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Exploring the Use of Podcasts and Vodcasts: Multimedia Tools for Word Learning

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Abstract

The study investigated the impact of podcasts and vodcasts accessed through an iPod on fourth- and sixth-grade students' vocabulary acquisition. Students were randomly assigned to either a podcast group or a vodcast group. Regardless of group assignment, each student completed three six-minute podcasts or vodcasts a day for three days. On average, students learned four out of nine words taught regardless of group assignment. The vodcast group learned significantly more words compared to the podcast group at the receptive level and at the expressive level. Student comments indicated that iPods should be used to teach and to review words.

Keywords

iPods; vocabulary instruction; mobile learning; podcasts; vodcasts; adolescence

Evidence shows that vocabulary diversity strongly correlates with oral language skills and reading comprehension (Beimiller, 2006). Between third grade and high school graduation, an average student's lexicon will grow from 13,000 words to 40,000 words (Flanigan, Hayes, Templeton, Bear, Invernizzi, & Johnston, 2011). To experience such a lexical growth, a student must learn a minimum of seven words a day (Flanigan et al., 2011). Direct and indirect vocabulary instruction that includes repeated exposure to words presented in rich context has shown to be effective for teaching vocabulary [Hairrell, Rupley, & Simmons, 2011; National Reading Panel (NRP), 2000]. However, these methods routinely require teacher-student interactions and can be time consuming, ranging from several minutes a day (Baumann, Edwards, Boland, Olejnik, & Kame'enui, 2003) to week-long instruction (Apthorp, 2006).

Preliminary evidence supports the use of computer-assisted learning as a best practice for vocabulary instruction and assessment (NRP, 2000). Specifically, mobile devices have the potential of revolutionizing the role technology plays in vocabulary instruction. Unlike their stationary counterpart, the desk top computer, mobile devices are handheld computers that can be accessed regardless of time and location. The relatively inexpensive cost of these devices makes it financially affordable for schools to purchase sufficient quantities so that all students can actively use them (Mifsud, 2004).

Because mobile devices are in essence handheld computers, information can be created and uploaded to the device for viewing at a later time. *iTunes U* and *YouTube* are prime examples of Web-based repositories for audio and video files created and uploaded by individuals for others to access via a desk-top computer or mobile device. The term *podcast* refers to audio-only files, which are similar in nature to a radio broadcast. Audio files—which include visuals in the form of text, graphics, and/or movies—are referred to as *vodcasts*. Podcasts (audio-only files) and vodcasts (audio and video files) have several advantages that make them conducive for vocabulary instruction. First, the static nature of podcasts and vodcasts make them a favorable pre-instructional strategy to in-depth word analysis or as a tool for reviewing previously taught words. Explicit definition work is noted as an effective practice for establishing initial word meanings (Jitendra, Edwards, Sacks, & Jacobson, 2004). Second, podcasts and vodcasts can be downloaded to a mobile device and viewed at any time, thereby circumventing dependency on teacher-provided instruction. As a result students can be exposed to large quantities of words over the course of a school year. Stahl and Shiel (1999) advocated for the direct instruction of 300–400 new word meanings a year in order to improve students' lexicons. Third, the content of podcasts and vodcasts can be structured to allow for multiple exposures to a new word. McKeown, Beck, Omanson, and Pople (1985) contended that approximately 12 meaningful encounters with a new word are required before sufficient understanding is acquired. Fourth, podcasts and vodcasts are economical alternatives to commercially available software programs. Because school personnel can create podcasts and vodcasts, no per-user fees are incurred by the school as is common with commercially available software packages. Once created, podcasts and vodcasts can be downloaded to multiple devices, allowing for whole grade levels of students to receive instruction.

Empirical evidence supporting the use of podcasts and vodcasts for educational purposes is emerging, with the majority of studies focusing on the use of mobile devices by adult learners (Cheung & Hew, 2009; Hew, 2009). A limited evidence-base exists supporting the use of this technology for teaching vocabulary to school-aged children. For example, Putman and Kingsley (2009) investigated the effects of investigator-created podcasts as a supplemental tool for teaching 22 science terms to typically developing fifth-grade students. Each week students listened to a podcast, which supplemented teacher- and textbook-provided instruction. Students who listened to the podcasts demonstrated a significant increase in words learned compared to those who received classroom instruction only. The results should be interpreted with caution as the investigators did not maintain control over the podcast intervention. No information was provided regarding the number of words taught per podcast, the length of the podcasts, or the actual number of times the students listened to the podcasts. Borgia (2009), using a case study method, also reported improved vocabulary learning by fifth-grade students when investigator-created podcasts were used as a supplemental teaching tool. Again, these findings should be interpreted with caution, as the procedures were vaguely described and inconsistencies in administration of the podcasts were noted across students.

