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Impact of Duolingo Language Program as an Artificial Intelligence Tool on Iranian EFL Teachers' Work Engagement

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Abstract

This research investigated how utilizing artificial intelligence tool, the Duolingo language program affected the job engagement of Iranian EFL instructors, taking into account the participants' teaching experience as well as their gender. There was a total of sixty English as a Foreign Language (EFL) instructors included in this study. There were thirty male teachers (15 novice and fifteen experienced) and thirty female teachers (15 novice and fifteen experienced) from five different language institutions in Dezful. The participants were introduced to the Duolingo language program and instructed on its use in the classroom throughout the course of two separate briefing sessions. Before the therapy was really carried out, it was necessary for each and every instructor to provide feedback on the extent of work engagement. They were questioned on their responses to the aforementioned scale once again after the therapy had been carried out. According to the findings of a statistical study, employing the Duolingo language program software application as an artificial intelligence tool was associated with a considerable increase in the level of job engagement experienced by EFL instructors. However, neither gender nor years of teaching experience played a particularly major part in the factors that contributed to instructors' job involvement in the Duolingo language program condition. In addition, the relationship between gender and years of experience teaching did not play a major role in determining how engaged instructors were in their profession. The findings are broken down and analysed, after which implications for classroom instruction are presented.

Keywords: Experience, gender, job engagement, Duolingo language program, artificial intelligence

Introduction

The incorporation of technology into educational practices has taken on an ever-increasing level of significance in the modern day, and teachers are under intense pressure to remain current with the technical knowledge advancements made by their students (Richards & Reppen, 2014). This is necessary in order to fulfil the prerequisites for digital literacy. According to Prensky (2001), a significant number of today's students have acquired a high level of fluency and expertise in the use of contemporary electronic resources and tools. There is a vast body of literature arguing in favour of the beneficial effects that technology-based instruction, such as the use of software programs, can have on language learners' academic development and achievement in settings such as schools and language centres ; however, there is a paucity of research focusing on other important factors, such as the engagement of teachers and workers in their jobs. In point of fact, the vast majority of research conducted in the past concentrated their attention on students rather than instructors in regard to the use of technological tools. It is only in the most recent few years that the significance of teacher psychology has begun to get the attention that it rightfully merits.

Teacher education is an enormous field in and of itself and has been the focus of numerous publications over the years that have attempted to provide teachers with some foundation to prepare them for teaching from a variety of different viewpoints, including historical, practical, and social viewpoints (e.g., Horwitz, 2013; Larsen-Freeman & Anderson, 2011). These publications have been written in an effort to prepare teachers for teaching from a variety of different viewpoints, including historical, practical, and social viewpoints. On the other hand, training in the use of technology in language teaching and learning has been relatively less widespread. There have been a number of publications that have been geared toward teacher education using technology (for example, Son and Windeatt, 2017), however, technology has remained an area that has been relatively overlooked in courses in terms of having clear goals in boosting the job involvement of the instructors (Son, 2018).

In our modern, technologically advanced society, it's possible that instructors aren't the only ones who can impart information to their students. Students now have more access

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to information than did students of previous generations because to the proliferation of technology in today's classrooms, particularly in the form of online classrooms, blended-learning models, one-on-one computing programs, and so on.

Literature Review

Duolingo language Software

The Duolingo language program firm is responsible for producing some of the most well-known computer-assisted language learning aids available today, including the software version of their namesake Duolingo language program. This business was first formed in 1992 by its current proprietor, Allen Stoltzfus, who is also the company's namesake. This firm was widely acknowledged as being among the most successful technology-based learning businesses in CALL (Santos, 2011). Stoltzfus was a pioneer in the development of a novel method of language acquisition. This method included giving natural possibilities for language learners via the use of computer software that contained both sounds and graphics. This computer-assisted language learning method makes use of cloud-based apps to aid students in improving their reading, writing, speaking, and listening abilities while studying a foreign language. The Duolingo language learning application was first distributed by CD and then adapted for use through the Internet. According to the website www.Rosettastone.com, the creators of RS assert that their program offers students an engaging atmosphere that is analogous to that of learning a first language.

