

# Review of Words & Monsters - A Free Vocabulary Game

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## Abstract

Words & Monsters is a free game that teaches the most frequently occurring vocabulary words for general English and for a number of other special purposes. Words & Monsters combines a patented adaptive technology with fast-paced multiplayer game action. As each new player begins, the word-puzzle tasks steadily adapt to that player's lexical ability. After about 20 minutes the game will have identified which specific words the player already knows and correlated their vocabulary ability to scores on standard proficiency tests such as: TOEFL, TOEIC, IELTS, EIKEN, and a hensachi score for Japan's kyotsu shiken. Words & Monsters then skips over the words that a player already knows and focuses on teaching the most frequently occurring vocabulary words the player does not know. The game allows for both multiplayer and solo play. When playing with others, a player's ability level provides no advantage; effort and focus are what matter most. Words & Monsters is available in the App Stores and it is suitable for ages 8 and up at any level of ability. This review summarizes all aspects of the Words & Monsters game and its learning management system for teachers.



## Background

People with strong English vocabularies generally experience greater success in education and career opportunities. The direct study of vocabulary with flashcards and word lists has been shown to quickly improve comprehension in both specific subject domains and general English. Studies have shown that direct study of vocabulary with flashcards is faster and provides better comprehension and longer memory retention than indirect study through reading and aural discussion (Naeimi & Chow, 2015; McLean & Hogg, 2013).

## Personal Digital Flashcards

Words & Monsters directly teaches high-frequency vocabulary through a variety of study tasks designed to increase visual, aural, and contextual comprehension of each word and its meaning. The game's database isolates and separately teaches the different meanings of polysemous words and it also teaches the most frequently occurring phrasal verbs. Words & Monsters offers each learner their own personalized deck of digital flashcards that appear in three types of paired-associate learning tasks; visual, aural, and contextual. To the degree possible, Words & Monsters defines and teaches each learner their new vocabulary using only words and meanings the learner already knows. In Words & Monsters, the distractors (incorrect answers) displayed during study tasks are: 1) the same part of speech; 2) more difficult than the item being taught, and 3) randomized to reduce the likelihood of pattern recognition.



### Words & Monsters Begins with VCheck

VCheck is a vocabulary diagnostic test that identifies which specific words a person already knows and which specific words they do not know. VCheck is what allows each player to study a personally tailored list of the most frequently occurring words they don't know (Browne & Culligan, 2008). VCheck also reports correlated scores for well-known proficiency tests and tracks score increases as a player makes progress with the game.

VCheck is a simple and intuitive process with visual and aural Meaning Decision Tasks. The VCheck testing process takes about 20 minutes and players will likely not even notice that a test is taking place. Once completed, VCheck will create a master list of the player's unknown words from among the 16,736 total base words in the game's adaptive dictionary. These 16,736 base words cover 99 percent of a 1.5-billion-word corpus of spoken and written English representing all genres.

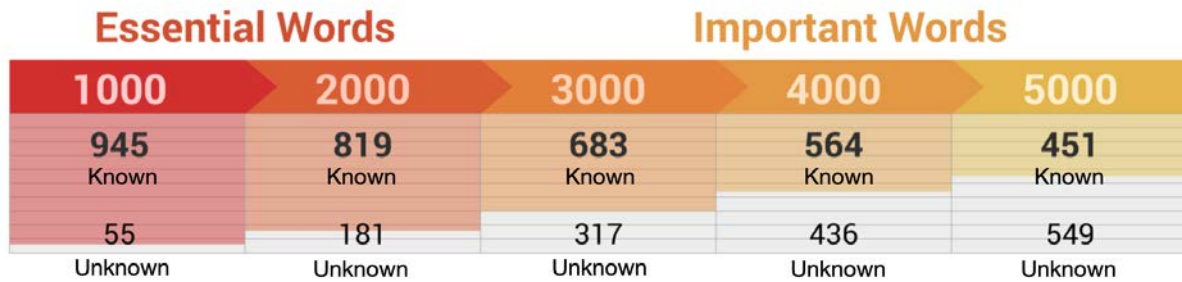
### Vocabulary Gaps and Coverage

Learning and memorizing the highest-frequency words is highly beneficial for language learners however, due to environmental differences, people do not naturally acquire their words in the order of word frequency. As a result, practically all English learners have gaps in their comprehension of the 5,000 most frequently occurring words.