Since mobile devices are the “vessel” for offering instruction, attention must be paid to the instruction design. Selection of the best presentation mode is noted as a challenge when developing computer-based programs for educational purposes (Acha, 2009). Studies

indicate that simultaneous presentation of verbal and visual information can enhance or detract from learning if too great a demand is placed on cognitive processing (Mayer & Moreno, 2010; Tindall-Ford, Chandler, & Sweller, 1997). Cebeci and Tekdal (2006) noted that podcasts should not exceed 15 minutes and that music should be interspersed with content to increase listenability.

Mobile devices are being used by educators as an instructional tool. Unfortunately, strong empirical evidence supporting their use for teaching vocabulary is either lacking (Borgia, 2009); Hairrell et al., 2011; Hew, 2009; Putman & Kingsley, 2009), or primarily addresses adult learners (Cheung & Hew, 2009; Kennedy, Hart & Kellems, 2010). Little is known about the effectiveness of mobile devices for vocabulary instruction with children and which mode of presentation, podcast or vodcast, is best for teaching. The purpose of this exploratory study was to investigate the utility of investigator-created vocabulary modules presented on an iPod for teaching vocabulary to fourth- and sixth-grade children. Specifically, this study sought to collect preliminary data in an effort to answer the following questions:

1. What effects does an investigator-created vocabulary module presented on an iPod have on fourth- and sixth-grade students' learning of novel nouns?
2. Does the presentation format, podcast versus vodcast, produce differential effects on the number of words learned?
3. What are students' perceptions of vocabulary learning through an investigator-created vocabulary module presented on an iPod?
4. Does the presentation format, podcast versus vodcast, affect students' perceptions of learning words through an investigator-created vocabulary module presented on an iPod?

METHOD

Participants

Forty (83%) fourth-grade students and eight (17%) sixth-grade students participated in the study. Fourth-grade students were recruited from two classrooms identified by the principal as not including students with known disabilities. Sixth-grade students were recruited from 27 eligible students identified by the sixth-grade teachers. All students attended the same school in rural central Pennsylvania and were in mainstream classrooms. No student was receiving special education services for cognitive, learning, and/or language deficits as reported by the classroom teachers. All students were native English speakers. The Receptive One-Word Picture Vocabulary Test – 4 (ROWPVT, Brownell, 2010) and the Expressive One-Word Picture Vocabulary Test - 4 (EOWPVT, Brownell, 2010) were administered to assess single-word knowledge. The fourth-graders' mean score on the ROWPVT was 112.58 (range = 88 – 143, *SD* = 12.95) and the mean score on the EOWPVT was 114.33 (range = 82 – 145, *SD* = 13.81). The sixth-graders' mean score on the ROWPVT was 108.5 (range = 95 – 119, *SD* = 8.04) and the mean score on the EOWPVT was 104.75 (range = 93 – 126, *SD* = 10.69).

Students were randomly assigned to one of two instructional groups, podcast group (24 students, 21 fourth-graders and 3 sixth-graders), or vodcast group (24 students, 19 fourth-graders and 5 sixth-graders). Regardless of group assignment, each student completed one podcast or vodcast each day for three consecutive days.

Target Words

Nine two-syllable, concrete novel nouns were used in the study (zebu, rupee, culvert, mukluk, coffer, zither, zebu, hassock, hamlet, and chigger). Novel nouns were selected to control for potential ceiling effects resulting from previous exposure to selected words. The nine words were chosen from a list of 18 two-syllable concrete nouns and were deemed to be novel because 90% or more of 27 first-year graduate students majoring in speech-language pathology could not provide a definition for these nine words and neither could three typically developing adolescents in the eighth grade.

Vocabulary Modules

The investigator created three vocabulary modules, each designed to teach three words. A total of nine words were taught across the three modules. The modules were created using a Macintosh desk-top computer, Final Cut Express - 4 (Apple, 2007), a video-editing software suite, and Live Type - 2 (Apple, 2006), a software program used for creating dynamic text. The modules were created in two formats, audio only (podcasts) and audio supplemented with graphics (vodcasts). Instructional parity between the podcasts and the vodcasts was preserved by deleting the video track associated with the vodcasts. Thus, the podcast group only heard the instruction, while pictures and words supported auditory explanations heard by the vodcast group.