The curriculum utilizes dynamic immersion, which is an approach to language learning that is centered on the interaction between students learning the language and native speakers. According to Santos (2011), the emphasis is placed not on form but on meaning and purpose. This method of dynamic immersion includes the following four steps: the picture, in which the words are presented; the intuition, in which the new terms must be matched to the corresponding pictures; the interaction, in which learners take part in the conversation and try to use new vocabulary; and the existing instructions, which help learners internalize what they have learned. On the website Rosettastone.com, the directions go from the easiest to the most difficult to follow. Duolingo's fourth generation of its language-learning software is now offered to students of 31 different languages in both online and offline formats. The offline Duolingo language learning tool is now in its fourth edition, and it includes the same exercises as the third version. Rosetta Studio and Rosetta World are the names of the two that are available online. In Rosetta Studio, students may take part in live lessons; in Rosetta World, they have the chance to engage in activities or games with other students or native speakers. Rosetta Studio allows students to take part in live classes. The Duolingo language program may be customized to account for the peculiarities of each language, although it typically presents the same visuals, exercises, and conversation in each of the languages it teaches (Santos, 2011).

There has been a significant amount of study conducted on the effects that the Duolingo language program software has had all over the globe. One of them discusses the influence that using the Duolingo language software has had on the vocabulary acquisition of Iranian primary students studying English. In comparison to the control group, the empirical group was able to learn and recall a greater number of words as a consequence of these tests. According to Lee (2007), learners had the ability to modify the pace at which they learned by adjusting the speed at which the program operated. This makes expanding one's vocabulary much easier. According to Azizifar, Gowhary, Jamalinesari, and Sharifi (2015), when students study on their own, they experience higher levels of motivation in the acquisition of a new language. It is possible to draw the following additional conclusions from the use of this software: computers are able to provide instant feedback, and students are less inhibited about speaking out when they make a mistake in front of their peers. Because of this, they do not experience fear and may have a low emotional filter, which makes learning easier and helps to have a calm affective filter setting, which promotes and makes it easier to learn the language (Azizifar, Gowhary, Jamalinesari, & Sharifi, 2015; Khodareza & Tabar, 2012; Krashen, 1982). This piece of software is a valuable resource that will help you become proficient in language learning. The students have developed a favorable attitude regarding the efficacy of RS as a result of their practice with this program, which gives them confidence in their ability to learn a language. According to Griffin, Martinez, and Martin (2014), learners may build a genuine American accent by consistent study of the topics and tailored training produced in this program. Additionally, learners can arrive at the meaning of words and phrases through the use of visuals rather than translation.

Work Engagement

According to Cardwell (2011), "interest in," "enthusiasm for," and "investment in" teaching are the three components that makeup "job engagement" for instructors. He is of the opinion that teachers who are both driven and engaged have a better chance of effectively engaging their students in the learning process. According to Maslach et al. (2008), the phrase "teacher job involvement" refers to a persistent, positive affective-motivational state of satisfaction that is characterized by traits such as energy, commitment, and absorption. This state serves as an excellent example of the human qualities that go into becoming an educator. According

to Cinches et al. (2017), highly engaged teachers report higher levels of inspiration and motivation, which contributes to an improvement in their teaching skills. According to what they mentioned, the quality of the students' education is one of the factors that plays a significant role in the overall academic engagement of students.

Seligman and Csikszentmihalyi (2000) define positive psychology as the "systematic study of human vitality and peak performance." Beginning around the turn of the century, there was a spike in interest in what positive psychology had invented: the systematic study of human vitality and peak performance. According to Schaufeli, Bakker, and Salanova (2006), the technique was further defined by Luthans (2002), who characterized it as "the study of positively oriented human resource qualities and psychological skills that may be tested, developed, and successfully managed for performance improvement in today's workplace." According to Schaufeli et al. (2002), teacher job involvement is described as a pleasant and pleased state of mind that is tied to work and incorporates the attributes of absorption, commitment, and energy in its practitioner. According to Bakker et al. (2008), absorption may be defined as a state in which one is intensely focused on their activity while also experiencing delight from doing so. According to Bakker et al. (2008), the second component of job engagement is devotion. Some of the qualities of dedication include a sense of purpose, passion, inspiration, pride, and challenge.