As a baseline for reference, a typical American high-school graduate knows about 11,000 of the 16,736 base words that constitute 99 percent of all word occurrences in the English language whereas a typical Japanese high-school graduate knows about 1,200 of the 16,736 base words. The VCheck test in Words & Monsters will report how many base words each player knows for General English and for the special purpose domains such as TOEFL and IELTS.

The Words & Monsters game will be most beneficial for students who currently know somewhere between 500 to 5,000 total English words based on their past study experiences. The vocabulary gaps in such students' knowledge of high-frequency vocabulary are likely to be causing them excessive frustration. By teaching each player the highest-frequency words that they do not know, Words & Monsters can provide an effective way to quickly and efficiently increase lexical coverage and comprehension.

## High-Frequency Words in 1000-Word Bands



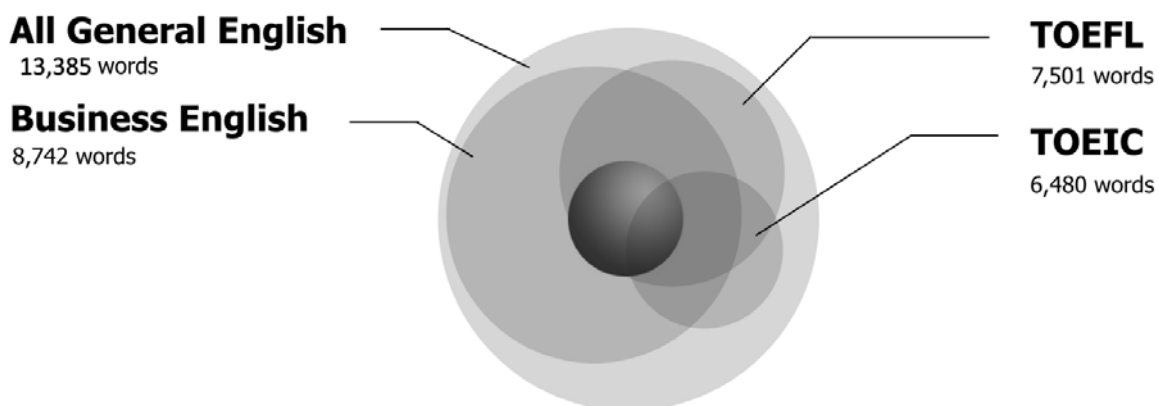
In the figure above we see a breakdown of a VCheck score for a typical intermediate-level learner with a TOEFL iBT score of 55. This learner has a total English vocabulary size of 5,004 words however they do not know 1,538 words among the first 5,000 most frequent words. In particular, the 236 unknown words among the first 2,000 most frequent words are presenting a major obstacle for this learner. Words & Monsters teaches each learner their missing words in the order of word frequency. Words & Monsters quickly and efficiently fills high-frequency vocabulary gaps.

### General English and Special-Purpose English

In addition to the General English course there are 13 special purpose courses including for proficiency tests such as: TOEFL, IELTS, TOEIC, EIKEN, kyotsu shiken, and more. For General English, the game teaches new vocabulary based on word frequency in all genres, subjects, and contexts. For a special purpose such as TOEFL, words are prioritized based on frequency within a 1.25-million word TOEFL corpus. During the VCheck testing process, the 13 special purpose courses are not made available to players. After a player has finished the VCheck test and collected ruby crystals during normal game play, they can unlock the 13 special purpose courses and select from among them at any time.

