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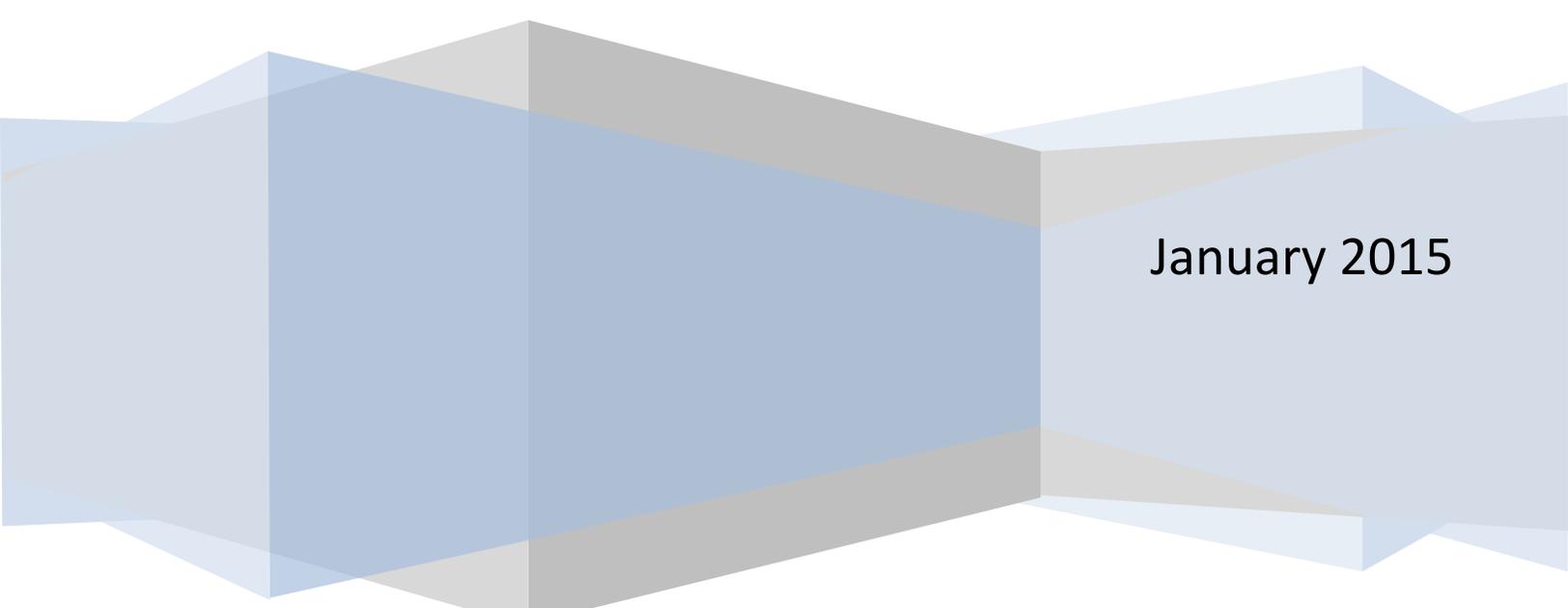
Impact of Vocabulary.com

On Middle School Students

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January 2015

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Vocabulary development plays an important supporting role in reading instruction. Educators are searching for ways to incorporate vocabulary as part of their English Language Arts curriculum. Understanding that, coupled with the continuing popularity of technology in education, companies are developing tools to marry the two in an effort to increase student success in reading. This report examined vocabulary development, gamification, and the use of adaptive learning in education. Specifically, it focused on the impact a gamification-type program had on students' engagement and success in reading. The program used for this study was Vocabulary.com.

Literature Review

Vocabulary Instruction

Vocabulary can be defined as the knowledge of words, their meanings, and the ability to use the words appropriately in language (Butler, Urrutia, Buenger, Gonzalez, Hunt, & Eisenhart, 2010; Biemiller & Boote, 2006). Due to the vast number of words in our language, Kamil and Hiebert (2005) claim that the skill of vocabulary is one that could never fully be mastered. The effects of a strong vocabulary have been linked to improvements in comprehension and fluency of reading (Butler et al, 2010, National Reading Panel, 2000; Zimmer, 2014). That is why it is one of the five major components of reading, along with phonemic awareness, phonics, fluency and comprehension (Butler et al, 2010; National Reading Panel, 2000). In addition, vocabulary growth aids students' written and expressive language skills.