Being completely committed to one's work is another definition of the word "dedication." According to Schaufeli et al. (2002), having vigor is defined as having a lot of energy while working, being ready to put in effort, and tenacity in hard conditions. According to research done by Hakanen et al. (2006), teachers who are dedicated to their work tend to be more focused, committed, and passionate about their work.

Research Questions

In line with the objectives of the study, the following research question was addressed:

> **RQ:** Does the use of the offline Duolingo software program have any significant effect on Iranian male and female experienced and novice EFL teachers' work engagement?

Methodology

Participants

In total, 60 Iranian EFL instructors took part in the research project. These teachers were employed at five recognized language institutions in the city of Dezful, Iran. In light of the fact that the research needed both male and female instructors for its various components, an effort was made to choose an equal number of male and female participants from each of the two gender categories under consideration. It was decided to include an equal number of teachers based on their years of teaching experience, in the sense that those who have been engaged in teaching English for less than five years were considered to be novices, and those who have been involved in EFL teaching for more than five years were considered to be experienced. Because the objectives of the study also required that the participants be novices and experienced teachers, it was decided to include an equal number of teachers based on their years of teaching experience. As a result, out of the sixty instructors of English as a foreign language who volunteered to take part in the research, thirty were male (15 novices and 15 experienced) and thirty were female (15 novices and 15 experienced). The sampling method used was purposive, and the participants were EFL instructors who had varying degrees of expertise at the time of selection.

Materials

Duolingo Software

There are a total of five levels available in the American English edition of the Duolingo language learning software. Each level is broken down into four units, and each unit is further split into four lessons. At the beginning of each lesson is a foundational lesson. Lessons in the core curriculum focus on a certain subject and grammar. After the main instruction, there will be some activities. The exercises include a skill or language component, such as pronunciation, vocabulary, reading, writing, listening, and speaking, and they culminate with review sections that test users' overall comprehension of the material. At the conclusion of each section, the activities are evaluated and rated based on a percentage (source: http://www.rosettastone.com).

The voice activation and recognition mechanism is the most important component of this program. The words, sentences, or phrases are read by native speakers, and the

responses of the users are evaluated via their microphones. Altering the rate at which one speaks is possible. According to Santos (2011), it ranges from easy to medium, normal, medium, and finally challenging, which corresponds to the genuine pace of native speakers. Numerous studies have been conducted on a variety of continents to determine the impact that the Duolingo language learning software has had. One of them examines the impact that using the Duolingo language software has on the vocabulary acquisition of elementary Iranian students of English as a Foreign Language. According to the findings, the experimental group was able to acquire and retain a greater amount of language when compared to the control group. According to Lee (2007), the students had complete control over the pace at which they learned and could alter the speed at which the program operated. This makes expanding one's vocabulary much easier. According to Azizifar, Gowhary, Jamalinesari, and Sharifi (2015), when students study on their own, they experience higher levels of motivation in the acquisition of new language.

This piece of software is a valuable resource that will help you become proficient in language learning. The students develop a favorable attitude regarding the usefulness of RS as a result of the exercises provided by this program, which give them confidence in their language-learning abilities. According to Griffin, Martinez, and Martin (2014), learners may build a genuine American accent by consistent study of the topics and tailored training produced in this program. In addition, learners can arrive at the meaning of words and phrases through the use of visuals rather than translation.