### Proficiency Test Subdomains

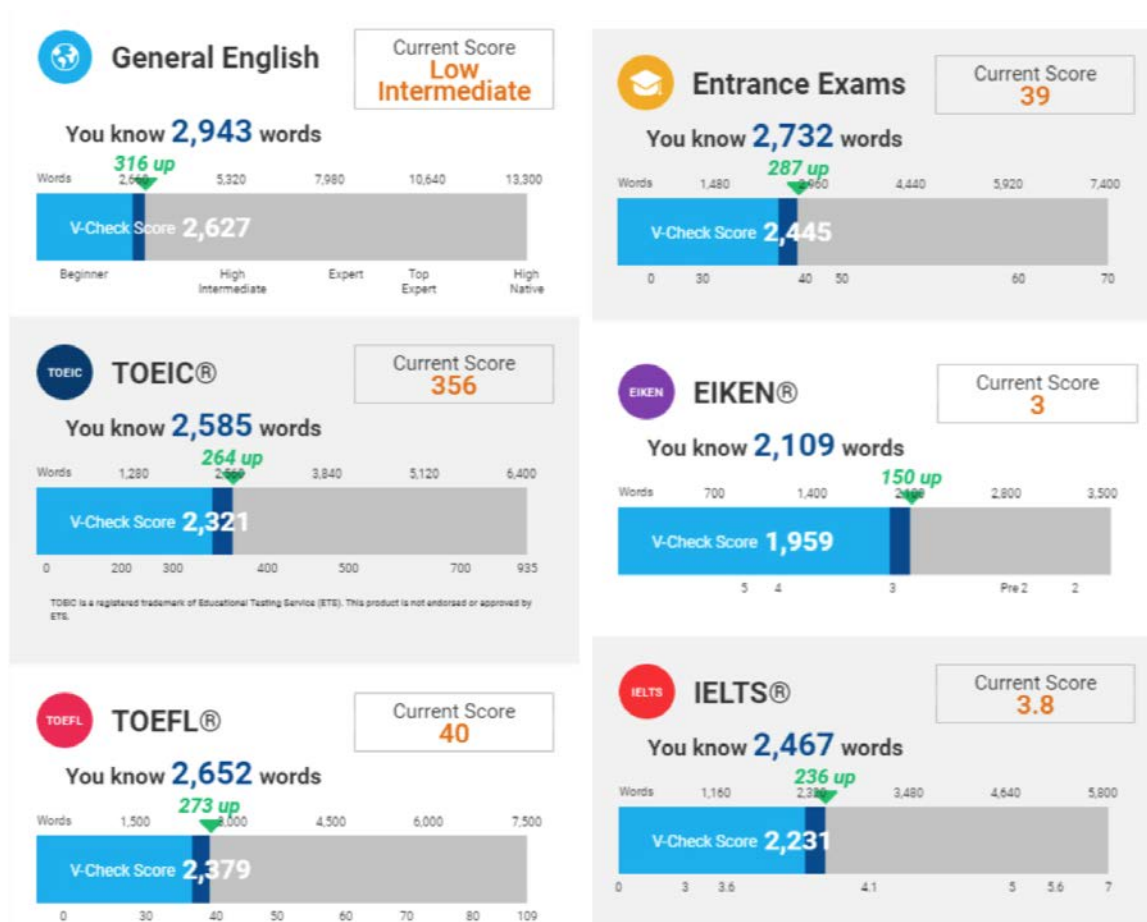
Corpus analysis of English proficiency tests reveals that each has its own particular word frequency counts. If a player is planning to take one of these tests, they will benefit most by focusing on the high-frequency vocabulary of that test. Each of the special purpose courses in Words & Monsters can provide 99 percent coverage of the words and phrasal verbs that occur on that test. The diagram below describes how two popular tests have their own particular orbits within the overall universe of General English. In the diagram, the concentrated mass at the center represents the common core of English; the 2,000 most frequent words. With Words & Monsters, once a player finishes learning all of the words for one of the special purpose courses, they can automatically continue studying with the General English course.



### VCheck Scores Correlate to Standard Test Scores at 0.82r

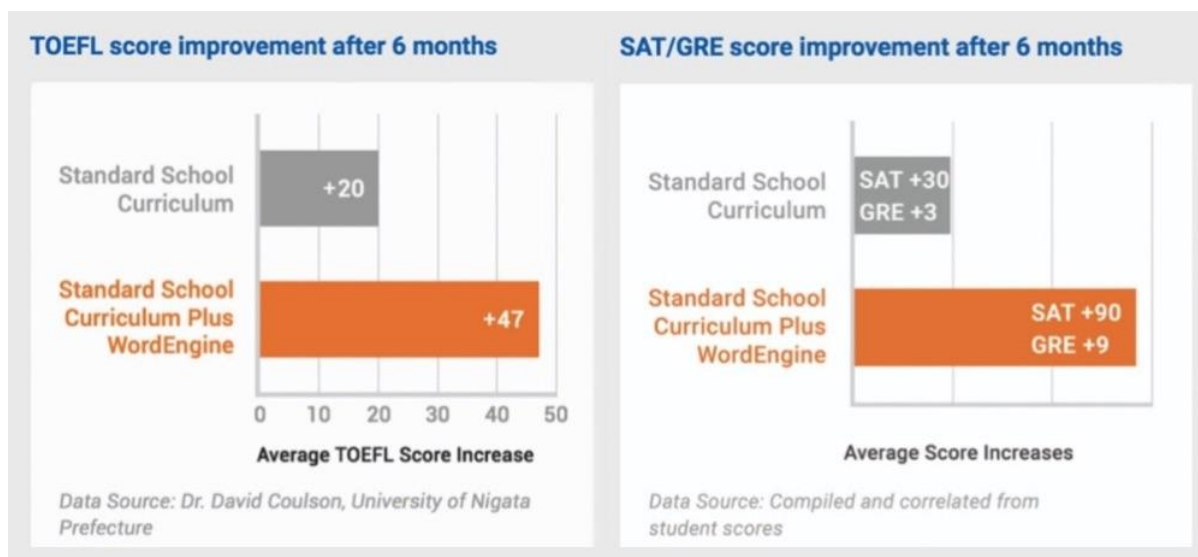
A feature of the Words & Monsters game is that it provides correlated test scores for a variety of major proficiency tests. These scores are based on the VCheck vocabulary test