Vocabulary instruction is imperative for all students, but especially those who are English as a Second Language (ESL) learners or come from low income homes. These students typically have a more limited vocabulary (Kelley, Lesaux, Kieffer, & Faller, 2010), and this becomes

especially problematic as students enter middle school and are expected to comprehend academic texts; essentially reading to learn as opposed to learning to read (Kelly et al, 2010; Lawrence, White, & Snow, 2010).

Throughout the years, there have been numerous research studies on best practices in vocabulary instruction. Many agree that quality vocabulary instruction involves direct teaching; repeated exposure; a focus on high frequency words; and the application of the word in different contexts. Most recently, there has been an emphasis on the use of computer technology to aid vocabulary instruction (Abrams & Walsh, 2014; Bromley, 2007; Butler, et al, 2010; Kamil & Hiebert, 2005; Kelly et al, 2010; Lawrence, White, & Snow, 2010; National Reading Panel, 2000; Nagy, Herman, & Anderson, 1985; Rubin, 2008; Texas Education Agency, 2002, Zimmer, 2014).

Students of all ages require direct teaching in vocabulary instruction to increase word learning. This instruction goes far beyond teaching words and their definitions. Instead, it requires teaching students about words (Kamil & Hiebert, 2005; Texas Education Agency, 2002). Some strategies include teaching words parts (prefixes, suffixes, and root words); effectively using the dictionary; appropriate and inappropriate use of words; and using context clues for word meaning.

For optimal learning gains in vocabulary instruction, repetition and multiple exposures to a word is necessary (Butler, et al, 2010; Kelly et al, 2010; Lawrence, White, & Snow, 2010; National Reading Panel, 2000; Nagy, Herman, & Anderson, 1985). Multiple exposures provide opportunities for students to review the word; hear and see it used in different contexts; and relate the word to their world and learning. Over time, the word becomes incorporated into students' active vocabulary, which improves reading comprehension and expression.

Choosing the correct words to target for instruction is also a crucial component to vocabulary instruction. First, the concept of quality versus quantity is applicable. For example, it is less important that students be exposed to 20 new words a week and quickly move onto another 20 the next week whether or not the previous week's words have been mastered. Conversely, vocabulary instruction should focus on fewer words with a deep understanding of each word's meaning and use (Kelley et al, 2010). Secondly, the words chosen should be those that students will encounter and utilize frequently, sometimes known as delivery words; Tier Two words; or high utility words (Butler, et al, 2010; Kelly et al, 2010; Lawrence, White, & Snow, 2010; Nagy, Herman, & Anderson, 1985). These words are not necessarily content specific, but rather, are general purpose academic words.

Providing multifaceted opportunities for students to hear, see, and use vocabulary words in different contexts will enhance learning. Because word learning is complicated, dependence on a single program or strategy is not enough. Definitions are important, but students also need opportunities to make word connections; understand its function in context; analyze the word structure; decipher the multiple meanings of words; and interact with the word visually, verbally, and expressively (Bromley, 2007; Kamil & Hiebert, 2005; National Reading Panel, 2000; Rubin, 2008; Texas Education Agency, 2002).

Students are growing up in a digital world, and therefore there has been an increased focus on the use of technology and its impact on vocabulary instruction. The National Reading Panel (2000) suggests that vocabulary development is enhanced when students are actively engaged, and multimedia has been shown to engage and motivate students. Vocabulary instruction through technology often provides students with the opportunity to engage in word play while also providing repeated exposure to words (Abrams & Walsh, 2014; National

Reading Panel, 2000; Texas Education Agency, 2002).

Adaptive Learning

One trend in educational technology is adaptive learning. Differentiating learning for individual students is common practice in today's classroom, but it is often very difficult for teachers to do with the high number of students they teach. However, technology has allowed for this type of personalized instruction through what is called adaptive learning (Water, 2014). Adaptive learning can be used for instruction, remediation, review, or pre-teaching. When a student interacts with adaptive learning, the program accumulates and tracks data continuously, as well as makes appropriate adjustments to questions. Because of this, adaptive learning programs are said to be assessment driven instruction, which is another popular trend in education (Water, 2014).

Adaptive learning is so powerful because of its ability to scaffold instruction -- a necessary strategy for quality learning. Students enter learning situations with a wide variety of backgrounds and knowledge. Adaptive learning allows for instruction to begin and continue on a path that supports the learner with the appropriate content, at the appropriate pace, in the appropriate manner (Chen, 2014; Shute & Towle, 2003). The ultimate result of adaptive learning is efficiency in learning by targeting the learner's specific needs, effective instruction with appropriate scaffolding, and enjoyment in the learning process due to the interactive and motivational factor of using technology (Chen, 2014; Shute & Towle, 2003; Water, 2014).