Instrument

Work Engagement Scale

This study used Schaufeli, Bakker, and Salanova's (2006) abridged version of the Utrecht Work Engagement Scale (UWES), which had previously been developed and validated. A positive job-related feeling of satisfaction that is distinguished by vitality, devotion, and absorption is referred to as work Engagement. This is a brief questionnaire designed to test work Engagement. The researchers gathered the data in 10 different countries (N = 14,521) in order to verify the original scale. The findings revealed that the original 17-item Utrecht Work Engagement Scale (UWES) may be simplified to 9 items (UWES-9). This allowed the researchers to validate the original scale. Confirmatory factor analyses were used to verify the factorial validity of the UWES-9, and it was found that all three scale scores had high levels of both internal consistency and test-retest reliability. In addition, the findings were best explained by a two-component model with a decreased Burnout factor (which included tiredness and cynicism) and an increased Engagement factor (which included vigor, devotion, absorption, and professional effectiveness). These findings provided more evidence that job engagement might be seen as a healthy alternative to burnout in the workplace. It was determined that the scores on the UWES-9 had satisfactory psychometric qualities and that the instrument had the potential to be used in research on many aspects of organizational behavior.

Data Collection Procedure

The first thing needed to be done in order to carry out the present research was to choose male and female as well as inexperienced and seasoned EFL instructors. Since the technique of research was one that was considered to be quasi-experimental, it was necessary to have a sufficient number of EFL instructors take part in the study. Given that an adequate number of teachers with such characteristics do not work in the same institution, the researcher made the decision to choose them from five different language institutes in the city of Dezful. It was necessary to schedule appointments with the proprietors of the institutions in order to get the necessary approval, and the instructors had to be chosen based on how easy it would be for them to participate in the study as well as how ready they were to do so. It seemed as if picking sixty English as a Foreign Language instructors, split evenly between beginner and experienced levels, would fulfill the requirements of the research. Therefore, 60 EFL instructors were chosen for the study, with a gender split of 30 males and 30 females. 15 of the teachers in each gender group were first-year instructors with less than 5 years of classroom experience, while the remaining 15 teachers had more than 5 years of classroom experience. They participated in two different orientation workshops with us so that they could get acquainted with the Duolingo language program and learn how to use it in their classrooms. Before the therapy could be administered, it was necessary for each and every instructor to provide their response on the scale of job engagement. Following the completion of the treatment, participants were questioned once again about their responses to the aforementioned scale in order to determine the influence that the software application had on the dependent variable of the investigation. In the end, the gathered data were examined in order to provide a response to the study question.

Results

The purpose of the study was to investigate the following research question: Does the use of the offline Duolingo software application have any meaningful influence on the work engagement shown by Iranian male and female experienced and novice EFL teachers? Comparing the pre-test

and post-test results of involvement with the Duolingo language program condition was necessary in order to get an answer to this study issue. The following table provides a representation of the descriptive statistics obtained from the tests:

Table 1

Descriptive Statistics for the Engagement Pre-test and Post-test of the Duolingo Language Program Condition

	Mean	*N*	Std. Deviation	Std. Error Mean
Engagement Pre-test	20.2333	60	4.45073	.57459
Engagement Post-test	36.0667	60	3.89640	.50302

The table above shows that the engagement mean score of the teachers who experienced the Duolingo language program went up from 20.23 on the pretest to 36.07 on the post-test. To see if this was a significant rise or not, the results of the paired-samples t-test in Table 2 had to be checked:

Table 2

Paired-sample t-Test Results Comparing the Engagement Pre-test and Post-test Scores in the Duolingo Language Program Condition

	Paired Differences							
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	*t*	*df*	Sig. (2-tailed)
Engagement Pre-test Engagement Post-test	-15.83333	2.72569	.35188	-16.53745	-15.12921	-44.996	59	.000

It could be found in Table 2 that there was a significant difference between the engagement pre-test and post-test scores of the teachers in the Duolingo language program, t (59) = -44.99, p = .000 < .05. Now, to see if the teachers' experience and gender also had an effect on this improvement in the sphere of engagement, the results of two-way ANCOVA should be checked:

Table 3

Descriptive Statistics for Gender and Teaching Experience: Engagement Post-test Scores of the Duolingo Language Program Condition

Gender	Experience	Mean	Std. Deviation	*N*
Male	Novice	34.7333	3.23964	15
	Experienced	38.6000	3.62137	15
	Total	36.6667	3.90696	30
Female	Novice	34.0000	3.22933	15
	Experienced	36.9333	3.97252	15
	Total	35.4667	3.85722	30
Total	Novice	34.3667	3.20004	30
	Experienced	37.7667	3.82986	30
	Total	36.0667	3.89640	60

The total mean score for male teachers on the engagement post-test in the Duolingo language program was

36.66, and the total mean score for female teachers equalled 35.46. In addition, novice teachers obtained a mean score of 34.36, while experienced teachers' mean score was 37.76. To see if these differences between male and female teachers on the one hand and between novice and experienced teachers, on the other hand, could be large enough to reach statistical significance or not, the results of the two-way ANOVA in Table 12 should be examined:

Table 4

Results of Two-way ANCOVA for the Effects of Gender and Teaching Experience on Engagement Post-test Scores of the Teachers in the Duolingo Language Program Condition

Source	Type III Sum of Squares	*df*	Mean Square	*F*	Sig.	Partial Eta Squared
Corrected Model	599.357	4	149.839	27.806	.000	.669
Intercept	1282.099	1	1282.099	237.925	.000	.812
Engagement Pretest	401.090	1	401.090	74.432	.000	.575
Gender	6.325	1	6.325	1.174	.283	.021
Experience	28.214	1	28.214	5.236	.026	.087
Gender * Experience	.022	1	.022	.004	.950	.000
Error	296.376	55	5.389			
Total	78944.000	60				
Corrected Total	895.733	59				

The results presented above reveal that gender did not have a significant role in the engagement post-test scores of the teachers in the Duolingo language program condition (p = .283); likewise, teaching experience failed to affect the engagement of the teachers in this condition (p = .026). Moreover, the interaction between these two variables (i.e., gender and teaching experience) also did not leave a significant impact on the engagement of the teachers (p = .950).

Discussion

This study aimed at investigating the effect of using Offline Rosetta on Iranian male and female experienced and novice EFL teachers' teachers' work engagement.

The findings with regard to the effect of the offline Duolingo language program on work engagement support the basic assumption of the job demands-resources theory: a combination of job resources (e.g., technology) that predict work engagement (e.g., Nielsen et al., 2017; Schaufeli & Bakker, 2004; Ventura et al., 2015). Further, the findings are in line with prior studies indicating that technology is an important job resource and is associated with higher work engagement (Nielsen et al., 2017; Skaalvik & Skaalvik, 2014; Xanthopoulou et al., 2009). Interestingly, technology-related collegial (i.e., social) support was associated with work engagement. This may be due to the high correlation between technology-related competency support and collegial support. This finding could also be explained by the fact that teachers still work very independently and autonomously or that those who are highly engaged in technology-related work feel the need for support. The role of technology-related collegial support in teacher well-being needs more attention in future studies, as the development of technology-related competence support requires shared collaboration (i.e., collegial activities).

Conclusion

Based on the findings of the research, the use of technology in general and relevant software applications in particular in the context of teaching English as a foreign language (EFL) might contribute to an increase in the level of job engagement shown by EFL instructors. It was shown, however, that gender and years of teaching experience do not have a major influence, and that educators of all genders and levels of experience may benefit from the usage of ICT tools in educational settings. It is possible to draw the conclusion that the promotion of teachers' appropriate use of ICT tools required the provision of assistance for technology-related skills.