Each of the three vocabulary modules followed the same instructional sequence. The description that follows illustrates the sequence and content of a vodcast module. The reader is reminded that graphics (pictures and text) were deleted from the podcasts modules; otherwise, the sequence and content remained the same between the podcasts and vodcasts. Each module consisted of three segments: (a) priming for learning, (b) instruction on the three words, and (c) a review of the three words. Priming the student for learning was achieved through a musical prelude followed by the introduction of the three words to be taught. As the word was introduced, the student saw its orthographic representation appear on the iPod screen while simultaneously hearing it pronounced. Finally, the student was instructed that word learning required correct storage of the word's phonemic properties and meaning.

Next, explicit instruction on each of the three words was provided. Phonemic and semantic information was provided for the first word, followed by the second word, then the last word. To support accurate phonological storage of the word, the narrator segmented the word into individual phonemes as the corresponding graphemes appeared on the screen. Next, the word was segmented into syllables while the corresponding graphemes, clustered by syllables, appeared on the screen. For example "The sounds in *zebu* are z-e-b-u. It has two syllables ze-bu." Last, a phonemically similar word was introduced to prevent phonemic confusion. A picture of the similar word along with its spelling was visible on the screen.

For example, “Don’t be confused by the word zebra” (picture of zebra and word appeared on the screen). The phonemic difference between each word was verbally and visually highlighted to the student. This was done by the narrator stressing the phonemic difference as the grapheme differences in each word were animated for emphasis. For example, “*Ze bra* ends with *bra* and *Zebu* ends with *bu*.”

Phonemic instruction was followed by semantic instruction, which consisted of a definition, the word used in a sentence, and a potentially semantically confusing word(s). The definition included four pieces of semantic information: the superordinate category to which the word belonged, a physical attribute, an action/function associated with the word, and a semantic association. For example, *zebu* was defined as an animal (superordinate category) that looks like a cow (semantic association) but has a hump between its shoulders (physical attribute), and is used to pull wagons (action/function). A written definition and a picture were displayed on the screen as the definition was spoken. Explicit definition instruction is noted as an effective first step in establishing word meaning (Biemiller, 2009; Stahl & Fairbanks, 1986). The word was then used in a sentence, thereby providing contextual support (Beck & McKeown, 2007; NRP 2000). Finally a semantically similar word(s) that could be confused for the target word was provided along with an explanation of the differences between the target word and the semantically similar word. For example, a cow and a camel were identified as semantically similar words to zebu.

Each module ended with a review of the three words. Music alerted the student to the start of the review, which consisted of three tasks: generating the word for the definition provided, generating the definition for the word provided, and determining if the word was used correctly in a sentence. For the last activity, the focus was on the phonemic structure of the target word, not correct syntactical use. For example, “The man bought food with *rubies*.” Written text corresponding to the spoken word was provided for each of the above three activities. After each activity, the student was given time to mentally generate an answer after which the correct the answer and an explanation were provided (Juel & Deffes, 2004; Stahl & Shiel, 1999).

The average length of the three modules was 6 minutes and 7 seconds. Each word was spoken by the narrator between 15 and 17 times. *Zither*, *chigger*, *coffer*, and *mukluk* were spoken 15 times, *culvert*, *hassock*, and *zebu* were spoken 16 times, and *rupee* and *hamlet* were spoken 17 times. Differences in the number of presentations among the nine words can be attributed to differences in the number of semantically confusing words presented. For example, zebu had two semantically confusing words, whereas culvert only had one. Additionally, explanations provided for some words resulted in the word being spoken more frequently. For example, the students were cautioned not to confuse the definition of *hamlet*, a small village, with Shakespeare’s play, *Hamlet*.

Dependent Measures: Investigator-Created Vocabulary Measures

Three investigator-created measures were developed and administered to capture students’ expressive word learning and receptive word learning of taught words at pretest, posttest, and follow-up. Each measure consisted of a practice item to allow for task learning followed by test items. The stimulus items on each investigator-created measure were randomly

reordered at posttesting and follow-up testing in an effort to control for order effects. Specific information regarding each measure, including administration procedures and scoring procedures, follows:

Picture identification measure—The picture identification measure assessed expressive learning by requiring the student to name the picture shown, a format similar to the EOWPVT. To check for transferability, the pictures used differed from those used in the vodcast versions of the vocabulary modules. The items were scored as correct or incorrect. To be scored as correct, the student had to say the precise name of the picture. Any phonemic differences in pronunciation that altered the word's phonology were scored as an error. For example, if a student said *haddock* for *hassock*, the response was scored as an error.