results of 7,300+ learners which correlated to their actual proficiency test scores at 0.82r. In the score report below, the correlated test scores appear at the top right corner of the vocabulary size for each subject domain.



## Improved Academic Achievement

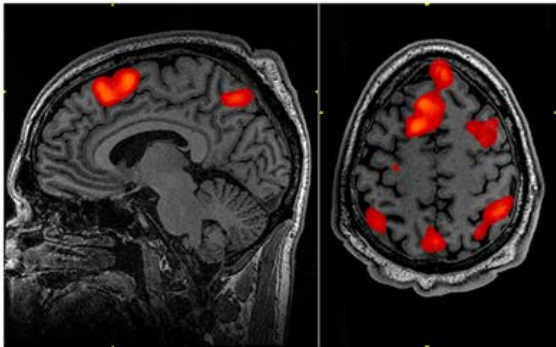
Independent studies have compared the adaptive digital flashcards used by Words & Monsters to equal time on task with traditional self-study assignments such as intensive reading, extensive reading, word lists, and paper flashcards. The conclusions of these studies is that the digital flashcards used in Words & Monsters increased average test scores significantly more than the other approaches tested (Agawa, Black & Herriman, 2011; Saunders & Roux, 2015). Student comments and feedback suggest that the average scores increased because more students had learned more of the words that occurred on their next tests.



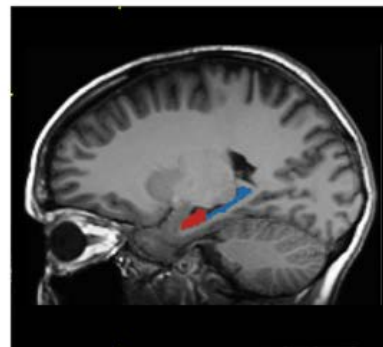
## Working Memory vs Automaticity

Encountering unknown words places a burden on the brain's working memory and its capacity to grasp overall meanings. When listening and reading in a foreign language, the brain must do extra work to identify, suspend, and process unknown words as it seeks information to resolve its comprehension gaps.

Researchers suggest that when 20 percent or more of words are unknown it becomes impossible to comprehend meaning (Laufer, 1992), and when less than two percent of words are unknown a person is likely to be confident in their ability to comprehend meaning (Nation & Hu, 2000). fMRI and fNIRS brain scans reveal a clear difference in the amount of energy that working memory requires to process unknown words compared to automatic recognition of known words.



Regions active during working memory tasks.



Regions active during automatic memory tasks.

Source: Journal Frontiers in Neurology Vol. 4, 2013

The Magnetic Resonance Image (fMRI) on the left highlights working memory while reading unknown words. The fMRI on the right shows the brain processing known words using automatic recall located in the hippocampus. These images highlight the additional energy and time required to process unknown words compared to words for which the person has developed automatic recall ability (Berglund-Barraza et al, 2019).

## Playful Engagement and Learning

Play is an essential form of learning through which people can develop a sense of achievement, mastery, empowerment, and self esteem when their actions lead to measurable results (Prensky, 2001; Garris et al, 2002; Hoffman & Nadelson, 2010). In the context of learning, dopamine uptake activity generally occurs during the anticipation phase of a task for which a correct result is expected but the reward value is uncertain. Uncertain rewards are especially fascinating to the brain and are associated with higher levels of dopamine production, a neurotransmitter associated with emotional attraction and long-term memory retention (Howard-Jones et al, 2011). Neuroscientists consider dopamine uptake a measurable indication of pleasure and it is often studied in the context of reinforcement learning (Wise, 2004). Unfortunately, the vast majority of learning games are built with certain and unexpected type rewards, and they are limited in content scope (Clark & Mayer, 2016). Words & Monsters provides managed uncertainty in both the study tasks and the game elements.