There are key characteristics for adaptive learning technologies. First, quality programs should not only track questions learners got wrong, but also understand why they were incorrect (Water, 2014). Additionally, motivation and learning increase when there is interaction between

the student and the technology. Therefore, interactive, formative assessment is a key component of adaptive learning (Chen, 2014). Lastly, all students have different learning styles. An adaptive program should not be simply tailored to a learner's knowledge. It should also adjust to their personal learning style's strengths and weaknesses, which results in additional rigor and effectiveness (Chen, 2014).

Gamification

A form of adaptive learning technology that is increasing in popularity is gamification. The idea of gamification began in 2010, and at the time, was utilized mostly in business marketing (Hamari, Koivisto, & Sarsa, 2014; Huotari and Hamari, 2012; Simoes, Redondo, & Vilas, 2013). In the business arena, it has become widely successful in increasing motivation, engagement, and encouraging desired behaviors (Huang & Soman, 2013). While game-based learning has been utilized as an effective educational strategy, the idea of combining game play, adaptive learning, and technology is still emerging.

As mentioned, gamification in education is still a young topic. Thus, much research still needs to be conducted to measure its effectiveness and to provide a solid, universal operational definition. Gamification, in its simplest definition, is the application of game-like elements in a non-game situation (Abrams & Walsh, 2014; Hamari, Koivisto, & Sarsa, 2014; Huang & Soman, 2013; Huotari and Hamari, 2012; Simoes, Redondo, & Vilas, 2013). Game-like elements include points, rewards, leader boards, and other recognition. Non-game situations/environments include school learning, educational tasks, and specific subject matter. The success in gamification is the influence that the game-like experience has on desired behavior, such as motivation, engagement, and a desire to continue playing (Hamari, Koivisto, & Sarsa, 2014; Huotari and Hamari, 2012; Huang & Soman, 2013).

A battle that educators consistently face is that of motivation and engagement in learning. While additional studies still need to be conducted on gamification, it has been shown to turn learning tasks from a “mundane task into an addictive learning process for the students” (Huang & Soman, 2013, p. 24). In addition, gamification has been shown to minimize negative emotions that students experience with traditional learning. An example of this would be a student’s fear of getting an answer wrong in front of the class. This is minimized because of the individualized learning method associated with gamification (Huang & Soman, 2013). However, it should be noted that gamification’s effectiveness is only as powerful as the interaction between the player of the game and the game itself. To increase interaction, gamification must provide the user appropriate challenges; some control of the game-like elements; feedback on progress; and an overall feeling of accomplishment (Abrams & Walsh, 2014; Hamari, Koivisto, & Sarsa, 2014).

Vocabulary.com

Vocabulary.com is an example of adaptive learning that uses the concept of gamification for educational purposes. As the name suggests, this learning tool focuses on vocabulary development and is designed for any learner from higher elementary school into adulthood. As users interact with the program, it immediately adapts to the individual’s vocabulary level using complex algorithms based on item response theory (IRT). The system provides users with immediate feedback on each question, which aids in their learning of targeted vocabulary. It also evaluates a user’s progress and keeps track of trouble words.

All words are repeated in questions through nine different question types, including the use of definitions; synonyms; antonyms; and context sentences. A user must convince the system that they have mastered a word by correctly answering a minimum number of questions about that word and its multiple meanings over time. Engagement is increased through its gamification

features, which include a reward and points system. Vocabulary.com is for individual users, as well as for classroom use. Teachers can track progress, target specific trouble words, and monitor students' usage. Vocabulary.com is a prime example of adaptive learning with a gamification approach and focuses on one of the essential elements of reading education.

Methodology and Procedures

Purpose of the Study

Gamification in education is still emerging, and educational research needs to analyze its effectiveness. Vocabulary.com uses elements of gamification as described by the experts above. In addition, Vocabulary.com uses best practices in vocabulary instruction. It does this specifically when used to enhance learning, not as the primary instructional tool. This study is designed to determine the impact of Vocabulary.com on middle school users. The primary focus is on academic achievement. Since vocabulary instruction impacts overall reading comprehension, effectiveness will be measured by the use of participants' standardized test scores in the area of reading. There will also be a focus on other variables, such as attendance and teacher.

Research Questions

The research questions for this study were:

1. Does high, consistent engagement of Vocabulary.com impact the academic abilities of seventh and eighth grader students as seen on standardized test scores in reading?
2. To what extent is the difference between students who have high, consistent engagement of Vocabulary.com compared to students who have low or inconsistent engagement with Vocabulary.com?