Definition measure—The definition measure also assessed expressive learning by requiring the student to provide a definition for the stated word. The directions for this measure were as follows: "I'm going to say a word and I want you to tell me what each word means. Tell me as much as you know. For example, if I said, 'What's a ball? You could say it's round, it bounces, it's a toy, a basketball or baseball are a type of ball.' Now you do one. What's a..." Each response was worth four points; one point for each attribute given, superordinate category, physical attribute, action/function, and semantic association.

Word selection measure—The word selection measure captured receptive learning by requiring the student to point to the picture named by the test administrator from a field of four choices. The measure's format, test administration, and scoring mimicked that of the PPVT. Each set of four choices was comprised of pictures that depicted the target word, a phonemic foil, a semantic foil, and an unrelated unusual word. For example, when assessing the target word *zebu*, the four choices presented were a picture of a zebu (target word), a zebra (phonemic foil), a cow (semantic foil), and a colander (unusual word). The pictures used for the target word, the phonemic foil, and semantic foil differed from those used in the vodcast versions of the vocabulary modules.

Student Perception Survey

An investigator-created survey was administered to capture students' perceptions of the vocabulary modules and the utility of an iPod as an instructional tool. The survey consisted of 26 items. Twenty-two statements used a 4-point Likert scale (*really agree, agree, disagree, really disagree*) to capture students' perceptions. Two versions of the survey were created. Statements 1, 2, 3, and 11 were altered slightly between surveys in order to ascertain students' satisfaction with their assigned presentation format, podcast versus vodcast. The remaining 22 items were consistent across the two versions.

Statements 4, 5, and 7 were designed to elicit feedback regarding the instructional procedures (e.g., highlighting phonemic and semantic confusions, review at end of each module). Statements 6, 8, 12, 13, 14, 18, and 19 inquired about the overall structure of the modules (e.g., rate of speech, prefer seeing a person, length, number of words taught). Item 19 used a cloze format to elicit the number of words that should be taught at a time.

Statements 9 and 10 inquired about the students' perceived confidence in their abilities to correctly pronounce the words taught and knowledge of the words' definitions. Statements 15, 16, and 17 inquired about the frequency with which iPods should be used for teaching vocabulary. If a student really agreed or agreed with the statement in Item 15 (Listening to the iPod each day got boring) then item 16 used an open-ended format as a follow up. Statement 17 used a cloze format to elicit the number of days a week the student would want to listen to an iPod when learning new words. Statements 20, 21, 22, and 23 inquired about when in the learning process iPods should be used. Statements 24 and 25 ascertained overall satisfaction with iPods as an instructional tool by having the student rate whether he or she would recommend the use of iPods to a friend and if the school should incorporate iPods into instruction. Item 26 used an open-ended format and asked, "What else should we know about using iPods for teaching new words?"

Procedures

Prior to the presentation of the vocabulary modules, the ROWPVT, the EOWPVT, and the three investigator-created vocabulary measures were administered. After pretesting, the student, as dictated by group assignment, either watched or listened to a vocabulary module presented on an investigator-provided Apple brand 80 GB iPod classic. The iPod classic was operated using a click wheel and had a 2.5 inch (diagonal) color screen display. All students wore headphones when listening to or viewing a module. The fourth-grade students completed the modules in small groups of five to six students during a morning break in academic instruction. The eight sixth-grade students completed the modules as a group in an empty classroom during an afternoon break in academic instruction. A new module teaching three words was completed each day for three consecutive days. In total, students received 18 minutes of instruction regarding nine words across three consecutive days.

The three investigator-created vocabulary measures and the student perception survey were administered the week after instruction ended. One-month after posttesting, the three investigator-created vocabulary measures were administered to assess maintenance of word learning.

For treatment fidelity, the investigator provided each student with an iPod that had the appropriate vocabulary module, 1, 2 or 3, in the assigned format, ready for listening or viewing. The student simply had to press play on the click wheel to start the vocabulary module. The investigator also checked volume levels to ensure audio could be heard prior to distribution of the iPods. The investigator monitored the students as they completed the modules. Upon completing each module, the student was instructed to name the three words taught on that module. The iPods remained in the investigator's possession across intervention days.