The findings draw our attention to a number of essential design concepts that need to be taken into account throughout the production and use of ICT products. In this respect, the educational consequences might be understood by

looking at things from three different perspectives: teaching, learning, and the presentation of the content. The significance of integrating technology into language instruction should be kept in mind throughout the process of creating and using tools for information and communication technology. When presented in this manner, the material is not only simple to understand but the learners' attention is also captured by the atmosphere of cooperative learning. Therefore, research into the capabilities of ICT should, at the very least in part, assist course developers, program designers, and educators with a better knowledge of what factors contribute to the achievement of success in a pedagogical context. In order to boost students' involvement in their work and more effectively distribute the necessary amount of effort to teach a variety of abilities, course developers and curriculum planners should keep in mind to include fascinating and pertinent technology tools into their education. In addition, the software needs to be created in modes that are more interactive and adaptable in order to improve communication, and it ought to provide the user with a greater number of possibilities with which to operate.

Technology is a topic that receives a lot of attention and study, yet there are still many unanswered questions, particularly in Iran. There is a need for further study to be done in order to discover the function that employing various ICT tools not only for instructors but also for students of varying ages and levels of English language proficiency plays in the classroom. It is suggested that a similar investigation be carried out once again, but this time with a much greater number of individuals hailing from the same origin. These possible directions of investigation into learning foreign languages might give further information on the topic. On the other hand, there is no conclusive proof of the manner in which these instructors really implement technology inside their classes. Consequently, future research needs to study the creative, autonomous, and engaging pedagogy of technology usage in the classroom by conducting classroom observations and identifying the ways in which instructors blend technology and engaging classroom activities.

References

Bakker, A. B., Schaufeli, W. B., Leiter, M. P., and Taris, T. W. (2008). Work engagement: An emerging concept in occupational health psychology. *Work Stress 22*, 187–200. https://doi.org/ 10.1080/02678370802393649

Cardwell, M. E. (2011). *Patterns of Relationships Between Teacher Engagement and Student Engagement* (Doctoral Dissertation). John Fisher College, Pittsford, New York.

Çelik, H. C., & Bindak, R. (2005). Examining the computer attitudes of primary school teachers according to various variables. *Inonu University Journal of the Faculty of Education, 6*(10), 27-38.

Çetin, O., Çalişkan, E., & Menzi, N. (2012). The relationship between technological competencies and attitudes of pre-service teachers towards technology. *Ilkogretim Online, 11*(2).

Cinches, M. F. C., Russell, R. L. V., Chavez, J. C., and Ortiz, R. O. (2017). *Student engagement: defining teacher effectiveness and teacher engagement*. J. Institute. Res. South East Asia 15, 5–19.

Dargut, T., & Çelik, G. (2014). Pre-service Turkish language teachers' attitudes and thoughts toward the use of technology in education. *Journal of Mother Tongue Education, 2*(2), 28-41.

Durak, H., & Seferoğlu, S. S. (2016). Investigation of social media literacy and social media usage patterns in Turkey. *The Journal of International Social Research, 9*(46), 526–535.

Emanuel, R., & Adams, J. N. (2011). College students' perceptions of campus sustainability. *International Journal of Sustainability in Higher Education, 12*(1), 79–92.

Ertmer, P. A., Ottenbreit-Leftwich, A. T., Sadik, O., Sendurur, E., & Sendurur, P. (2012). Teacher beliefs and technology integration practices: A critical relationship. *Computers & Education*, *59*(2), 423-435.

Galton, F. (1896). *Hereditary genius: An inquiry into its laws and consequences*. London, UK: Macmillan-Fontana.

Gee, G. C., Ro, A., Shariff-Marco, S., & Chae, D. (2009). Racial discrimination and health among Asian Americans: Evidence, assessment, and directions for future research. *Epidemiologic Reviews, 31,* 130 –151. http://dx.doi.org/10.1093/epirev/mxp009

Griffin, R. A., Martinez, J., & Martin, E. P. (2014). Duolingo language program and language proficiency of international secondary school English language learners. *Engaging Cultures and Voices, 6*(2), 36-73.