## Natural Motivation

Natural motivation describes an intuitive reaction to external experiences that cause a person to take positive action (Dobbin, 2012). Educational psychologists recommend the integration of uncertain-type game rewards to promote natural motivation to increase academic achievement (Howard-Jones & Jay 2016). Words & Monsters gamifies the learning of high-frequency vocabulary by integrating uncertain-type game rewards to promote natural motivation.



## **The Motivational Value of Uncertainty**

An uncertain-type reward increases a learner's engagement by causing higher levels of dopamine production (Fiorillo, Tobler & Schultz, 2003; Howard-Jones, 2011). This seemingly contradicts traditional educational approaches where correct responses are rewarded and incorrect responses are not. All top rated games implement reward systems in which the player must wait a few seconds before learning the actual value of an uncertain reward they have just earned. This brief delay-and-reveal process is similar to the series of rushes that powerfully attract humans to gambling (Shizgal & Arvanitogiannis, 2003).

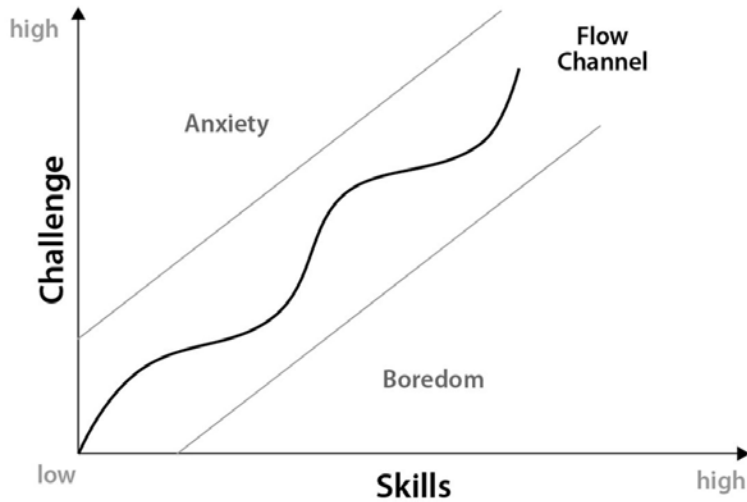
## **Managed Task Uncertainty**

Words & Monsters is able to control the degree of uncertainty for each study task because the database has a statistical quantum of difficulty on a log scale for each item and that measure of difficulty is correlated to each learner's lexical ability on the same log scale. For example, when a person with an assessed ability of 6.00 meets an item, such as "paraprosdokian," with a difficulty of 6.00, that person has a 50 percent likelihood of knowing the meaning of paraprosdokian. A person with an ability of 3.00 will have a much lower likelihood of knowing paraprosdokian. Using log scale correlations, the Words & Monsters game can identify the percentage likelihood of any given player knowing any given word in the game's inventory.

Words & Monsters uses its ability-difficulty database to maintain an ideal ratio of uncertainty in the study tasks for each learner. The notion of an ideal uncertainty ratio for the study tasks is similar to, and consistent with, Krashen's  $i + 1$  input hypothesis (1987). The pedagogical objective is to enable each player to learn quickly from their errors and yet not become discouraged. Ideally, a player should be able to get somewhere between 70 to 90 percent of their study tasks correct. Below 70 percent correct will be stressful and discouraging. A pace of 70 percent correct involves a high percentage of new learning however, it will not be experienced as easy going. A pace of 90 percent correct will involve less new learning but the player will feel a stronger sense of mastery. Above 90 percent correct and any activity will soon start to feel boring. Words & Monsters is a dynamic and adaptive game. The difficulty of the study tasks waxes and wanes within the targeted 70 to 90 percent range to help each player achieve a Flow State during their study.

