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# Cross-Disciplinary Investigation of EAP Students' Vocabulary Learning Strategies in Online Platforms: The Mediating Role of Multiple Intelligence

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**Abstract.** This study was motivated by an interest in the process of acquiring EAP vocabulary for Iranian university students. The study identified the vocabulary learning strategies of 360 undergraduate EAP students considering the role of multiple intelligence and online education platforms using self-reported questionnaires. They were members of Telegram groups studying engineering, medical sciences, and humanities at different universities in Iran. Descriptive analysis of the VLS survey indicated that the participants frequently use strategies for making the new vocabulary part of their repertoire, followed by strategies for getting the meaning of the new word, and studying the vocabulary, respectively. Inferential analysis of the VLS data revealed that engineering students use different strategies to get the meaning of a new word

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to which they are exposed in the online classroom. Descriptive and inferential analysis of the participants' MIs demonstrated the positive relationship of logical-mathematical, visual-spatial, bodily-kinesthetic, musical, and intrapersonal intelligence with the use of strategies for making the new vocabulary part of the repertoire only for the engineering group. The results suggest implications for EAP practitioners and learners.

**Keywords:** EAP learners, multiple intelligence, vocabulary learning strategies, online education

## 1. Introduction

### 1.1 The importance of vocabulary in language learning

The recent revival of interest in words has emphasized vocabulary learning as the most challenging side of proficiency in a second or a foreign language due to the absolute enormity of the task (Meara, 1995; Nation, 2001; Schmitt, 2010). Language is like a building: grammar is the structure of the building, and words are the bricks in the structure. While both are vital, bricks outnumber structural elements, so no linguist today would seriously question the fact that vocabulary dominates the language field from a quantitative standpoint and vocabulary acquisition is the biggest obstacle to language acquisition (Ma, 2009). Lexicon is a substantial ingredient of language proficiency level and, hence, it has been highly addressed in language learning studies (Pellicer-Snchez, 2018). Learning and teaching the vocabulary of a foreign language is considered a primary challenge for both learners and teachers. Nation (2013) has defined second language (L2) vocabulary knowledge as the critical piece of learning English as a Second Language (ESL) or English as a Foreign Language (EFL) since it exerts a strong influence on language skills such as reading and writing. Although the literature is replete with studies on the importance of vocabulary learning in all language learning dimensions, it still needs to be explored concerning various features such as learners' idiosyncratic characteristics, potentials, experiences, attitudes, strategies, capacities, etc. which are indeed dissimilar in the settings in which studies are carried out. Due to the learners' differences, the learning profiles of EFL learners might be interestingly and remarkably different providing guiding implications for

teaching and learning a foreign language in peculiar and even general learning potentials. Individual differences connect to distinct learning strategies. Mandasari and Oktaviani (2018) stated that learning English as a foreign language, especially in a formal context, makes the learners develop their strategy to attain the aim of learning.

### 1.2 Matches between multiple intelligences, learning strategies, and vocabulary learning strategies

Educators presumed that the accommodation of students' learning styles with Multiple Intelligences (MIs) in lesson plans helps them optimal attainment of their goals. However, the presumption was not subjected to close critical observation by researchers and teachers (Pashler et al., 2008). To put it another way, accommodating learning styles, multiple intelligences, and improved academic achievement was not directly linked. To investigate these relationships, researchers looked at learning styles, multiple intelligences, and English proficiency. As an example, Abbasian and Shirazifard (2016) investigated the correlation between multiple intelligences, learning styles, and English language proficiency among students. They found that EFL learners' learning styles are significantly related to their English language proficiency, and the multiple intelligences of EFL learners are highly related to their English proficiency. Put simply, students with accommodated learning styles and MI types performed better in learning English as a foreign language compared to the students who were taught in a traditional curriculum. Moreover, Glomo-Narzoles (2013) identified the dominant MIs and the motivations of 165 EFL learners in Bahrain. He revealed the possibility of motivating the learners "through the use of tasks relating to the different intelligences" (p. 50). Once the learners' MI types were identified, the researcher also aimed at determining whether the types of motivation they had were either instrumental or integrative (Gardner, 1985; Gardner & Tremblay, 1994). Glomo-Narzoles (2013) argued that the accommodation of students' multiple intelligences in the English classroom motivated the EFL learners to acquire the target language. In another study, Yassin (2015) employed the Visual-Auditory-Reading-Kinesthetic (VARK) instrument to inspect the learning styles of Gulf Co-operation Council (GCC) students in the English classes of two North American

universities. He noticed that the students scored successfully on the Test of English as a Foreign Language (TOEFL) and performed well in the university setting because the American educators accommodate their teaching styles with the GCC students' learning styles. Yeow et al. (2010) also implemented a study on the learning styles, English proficiency, and assessment performance of medical students. The researchers argued that the students performed better when their learning styles were accommodated.

In short, a review of the literature confirms that matching teaching styles to learning styles and multiple intelligences leads to higher levels of language proficiency and test performances of both EFL and ESL students.