3. To what extent is the difference between students who have high, consistent engagement of Vocabulary.com compared to other students in the school and district?
4. How does high, consistent engagement of Vocabulary.com impact the attendance of seventh and eighth grade students?
5. Does the teacher play a role in student engagement with Vocabulary.com?

Setting and Participants

This study took place in a public middle school in southwest Florida. For the purpose of the study, the school will be called Southwest Middle School. It was chosen because of its high engagement with Vocabulary.com. For example, during the 2013-2014 school year, the school won the monthly Vocabulary.com national school leaderboard award twice. This competition includes all schools that use the Vocabulary.com program, including high schools with larger populations. Southwest Middle School is made up of approximately 700 students. Of those, 52% were considered Economically Needy and 40% had a primary home language other than English. The majority race was split between Caucasian and Hispanic, both at 43%.

The students chosen for this study were seventh and eighth graders. Sixth grade students at Southwest Middle School were eliminated from the study so comparison analysis could be done with the prior school years data and sixth grade students were not a part of the school the year prior. Participant demographics can be seen in Table 1. Of the seventh and eighth grade students, purposeful sampling was used to identify specific students with high, consistent engagement with Vocabulary.com, as well as low, inconsistent engagement with Vocabulary.com. A total of 96 students' data was included; 55 high users and 41 low users.

Table 1

Participant Demographics

Demographic	7 th Low	7 th High	8 th Low	8 th High
White	43%	52%	30%	56%
Hispanic	43%	48%	63%	38%
Black	7%	0%	4%	8%
Asian	7%	0%	4%	0%
Male	43%	52%	55%	59%
Female	57%	48%	45%	41%

Procedures

Vocabulary.com sent the researchers de-identified student data on usership of the program. Students were de-identified by name and given a random student number. This data is what Vocabulary.com collects on all users of the program because each user logs in with a unique username and password. Because of the variety of the program’s data, there were several areas of data collection including words mastered, questions answered, time logged in, and points earned.

From there, students were purposefully selected as high, consistent users of the program from the start of the school year up until standardized testing. The students were identified on multiple criteria including a ratio of words mastered to questions answered of 6% and higher, and having mastered at least 15 new words per month for a minimum of four months. In addition, possible participants were eliminated if they were missing three or more months of data. Low, inconsistent students were also identified. These were students who had less than a 3% ratio of words mastered to questions answered. Many of these students had four or more months of no use in the program at all.

Once students were selected by the researchers using their random student number, Vocabulary.com sent the names of students to the district for data collection of student test scores, demographics, and attendance. At no time did the researchers connect student numbers to student names. The information was once again de-identified by their random student number before being sent back to the researchers.

Results

The purpose of this study was to examine the impact of high, consistent use (known as high users through the remainder of the paper) and low or inconsistent use (known as low users through the remainder of the paper) of the Vocabulary.com gamification learning tool on academic achievement and attendance. In order to compare the academic achievement of the selected participants to each other and to other seventh and eighth grade students in the school and district, standardized testing data was used for analysis. In the state of Florida, the Florida Comprehensive Assessment Test (FCAT) is utilized to mark student academic achievement. This study used data on the reading portion of the FCAT, because the review of literature above shows the impact of vocabulary development on overall fluency and comprehension. In addition, 20% of the questions on the FCAT Reading assessment in seventh and eighth grade are specific to vocabulary, documented as “Words and Phrases in Context”.

Academic Achievement – Developmental Scale Score

FCAT Reading scores are reported in different manners. The first analysis of data was on the Developmental Scale Score (DSS). DSS results are reported on a vertical scale and are used to track a student’s annual progress. The scores are not designed to be used for direct comparison to the previous year. Therefore, this analysis focused on the 2013-2014 school year only - the year Vocabulary.com was utilized school-wide. The DSS of selected participants was found

separately for seventh and eighth grade groups. Table 2 shows the Reading DSS for the high users, the low users, the school averages for both grades, and the district averages for both grades.

Table 2

Southwest Middle Schools Reading Scores

Grade	High Users	Low Users	School Average	District Average
Seventh Grade	252	241	237	231
Eighth Grade	272	234	245	239

The higher users in both the seventh and eighth grade groups scored well over the school average. This was more predominant in eighth grade with 27 points higher, whereas seventh grade was 15 points higher. In contrast, the eighth grade low user group scored significantly lower than the school average with a difference of 11 points. This was not the case in seventh grade where the low users scored just above the school average. When analyzing individual student scores, only 26% of eighth grade low users and 50% of seventh grade low users scored above the school average. However, 94% of eighth grade high users and 81% of seventh grade high users scored above the school average.

