov/?id=ED502398

Kelley, P., & Whatson, T. (2013). Making long-term memories in minutes: a spaced learning pattern from memory research in education. Frontiers in human neuroscience, 7, 589.

Lesaux, N., Kieffer, M., Kelley, J., & Harris, J. (2014). Effects of Academic Vocabulary Instruction for Linguistically Diverse Adolescents: Evidence From a Randomized Field Trial. American Educational Research Journal, 51(6), 1159-1194. Retrieved from http://www.jstor.org/stable/24546714

Marulis, L., & Neuman, S. (2010). The Effects of Vocabulary Intervention on Young Children's Word Learning: A Meta-Analysis. Review of Educational Research, 80(3), 300-335. Retrieved from http://www.jstor.org/stable/40927284

Metcalfe, J., & Xu, J. (2016). People mind wander more during massed than spaced inductive learning. Journal of Experimental Psychology. Learning, Memory, and Cognition, 42(6), 978-984.

Moody, S., Hu, X., Kuo, L.-J., Jouhar, M., Xu, Z., & Lee, S. (2018). Vocabulary Instruction: A Critical Analysis of Theories, Research, and Practice. Education Sciences, 8(4), 180. http://doi.org/10.3390/educsci8040180

Rahimi, M., & Allahyari, A. (2019). Effects of Multimedia Learning Combined With Strategy-Based Instruction on Vocabulary Learning and Strategy Use. SAGE Open, 9(2), 215824401984408. doi: 10.1177/2158244019844081

Schimanke, F., Mertens, R., & Vornberger, O. (2014). Spaced repetition learning games on mobile devices: Foundations and perspectives. Interactive Technology and Smart Education, 11(3), 201-222.

Sobel, H., Cepeda, N., & Kapler, I. (2011). Spacing effects in real- world classroom vocabulary learning. Applied Cognitive Psychology, 25(5), 763-767.

Witchel, H. J., Guppy, J. H., & Smith, C. F. (2018). The self-assessment dilemma: an open-source, ethical method using Matlab to formulate multiple-choice quiz questions for online reinforcement. Advances in physiology education, 42(4), 697-703.

Vlach, H., & Sandhofer, C. (2012). Distributing Learning Over Time: The Spacing Effect in Children's Acquisition and Generalization of Science Concepts. Child Development, 83(4), 1137-1144.

Vlach, Bredemann, & Kraft. (2019). To mass or space? Young children do not possess adults' incorrect biases about spaced learning. Journal of Experimental Child Psychology, 183, 115-133.

Xin, J.F., and Rieth, H. (2001) Video-assisted vocabulary instruction for elementary school students with learning disabilities. Information Technology in Childhood Education Annual, 12, 87-103. Accessed Aug 2019 at https://www.learntechlib.org/primary/j/ITCE/v/2001/n/1/