Statistical Methods

All baseline characteristics were descriptively summarized and compared between the vodcast and podcast groups using Fisher's exact test or 2-sample t tests with equal variance for categorical and continuous outcomes respectively. There were three main outcomes of interest: picture identification, definition, and word selection. One-way ANOVA models

were considered in order to perform Levene's test of homogeneity of variance over time points as well as between the two treatment groups for each of the four outcomes. Mixed models were then constructed with one between-group factor (treatment assignment: podcast/vodcast) and one repeated measures factor (time: pretest, posttest, follow-up), and first-order interactions. Model selection was utilized using AIC criteria, and all models were adjusted for unequal variances between time points only, and denominator degrees of freedom were calculated using the Satterthwaite approximation. Statistical significance was determined at $p = 0.05$, and Bonferroni corrections were utilized for any post-hoc analyses between time points to adjust for multiple comparisons. All data analyses were conducted using SAS (Statistical Analysis System) Version 9.3 for Windows (SAS Inc., Cary, NC).

RESULTS

Group Comparison

The podcast and vodcast groups each had 24 students. Randomization between the groups was considered successful as there were no significant differences between groups at baseline. An independent samples t test with equal variances revealed no significant group differences on either the EOWPVT or the ROWPVT.

Picture Identification Measure

Table 1 presents unadjusted means and standard deviations for the three measures. The mixed model revealed a significant main effect of time ($p < 0.001$), but not of group or of time by group interaction. Significant learning occurred from pre- to posttesting (mean improvement = 2.71, $p < 0.001$) and from pre- to follow-up testing (mean improvement = 3.04, $p < 0.001$), but not from post- to follow-up testing (mean = 0.34, $p = 0.48$).

Definition Measure

The mixed model revealed a significant main effect of time ($p < 0.001$), group ($p = 0.02$), and time-by-group interaction ($p = 0.02$). Both groups only demonstrated significant learning from pre- to posttesting (mean improvement = 5.04, $p < 0.001$) and from pre- to follow-up testing (mean improvement = 5.33, $p < 0.001$) but no difference from post to follow-up (mean = 0.29, $p = 0.54$). Overall, significantly more words were defined by the vodcast group than the podcast group (mean = 0.29, $p = 0.02$).

Student Perception Survey

Twenty-two statements were rated using a 4-point Likert scale with 1, being *really agree* and 4 being *really disagree*. The remaining four questions used an open-response format. A preliminary analysis of the data using the 4-point scale resulted in small sample sizes per response category. In an attempt to better capture students' perceptions, responses were collapsed into a 2-point scale with 1 = *agree* (ratings of 1 or 2) and 2 = *disagree* (ratings of 3 and 4). Due to a lack of homogeneity between groups, statistics tests for comparing group responses could not be performed. Therefore, results are reported by the percentage of students in each group who either agreed or disagreed with each statement.

Regarding presentation format 79% or more of the students in both groups felt they were able to learn the words' meanings and pronunciations via their assigned presentation format. The vodcast group (87.50%) did not feel that seeing pictures hindered learning, while the podcast group was neutral as to whether seeing a picture hindered their learning. The majority of students (79.20%) in both groups felt that pictures did or would have facilitated learning. At least 95% of students were confident that they could pronounce the words and knew their meanings upon completion of the modules. The vodcast group (87.50%) did not prefer seeing a person over hearing a person; whereas, the podcast group had a more neutral response.

Regarding the instructional procedures used to teach the words, at least 79% of the students, regardless of group, felt that highlighting phonemically and semantically confusing words promoted learning. All students in the podcast group found the review at the end of each module *helpful*, while 87.50% of students in the vodcast group found it *beneficial*.

Overall, the structure of the modules was rated favorably by students. The vodcast group had a neutral response as to the usefulness of music for signaling transitions in instruction, while two-thirds of the students in the podcast group found it helpful. The majority of students (91.70%) believed the narrator did not speak too quickly. At least 83% of the students did not believe the lessons were too long or too short. The majority of students in the vodcast group (91.70%) did not find learning three words at a time difficult; whereas 25% of the podcast group did. When asked how many words would be ideal to learn at a time, responses ranged from one to five words for both groups. Learning three words at a time was ideal for 54.20% of the vodcast group; whereas 29.10% of the podcast group preferred to learn two words or three words at a time. Five words were the preferred number for 20.90% of the podcast group, but only 8.30% of the vodcast group agreed. Learning four words at a time was favored by 16.70% of students in both groups. Remaining students in the vodcast group answered with two words (12.50%) or one word (8.30%), and 4.20% of the podcast group felt one word was best.