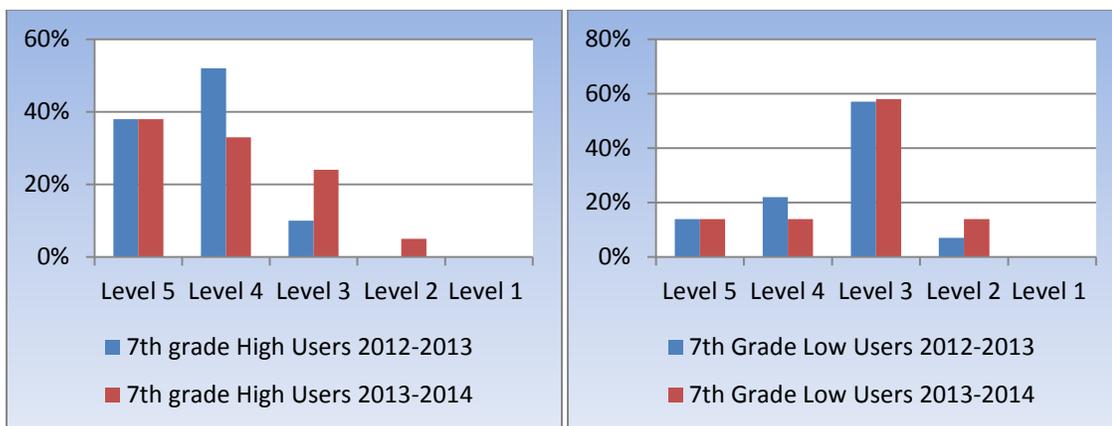
In addition to school data, participant scores were compared to district scores and similar results were found. The higher users in both the seventh and eighth grade groups scored well over the district average. This was more predominant in eighth grade with 33 points higher, where seventh grade was 21 points higher. In contrast, eighth grade low users scored lower than the district average with a difference of 5 points. This again was not the case in seventh grade where the low users scored ten points higher than the district average. The results of the DSS for the year of program utilization suggest that Vocabulary.com does impact academic achievement.

Academic Achievement – Achievement Levels

The FCAT also reports student data in the form of Achievement Levels. Using the DSS and the student’s grade, an Achievement Level of 1-5 is given where 1 is “inadequate” level of success; 2 is “below satisfactory”; 3 is “satisfactory”; 4 is “above satisfactory”; and 5 is “mastery”. Figure 1 shows the Achievement Levels of the high and low user groups in seventh grade. For the purpose of comparison, the information is provided for both the year of Vocabulary.com implementation and the year prior.

Figure 1

Achievement Levels of Seventh Grade Participants



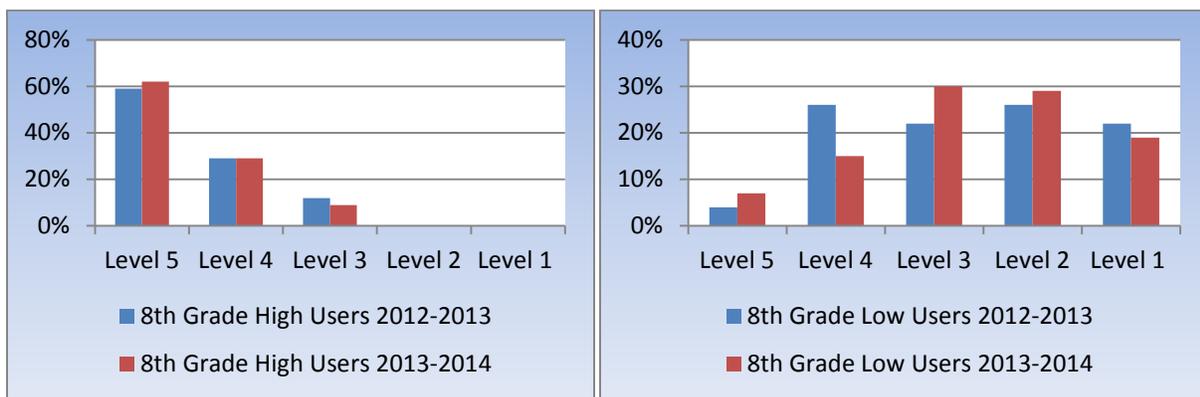
In seventh grade, there was not a significant difference in gains made between the high user group and low user group. When examining the data by participant, 38% of seventh grade high users increased an Achievement Level or remained at the highest level (Level 5), but similarly, 36% of the low users did the same. On the contrary, seventh grade high users had 33% of participants decreasing an achievement level, while only 28% of the low users decreased.