Hakanen, J. J., Bakker, A. B., and Schaufeli, W. B. (2006). *Burnout and work engagement among teachers*. *J. Schl. Psychol. 43,* 495–513. https://doi.org/10.1016/j.jsp.2005.11.001

Hart, T. (2004). Opening the contemplative mind in the classroom. *Journal of Transformative Education*, *2*(1), 28-46.

Horowitz, M. J. (2013). *States of mind: Configurational analysis of individual psychology.* Springer.

Krashen, S. (1982). *Principles and practice in second language acquisition.* University of Southern California.

Larsen-Freeman, D., & Anderson, M. (2013). *Techniques and principles in language teaching 3rd edition-Oxford handbooks for language teachers*. Oxford university press.

Lee, K. (2007). Online collaborative case study learning. *Journal of College Reading and Learning, 37*(2), 83-92.

Nielsen, K., Nielsen, M. B., Ogbonnaya, C., Känsälä, M., Saari, E., & Isaksson, K. (2017). Workplace resources to improve both employee well-being and performance: A systematic review and meta-analysis. *Work & Stress, 31,* 101–120.

Öztürk, T. (2006). Sosyal bilgiler öğretmen adaylarının eğitimde teknoloji kullanımına yönelik yeterliliklerinin değerlendirilmesi (Balıkesir örneği). (Master thesis). YÖK Tez Merkezi. (Order no. 215394).

Richards, J. C., & Reppen, R. (2014). Towards a pedagogy of grammar instruction. *RELC Journal, 45*(1), 5-25.

Şahin, M. C., & Namlı, N. A. (2019). Öğretmen adaylarının eğitimde teknoloji kullanma tutumlarının incelenmesi. Türkiye Sosyal Araştırmalar Dergisi, 23(1), 95-112. https://dergipark.org.tr/tr/download/article-file/695306

Santos, V. D. (2011). Duolingo language programPortuguese (Brazil) levels 1, 2, & 3 Personal Edition Version 4 (TOTALe).

Schaufeli, W. B., Bakker, A. B., & Salanova, M. (2006). The measurement of work engagement with a short questionnaire: A cross-national study. *Educational and Psychological Measurement, 66*, 701–716.

Schaufeli, W. B., Salanova, M., González-Romá, V., and Bakker, A. B. (2002). The measurement of engagement and burnout: A two sample confirmatory factor analytic approach. *J. Happin. Stud. 3,* 71–92. https://doi.org/10.1023/A:1015630930326

Seligman, M. E., & Csikszentmihalyi, M. (2000). *Positive psychology: An introduction* (Vol. 55, No. 1, p. 5). American Psychological Association.

Selwyn, N. (2012). Social media in higher education. *The Europa World of Learning*, *1*(3), 1-10.

Sharifi, M., Azizifar, A., Jamalinesari, A., & Gowhary, H. (2015). The effect of Duolingo computer software on vocabulary learning of Iranian elementary EFL learners. *Procedia-Social and Behavioral Sciences, 192*, 260-266.

Şimşek, K., & Yıldırım, N. (2016). Constraints to open innovation in science and technology parks. *Procedia-Social and Behavioral Sciences, 235*, 719-728.

Son, J. B. (2018). *Teacher development in technology-enhanced language teaching*. Springer International Publishing.

Son, J. B., & Windeatt, S. (2017). Teacher training in computer-assisted language learning. *Language teacher education and technology: Approaches and practices*, 1.

Tabar, H., & Khodareza, M. (2012). The effect of using multimedia on vocabulary learning of pre-intermediate and intermediate Iranian EFL learners. *Journal of Basic and Applied Scientific Research, 2*(12), 12879-12891.

Ülker, D., & Yılmaz, Y. (2016). Learning Management Systems and Comparison of Open-Source Learning Management Systems and Proprietary Learning Management Systems. *Journal of Systems Integration, 7*(2).

Xanthopoulou, D., Bakker, A. B., Demerouti, E., & Schaufeli, W. B. (2009). Reciprocal relationships between job resources, personal resources, and work engagement. *Journal of Vocational Behavior*, *74*(3), 235-244.