Regarding the role of iPods in vocabulary instruction, at least 83% of students did not find listening to the iPod each day boring. The lack of graphics (e.g., "Same thing over and over and nothing to look at," "Pictures would have helped; keep from looking around the room") or repetitiveness of the modules ("Going back and forth between the lessons and review and knowing what I had to do made it boring") were cited as reasons for believing an iPod would become boring if listened to each day. When asked to state the ideal number of days iPods should be used for vocabulary instruction, responses ranged from one to seven days for the vodcast group and two to seven days for the podcast group. Listening to an iPod three days a week was preferred by 34.80% of the students in the vodcast group; whereas 26.10% of the podcast group preferred using the iPod two days or four days each week. Two days, four days, or five days each week were preferred by 17.40% of students in the vodcast group, while 8.70% of students preferred seven days and 4.30% preferred one day a week. Three days (21.70%), five days (17.40%), or six days (8.70%) were each ideal for students in the podcast group.

Both groups believed iPods should be used to teach new words (91.70% of vodcast group and 83.30% of podcast group). The vodcast group (91.70%) did not prefer books, class notes, or a teacher over iPods for learning new words. However, the podcast group did not feel as strongly (75%). Twenty percent of students in the vodcast group and 37.50% of students in the podcast group believed iPods should be used to review words taught by a teacher, not to teach new words. At least 83.30% of students would tell their friends that iPods are a good way to learn new words and believed that the school should use iPods to teach new words.

Question 26 was opened-ended and elicited additional comments the students may have had about the study. Thirty-three students answered the question, 16 from the vodcast group and 17 from the podcast group. Four general themes emerged. Thirteen comments related to the first theme, *overall satisfaction with iPods*. Eleven comments were positive toward the use of iPods (e.g., “I really liked it”). One comment indicated satisfaction but not enough to recommend it (“There wasn’t anything I didn’t like, but wouldn’t recommend it). One comment was negative (“It was boring”). Two students believed they learned the words, but one student also commented that it was “hard to remember [the word] afterwards” but was “easy to learn and do.”

Ten comments focused on the second theme, *presentation format*. Six students in the podcast group expressed a desire for visuals, whether in the form of pictures or words. Three members of the vodcast group felt pictures were beneficial, while one member believed that too many pictures were presented.

Twenty comments were made about the modules’ *instructional procedures*, the third theme. Seven out of eight comments indicated that the review at the end of each module was beneficial. Two comments related to the use of syllable segmentation as a strategy for teaching a word’s pronunciation. One student in the podcast group liked the use of syllable segmentation; whereas one vodcast group member felt it was annoying. Six students liked being informed of potential semantic/phonemic confusions (“Don’t be confused by ...”). Four comments were random observations.

The final theme related to the *logistical* use of iPods as an instructional tool. Two students believed the iPods negated ambient classroom noise, thereby making it easier to hear the instruction. Three comments focused on the number of words that should be taught. One student felt students should maintain autonomy over the number of words learned at a time, while another student cautioned that teaching too many words at a time should be avoided. Two students believed boundaries for when and why iPods are appropriate should be set (“We should know that it’s not for gaming or for listening to music” and “iPods be used between classes as not to interrupt instruction”). Two comments related to the technical aspect of iPods. A member of the podcast group felt the music was too loud at times. A student in the podcast group found the malfunctioning of an iPod, which resulted in a delay in his completing the module, to be frustrating.

DISCUSSION

This exploratory study sought to provide preliminary data regarding the effectiveness of investigator created vocabulary modules presented on iPods for teaching new words to adolescents and whether the presentation format, podcast (audio-only format) versus vodcast (audio and visual format), produced differences in the number of words learned. Results show that students learned words regardless of presentation format; however, more words were learned by the vodcast group than the podcast group at the receptive and expressive levels.

Word learning is an evolving process with more words being understood than actually used. Each encounter with a word refines, while deepening, one's knowledge of the word (Beck & McKeown, 2007). As a result, a person understands and uses words within his or her lexicon with varying degrees of precision (Baker, Simmons, & Kame'enui, 1998). Given the evolutionary nature of word learning, a judicious discussion of a strategy's effectiveness for teaching vocabulary must evaluate its contribution to breadth and depth of word learning (Coyne, McCoach, Loftus, Zipoli, & Kapp, 2009; Pullen, Tuckwiller, Ashworth, Lovelace, & Cash, 2011).

Breadth of Word Learning

The first purpose of the study was to determine if iPods could be used to teach new words to students. Results show that regardless of presentation format students learned many of the words taught, thereby increasing the breadth of their lexicons or, that is to say, the number of words about which they knew something. Specifically, after only receiving 18 minutes of instruction (two minutes of instruction per word) across three consecutive days, both groups were able to receptively identify a minimum of seven words, define a minimum of four words, and provide the label for a minimum of two words at posttesting. These findings are exciting because 300–400 words should be taught a year (McKeown et al., 1985; Stahl & Shiel, 1999) and similar gains as seen in this study required between 360–1,080 minutes of adult provided instruction (Lubliner & Smentana, 2005; Nash & Snowling, 2006; Nelson & Stage; Twyman, McCleery & Tinda, 2006). Some researchers might argue that students in the current study only acquired rudimentary knowledge of the words (Nagy & Anderson, 1984). While this is a fair observation, we know from the literature that not all words must be known at a deep level of knowledge (Baker, Simmons, & Kame'enui, 1998). Furthermore, research is clear that multiple methods are best for teaching vocabulary (NRP, 2000).