The same analysis was done for eighth grade users and the group results can be seen in Figure 2 with differing results. A significant 61% of eighth grade high users increased an

Achievement Level or remained at the highest level (Level 5), but only 33% of low users increased. Upon examination, only 18% of high users, but 26% of low users decreased an achievement level between the two years. While there seemed to be no strong connection between high users versus low users and increase in achievement levels in seventh grade, the same was not true in eighth grade. High usership of Vocabulary.com in eighth grade did positively impact achievement levels.

Figure 2

Achievement Levels of Eighth Grade Participants

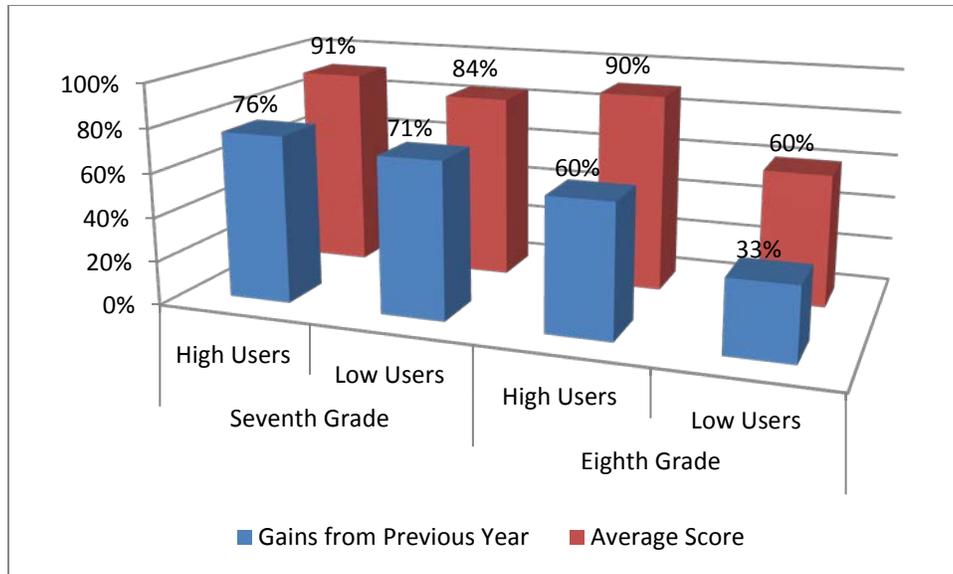


Academic Achievement – Vocabulary Portion of the FCAT

The data reports documented by the district allowed for analysis to be completed on just the questions on the test pertaining to vocabulary and word knowledge. This portion makes up 20% of the reading test. Using Figure 3, high users in both seventh and eighth grade scored higher than low users. In addition, both seventh and eighth grade high users made more gains than low users from the previous year. From this data, it is evident that high engagement with Vocabulary.com impacted scores on the vocabulary and word knowledge portion of the assessment, with a large difference in eighth grade.

Figure 3

Analysis of Vocabulary Questions



Attendance

Academic achievement was the primary focus of the study, but a look at attendance data was evaluated as well. Gamification is known to increase motivation and engagement, so it was possible that high, consistent use of Vocabulary.com could impact attendance in school. Table 3 shows the attendance rates of the participants. The percentage of low users in seventh grade who increased their attendance between the two years was greater than the high users. In eighth grade, there was no difference. Using this information, there is no evidence that high use of Vocabulary.com impacts attendance. It is worth noting, however, that Vocabulary.com can be played both at home or at school, because students can log into the internet-based website anywhere there is access to the World Wide Web.

Table 3

Average Days Attended

	2012-2013	2013-2014	Difference	Students who Increased Attendance
7 th Grade High Users	173	172	-1	29%
7 th Grade Low Users	176	174	-2	46%
8 th Grade High Users	175	175	0	44%

8 th Grade Low Users	171	172	+1	44%
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Teacher Impact