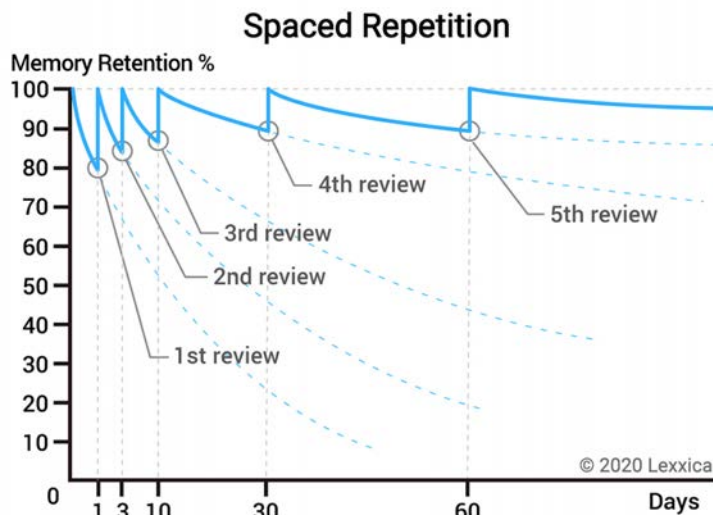
## **Flow State and Comprehensible Input**

A Flow State is achieved when the mind is so deeply interested in doing something that it loses track of time (Csikszentimihalyi, 1990). Words & Monsters promotes Flow by keeping the ratio of new and unknown words below the frustration level and above the boredom level.

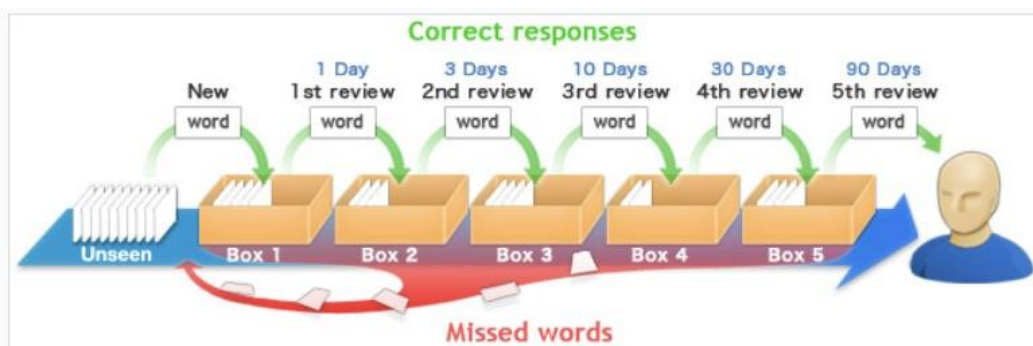


### Spaced Repetition for Memory Retention

Over 100 years ago the German psychologist Hermann Ebbinghaus conducted studies to substantiate his theory that spaced repetitions can result in faster permanent retention of new words and basic facts. In spaced repetition protocol, new items of knowledge, such as vocabulary words, are first learnt and then rehearsed again at five increasing time intervals. It is important that the words not be rehearsed again before the assigned waiting time has been met or exceeded. The waiting times are designed to get each item closer to being forgotten.



The diagram above shows how the retention of new knowledge is strengthened and extended with each next rehearsal. It may seem counterintuitive that words should be rehearsed when they are close to being forgotten rather than while they are still fully known or perhaps already forgotten. Balota’s 2007 study concluded that it is specifically the increasing time intervals between the rehearsals that strengthens memory and make spaced repetition more time efficient and effective than a mass learning or cramming approach.







- Words & Monsters is a free multiplayer mobile game available on Apple and Android smartphones and tablets. The game is suitable for ages 8 and up at any level of ability.
- Words & Monsters provides brief yet substantive game sessions centered around paired-associate vocabulary tasks that are controlled for difficulty and managed by a spaced repetition system. Each student studies their own personalized word list that has been tailored to meet their needs
- The game provides learners with two harmonized streams of managed uncertainty; one in the vocabulary study tasks and the other in the puzzle-action game elements
- The first step after downloading the game is to select and name a personal avatar from among the 72 options available. A player's personal avatar is their representative hero in the game world. Players will see each others' avatars and nicknames during the multiplayer battles and on the leaderboards