The explicit nature of the instruction may account for word learning, regardless of the presentation format. These findings align with converging evidence supporting the benefit of explicit instruction for initial word learning (Jitendra et al., 2004; McKeown & Beck, 2004). Further support can be gleaned from student comments such as “Really liked when they told you what not to confuse the word with ...,” “Liked that they gave similar words in sound and meaning,” “The reviews were very helpful,” “Liked the review. Helped me remember ... like answering the questions and seeing if I was right or wrong.”

The findings of the current study suggest that iPods could be used as a means for quickly establishing initial word knowledge on which deeper levels of understanding can be layered. Using iPods to teach new words is supported by student comments such as “It’s easier than reading a book,” “It is more entertaining than the teacher talking, so it got my attention better,” and “You actually hear it more than you hear your teacher.”

Depth of Word Learning

The second purpose of the study was to determine if presentation format produced differences in the number of words learned. Results indicate that the vodcast group learned significantly more words than did the podcast group at the receptive level (low depth) and at the expressive level (more in-depth). The integration of visuals within the vodcasts most likely accounts for the group differences observed. The printed words and pictures (visual channel) reinforced the narration (verbal channel), thereby decreasing cognitive overload (Mayer & Moreno, 2010). Unlike the vodcast group, the podcast group had to construct a mental picture of the word as semantic information was provided, thereby increasing the cognitive load (Mayer, Mathias, & Wetzell, 2002). Student comments support this hypothesis. Three students in the vodcast group noted that pictures were beneficial and six students in the audio group commented that pictures would have been beneficial. Boredom also may account for group differences as extrapolated from comments made by the podcast group, “Pictures would have helped; keep from looking around room”, “Just sit there and listen to people talking, “Same thing over and over and nothing to look at”.

The current study used two measures to capture expressive learning, picture identification and definition generation; both were expressive tasks but required recall of different pieces of information. There were no meaningful group differences on the picture identification measure; however, the vodcast group defined more words than did the podcast group at posttesting. Complexities associated with phonological encoding, which are required for expressive tasks, may account for the observed differences. Producing a word requires a person to connect semantic information to a word’s phonological properties, which are then translated into speech movements (Golinkoff & Hirsh-Pasek, 1999). The definitions used known words to define an unknown word (e.g. “A zebu is a *cow* with a *hump* between its *shoulders* and is *used* to *pull* wagons.”). Therefore, it is reasonable to assume that students possessed an established phonological-semantic connection of the words used in the definition thereby making it easier to accurately recall the definition; whereas naming the picture required accurate retrieval and connection of newly stored semantic and phonemic information (Nash & Donaldson, 2005). Production tasks such as picture naming have proven to be difficult for children (Ellis Weismer & Hesketh, 1996).

Regardless of group assignment, fewer words were learned at the expressive level than at the receptive level. Differences between receptive and expressive learning may be attributed to the learning demands inherent within expressive language. The expressive tasks, as used in the study, assessed a deeper level of word knowledge than did the receptive task (Coyne et al., 2009; Pullen et al, 2011). It is reasonable to assume that the brief, explicit format of the instruction was sufficient for establishing initial word meanings but was insufficient for promoting deeper levels of knowledge. This is not surprising as ample evidence

demonstrates that repeated exposures and interactions with words in multiple contexts are required for full word knowledge to be acquired (NRP, 2000).

Finally, the large standard deviations noted on the two expressive measures, Picture identification and definition, indicate variability in the number of words learned per student. A similar magnitude of variability was not observed at the receptive level. These findings imply that learning outcomes achievable through vocabulary modules accessed through an iPod may be more homogenous across students at the receptive level than at the expressive level regardless of presentation format.

Maintenance of Word Learning

Vocabulary instruction is only effective if lasting increases in a child's lexicon are achieved. Maintenance of word learning has been identified as a critical variable missing from the current research literature (Hairrell et al., 2011). To address this gap, students' retention of words learned was assessed at one-month post instruction. Results indicate that students' receptive and expressive knowledge of words learned did not deteriorate over the one-month period regardless of presentation format. These findings are very positive toward iPods as an instructional tool for producing immediate changes in receptive and expressive learning that are maintained across time.