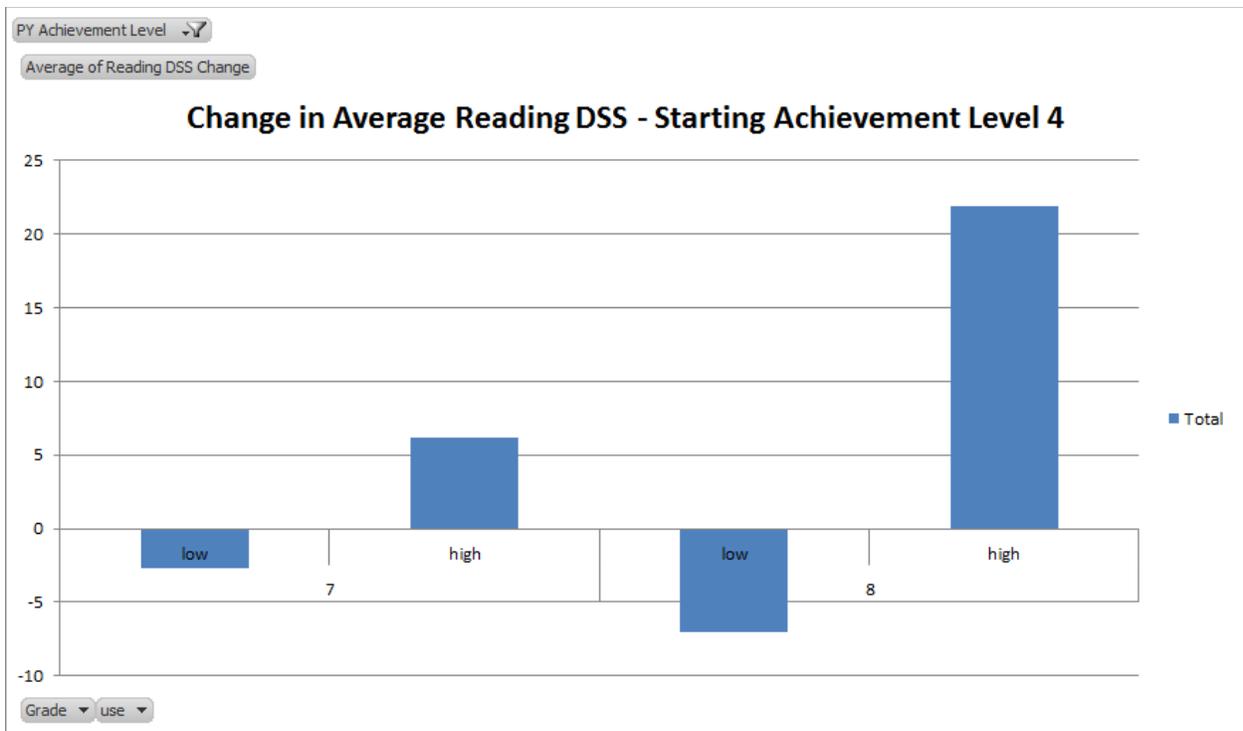
Data analysis allowed the researchers to examine the role of the teacher on student engagement. Vocabulary.com was a whole school initiative so all students had access and an introduction to the program. However, 85% of the high users had the same English Language Arts teacher. Similarly, 71% of seventh grade high users had the same English Language Arts teacher. This indicates that teacher emphasis and promotion impacts usership.

Subgroup Testing

Participants for the study were chosen based on usership of Vocabulary.com, as outlined above. Once standardized tests scores were collected on participants, the diversity in the students' achievement levels for the baseline year was noted. It was decided that an analysis of students with the same starting achievement level could be conducted. For the purpose of documenting growth between high users and low users with similar starting achievement levels, a subgroup of students were chosen from the original participants. The participants chosen all had a Level 4 achievement level for the baseline year, which included 14 students in seventh grade (three low users and eleven high users) and 17 students in eighth grade (seven low users and ten high users). Figure 4 shows the change in average reading DSS scores for these students. Both seventh and eighth grade high users made positive gains, with the greatest gains in eighth grade.

Figure 4

Change in Average DSS Scores



Discussion

As seen by the data analysis, high consistent usership of Vocabulary.com can impact the academic achievement of students as seen on the reading portion of the FCAT standardized assessment. These results were stronger for the eighth grade participant group more than the seventh grade participant group. Participants of the study in both seventh and eighth grade scored higher than the school average as well as the district average. Conclusions on low usership had inconsistent results, with eighth grade low usership yielding lower scores than school and district averages, but seventh grade low usership scoring higher than school and district averages. For that reason, it was important to address differences between the seventh grade and eighth grade participants.