- Players accumulate ruby crystals by defeating monsters in battles. They use their ruby crystals for a variety of purposes including acquiring weapons, headgear, and bodywear to equip their avatars
- Players collect many things as they play including: new vocabulary words, common spoken expressions, ruby crystals, trophies, ribbons, weapons, bodywear, headgear, and defeated monsters. The items they collect are displayed on their Collection page and the words and phrases they learn are displayed on their My Words page
- Teachers have free access to the Words & Monsters learning management system ("WAM Admin"). Teachers use WAM Admin to set study goals, monitor learner progress, and download materials for use in class
- WAM Admin allows teachers to join an entire classroom, or perhaps a selected team of top students, to Team Challenge vocabulary tournaments operated by Lexxica
- WAM Admin allows teachers to download vocab worksheets to confirm that each student is retaining what the game says they have learned. Each student's game sheet is different but they all share a common answer key to make assessment easy
- Words & Monsters sustains its free operations through grants and a donation business model. Satisfied players and teachers are welcome to donate but it is not necessary. All of the advanced features are always available to all participants regardless of financial considerations

## Study Goals and Student Progress

Professional educators need simple ways to set study goals and monitor student progress. Lexica's WAM Admin system tracks progress for hundreds or even thousands of students and sends out concise weekly email reports to teachers and administrators. WAM Admin can be accessed with a computer or mobile phone. WAM Admin provides key performance indicators and tremendously rich data about each student's progress with Words & Monsters.

User Information		Weekly Goal			Study Progress					
Real Name Login ID	Nickname	Weekly Goal	Goal Hits	Total Weeks	Total Responses	Correct Responses	Correct Ratio	Time on Task	Correct/Minute	Recent Study
1 Terao Kouki mmk21p1238	有田みかん	210	17	373	20829	15742	75.6	29:20:53	8.9	2022/01/30 21:02
2 Shiiba Momo mmk21p1041					8643	7024	81.3	13:28:23	8.7	2022/02/16 10:04
3 Miyai Kokoro mmk21p1111					7222	5772	79.9	10:20:09	9.3	2022/02/01 01:43
4 Takahashi Hi mmk21p1233					6473	5136	79.3	09:52:11	8.7	2022/02/07 06:48
5 Nitta Konomi mmk21p1086					4886	3895	79.7	06:38:58	9.8	2022/01/27 19:14
6 Yamanaka Mi mmk21p1262					4517	3868	85.6	05:43:06	11.3	2022/01/16 17:16
7 Morita Asahi mmk21p1118	furaminngooo	210	14	373	4086	3694	90.4	04:52:54	12.6	2022/01/18 09:50
8 Hosoda Takuya mmk21p1266	赤いきつね	210	15	373	4058	3347	82.5	05:46:41	9.7	2022/01/22 23:52

Both the Words & Monsters game and the WAM Admin LMS are available free of cost for do-it-yourself implementations. Schools and districts seeking to use Words & Monsters and WAM Admin with large numbers of students are advised to purchase a site license and have Lexica prepare the required accounts and provide ongoing technical support.

### Teachers and Students Enjoy a Team Challenge

Words & Monsters offers Team Challenge tournaments to all teachers and players. These free TGT Cooperative Learning tournaments are open to teams of 8 or more. Students and teachers are encouraged to enter special teams of top students who love playing Words & Monsters and who regularly do more than they are asked.



“My students learned thousands of new words and the Team Challenge program transformed the experience from independent self study to a team effort where students pull together and motivate each other.” Catherine da Silva, Tokyo International University

### What is TGT Cooperative Learning?

TGT stands for Teams, Games, and Tournaments. TGT Cooperative Learning is when students are formed into multiple teams that compete in weekly matches. Teams can be composed of players from within the same school or they can be from players all around the world. All students study individually at their own level of ability, and their individual study progress is combined to establish a collective score for their team. Team members do not need to be at the same level of ability, in fact it is best if they are at different levels of ability (Slavin, 1980). As fast and effective as Words & Monsters is on any given day, when a tournament is running, Words & Monsters can be up to 50 percent more effective.



## Summary

Words & Monsters is a free mobile vocabulary game based on the best available research. Words & Monsters is a fast, fun, and satisfying way for learners to quickly gain automatic recall ability for the vocabulary words that occur most often in the English language. Words & Monsters adjusts to the actual vocabulary ability of each player and is therefore suitable for both native and non-native English language learners ages 8 and up. Gaining fast recall ability for the most frequently occurring words allows the brain's working memory to stay focused on overall meanings rather than unknown words. The WAM Admin learning management system provides teachers with tools for setting self-study goals; monitoring student performance, and joining international vocabulary tournaments.

## Words & Monsters website

<https://free.wordsandmonsters.com>

## Contact Lexica

[Contact Us](#)

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