Student Perceptions

Regardless of presentation format students believed that they had learned the words and felt that schools should use this form of technology. The majority of students (91.7%) in the vodcast group indicated a preference for iPods over books, class notes, and teachers for learning new words. The sentiment was not as strong for the podcast group, with 37.5% of students preferring books, class notes, or teacher-delivered instruction as compared to iPod-delivered instruction. The visual aspect of the vodcast may account for group differences as supported by student comments: "Disliked having no pictures" and "Put pictures on the iPods so you can see what it is." Many students commented that iPods would be an effective tool for reviewing words previously taught.

In regard to instructional content and presentation format, students felt being made aware of semantically and phonemically confusing words facilitated learning. Students indicated that pictures did or would have facilitated learning; however, the podcast group did not perceive the lack of pictures as a hindrance to their learning. The review at the end of each lesson was rated favorably by both groups. Students, regardless of group, did not feel that the duration of the modules (six minutes) was too long or too short. Students were mixed as to the number of words that should be taught in a single module and the frequency of iPod use in a single week. Although neither group found learning three new words to be difficult, recommendations for the perfect number of words to be learned at a time ranged from one to five words, with two or three words being the response provided most often by students between the groups. Similarly, the frequency of viewing ranged from one to seven days, with three days being recommended by the greatest percentage of students. Student comments indicate that they should have autonomy over which words to learn and the number of words

to be learned at a time. Finally, neither group felt strongly about the benefits of music for signaling transitions.

Study Limitations and Future Research

Since this was an exploratory study, the generalizability of these findings is limited. A small sample size was used with a disproportionate number of fourth-graders to sixth-graders. The positive nature of these results justifies a future study comprised of a larger sample size with equivalency in the number of students among grade levels and a control group. Second, a deeper understanding of the combinations of presentation format and module structure that produce positive learning gains is needed. The current study contrasted a podcast to vodcast format for teaching three words at a time. Future studies should compare static to interactive modules and vary the duration of modules and number of words taught. Third, the words selected for instruction were not academically relevant and were all nouns. Future studies should utilize more educationally relevant word classes. Last, the sustainability of learning effects produced by iPods should be investigated. iPods were not an instructional tool used at this school. Therefore, it is reasonable to assume that learning may have been influenced by the novelty of the iPod. Students were more attentive to the instruction because it was presented in an innovative manner. Student learning might wane over time if iPods were a standard instructional tool.

CONCLUSIONS

The impact vocabulary knowledge has on academic achievement is undisputed. The findings of the present study make an important contribution to the literature by providing preliminary evidence in support of short, static vocabulary lessons presented on an iPod as an effective tool for teaching word meanings. Specifically, 18 minutes of instruction across three days was sufficient for establishing receptive knowledge and expressive definition knowledge of 44% of the words taught, regardless of presentation format. The inclusion of graphics did significantly increase the number of words students in the vodcast group could identify receptively and could define as compared to the podcast group. However, presentation format did not impact the number of words students could label. The retention of words learned one-month post- instruction, regardless of presentation format, was promising. Furthermore students felt confident that they had learned the words. They perceived short bursts of instruction delivered via an iPod favorably for learning and reviewing new words. In the words of a student, “You guys should be doing this!”

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Table 1

Unadjusted Group Scores by Measure at Points-in-Time

Measure	Vodcast group (MeanSD)	Podcast group (MeanSD)	Cohen'sd
Picture Identification			
Pretest	0.00 (0.00)	0.04 (0.20)	−0.28
Posttest	3.08 (2.41)	2.38 (2.12)	0.31
Follow-up	3.42 (2.45)	2.70 (2.20)	0.31
Definition (9-point scale)			
Pretest	0.17 (0.48)	0.33 (0.56)	−0.31
Posttest	5.88 (2.09)	4.71 (1.92)	0.58
Follow-up	6.21 (2.30)	4.96 (2.77)	0.49
Definition (36-point scale)			
Pretest	0.21 (0.51)	0.38 (0.65)	−0.29
Posttest	13.29 (5.75)	10.33 (5.41)	0.53
Follow-up	14.08 (5.87)	11.35 (6.46)	0.44
Word Selection			
Pretest	2.43 (1.89)	3.58 (2.59)	−0.51
Posttest	8.67 (0.87)	7.87 (0.85)	0.93
Follow-up	8.50 (0.78)	8.00 (1.24)	0.48