There were stark differences between the high users in eighth grade and the high users in seventh grade. This was mostly seen in the ratio of words mastered to questions answered. While all high users were identified as having a ratio of 6% or higher, the top 12 users in eighth grade

had 8% and higher, with the school's top user being a part of this group. On the other hand, only the top three seventh grade users had a ratio that was above 8%. Although one is unable to compare eighth grade DSS scores to seventh grade DSS scores, it is worth noting the 20 point difference in eighth grade high users versus seventh grade high users. Meanwhile, there was only an eight point difference in the school's average scores in seventh and eighth grade.

In examining the low usership ratios in seventh and eighth grade, another major difference occurs. All of the low users in the eighth grade group had a less than 1% ratio, meaning they hardly used the program. However, in seventh grade, the ratio grew up to 3%. While still considered low usership, the seventh grade students identified had more experience and time-on-task with the program. As the results showed, the seventh grade low users had higher scores than eighth grade low users, and higher scores than the seventh grade school and district averages. Moreover, the eighth grade low users with little or no time-on-task with the program had a significantly lower DSS score than the high users, and the eighth grade school and district average. Therefore, even some interaction with Vocabulary.com, compared to no interaction with the program, positively impacted scores.

These results show a more specific correlation between of the ratio of words mastered and questions answered to achievement levels of the FCAT reading test. Specifically, the students with the higher ratios scored significantly higher than the school and district average. The students with the lowest ratios scored significantly lower than the school and district averages. When looking at the high versus low users in eighth grade, there is larger gap in terms of their ratio. This directly correlates to the vast difference in the DSS reading score in eighth grade between the high and low users with a difference of 38 points. Meanwhile, there was a

difference of 11 points between seventh grade high users and low users. While different, this was not as significant as the results seen in eighth grade.

It is also important to recognize the assessment scores of the participant groups prior to the introduction of Vocabulary.com. In seventh grade, the high user participants scored an average of 16 points higher on the reading assessment than the low users. Similarly, eighth grade high users scored an average of 36 points higher than low users the year prior to using Vocabulary.com. In addition, 87% of the top users in seventh and eighth grade combined already had the highest Achievement in reading, a Level 5. This shows that Vocabulary.com may appeal more to already high-achieving students.

Focusing on the scores of Southwest Middle School alone, it is important to note the setting was purposefully chosen for its overall high usership of Vocabulary.com. This could have had impact on the overall school DSS reading averages for both grade levels. All students were immersed in the Vocabulary.com culture as they were visited by Vocabulary.com staff members to receive the Vocabulary.com Championship Banner twice in the school year. As seen in Table 1, Southwest Middle School's seventh and eighth grade averages were above district averages.

Limitations

There are limitations to this study. First, this study was limited to seventh and eighth grade users and does not include impact for other grade levels. Additionally, student achievement in this study is defined by standardized reading test scores as reported by the FCAT. There may have been other factors such as school and district initiatives, which impacted reading scores. Furthermore, there are other ways to measure impact on academic achievement other than standardized test scores. Lastly, Vocabulary.com, like all gamification programs, requires desire and motivation by the user. It could be inferred that the students who would engage more

with the program are motivated to learn and succeed, and thus that natural motivation as a learner is the reason for higher FCAT reading scores.

Recommendations for Future Research

Gamification in education is a growing trend. Adaptive programs that use the motivation of game-like features for the purpose of academic growth, like Vocabulary.com are under the spotlight. For that reason, the following are recommendations for future research. This study was limited to the impact of the program over a single school year. A longitudinal study on a student's use of the program for an extended period of time combined with its impact on academics is suggested. This study used Reading FCAT scores to define academic achievement. It is recommended that impact in other areas, such as writing, or using other measures aside from standardized testing be conducted. Specific participant groups of future studies should also be examined, for example ESL learners, high school students, at risk students, students with similar starting achievement levels, or gifted learners. Lastly, increasing or changing the setting is recommended, such as a district-wide study, multiple schools, or a focus on schools with a vastly different demographic.

Summary

This study was designed to determine the effectiveness of Vocabulary.com on middle school users. Since vocabulary instruction impacts overall reading comprehension, effectiveness was measured by the use of standardized reading test scores of participants, specifically the FCAT. Results showed that seventh and eighth grade students who had high, consistent engagement with Vocabulary.com had higher reading scores than students with low, inconsistent engagement with the program. Furthermore, the group with the higher ratio of engagement using words mastered to questions answered yielded even higher results compared to school and

district averages. These results were stronger for eighth grade students. Engagement with the program was positively impacted by teacher promotion and utilization as part of the curriculum. There exists a correlation between high, consistent engagement with Vocabulary.com and reading test scores on the FCAT, with the greatest effect on already high performing students.

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