### 1.3 VLS within an EAP context

On the subject of English for academic purposes, EAP learners are exposed to numerous texts, especially texts in an academic setting. They have to construct meaning based on their foregoing knowledge. Hence, EAP learners need an adequate amount of academic words to pass the exams and to communicate effectively in class. Thus, Vocabulary Learning Strategies (VLSs) undertake a key role in English for academic purposes situations (Al-Omairi, 2020). Haghi and Pasand (2013) also argued EAP learners' demand for studying and comprehending sufficient written texts in the English language. Accordingly, the use of a variety of VLSs facilitates EAP students in coping with and comprehending texts. Wanpen et al. (2013) derived that vocabulary learning is a strand of learner attainment in the area of EAP/ ESP. Using strategy to assist EAP/ ESP students by boosting their awareness of various VLS is a basic component and a supreme helping for EAP majors in dealing with unfamiliar lexicon. During the last few years, a number of studies have focused on the use of VLSs by learners to acquire new words in ESP/EAP contexts. Hashemi and Hadavi (2015) inquired into VLS use among EFL Iranian medical sciences learners. Using the survey developed by Gu and Johnson (1996), they reported the participants applied guessing and social strategies the most, but dictionary strategy, note-taking, and autonomy were the least used strategies. Afshar et al. (2014) also adopted a questionnaire and studied 173 Iranian undergraduate students. Their

findings did not reveal a significant difference in the choice and use of vocabulary learning strategies by the groups. However, the researchers reported meaningful differences in the use of individual strategies in seven out of (45) strategies. Bernardo and Gonzales (2009) conducted a study on the popular vocabulary learning strategies among baccalaureate learners of five majors: 1) hospitality management, 2) engineering and computer science, 3) liberal arts and education, 4) allied medical science and 5) business education in Philippine university. They deduced significant differences in the use of social and determination strategies across the five disciplines. Their findings also revealed insignificant differences in the use of metacognitive, cognitive, and memory strategies.

**1.4 E-learning**

E-learning has drawn interest from academic and non-academic institutions due to the new developments of Information and Communication Technologies (ICT) to support learning. ICT advances largely consist of multimedia and the Internet with its World Wide Web. Interest in ICT-supported learning also imposes lower (expected) costs and leads to an easy expansion of education to the growing and flexible market that is difficult to work out by traditional delivery (Abiagam & Usoro, 2009).

Since the late 1990s, practitioners and academics have shown immense interest in e-learning; i.e., the delivery of training, education, and collaboration using hundreds of electronic media. The Internet, the most predominant electronic media, has driven the development of e-learning. For any definition of e-learning, it is safe to accept its general sense; i.e., any learning through ICT. Thus, a blended strategy that mixes the traditional face-to-face approach is accommodated (Ellis et al., 2007). For example, the University of the West of Scotland applies Blackboard as an e-learning platform to operate 'pure' e-learning and to deliver mixed-mode or blended e-learning to campus students who use e-learning to augment face-to-face learning. The UK has attained plenty of success in e-learning through blended learning, and the US has been successful mainly in the pure form of e-learning.

Hence, the literature is replete with research on VLS considering various variables like MI types. However, the present study aims at further

scrutiny of the use of VLS among EAP students taking into account their multiple intelligences and the role of online education through the following research questions:

**1.** What vocabulary learning strategies do EAP students of different disciplines use to learn their discipline-specific vocabulary in online contexts?

**2.** Can the differences in the students' vocabulary learning strategies be attributed to their specific disciplines?

**3.** Do groups of participants with various intellectual tendencies differ significantly in the use of VLSs?

## 2. Method

### 2.1 Participants

The participants of this study were drawn from a pool of 6163 undergraduate EAP students majoring in different branches of engineering, medical sciences, and humanities at 10 Iranian universities. Persian was the official language of all the participants. The researcher, for practical reasons, did not take into account the location of universities, or the participants' gender, age, language proficiency, education level, and individual learning strategies. The study applied a web-based survey to gather data from three Telegram groups. The groups included 6163 members in total out of which 426 students responded to the questionnaire; only 360 students (118 from Engineering group, 120 from Medical Sciences group, and 122 from Humanities group) provided the research with qualified responses. As the questionnaires did not include any sensitive and personal data, the researcher explained the purpose and rationale of the study and assured the participants that their data would not be shared with a third party. The data was collected during the Fall 2021 semester. Due to the COVID-19 pandemic. The participants were studying EAP courses in online classrooms.

### 2.2 Instruments

The survey for measuring participants' vocabulary learning strategies was designed based on Kulikova's modified VLSs questionnaire (2015)

because our project was narrowed down to EAP learners' VLS profile and the online context was adopted as a main variable. The scale is divided into three categories: the strategies that students use to get the meaning of new vocabulary, strategies that learners use to study new vocabulary, and the strategies that learners follow to revise vocabulary to keep them in their repertoire. Before distributing the questionnaire, it was sent in an online form to 9 university teachers to referee them. The questionnaire was finally updated according to the comments given by the referees. It was assessed using a 5-point Likert scale from always, often, sometimes, rarely, to never. The questionnaire was translated into Persian by two certified English-Persian translators to ensure that all the participants understood the items.

Part two of the survey instrument consists of eight distinct categories of multiple intelligences (Christison, 2005). Linguistic-verbal intelligence: one's ability to process words and sentences to make or create meaning; Mathematical-logical intelligence: one's ability to process numbers and logical equations to understand calculations and complex mathematical questions; Visual intelligence: the ability to find one's way around an environment, to form mental images of physical reality; Musical intelligence: the ability to perceive and create pitch and rhythmic patterns; Bodily-kinesthetic intelligence: fine motor movement and athletic prowess; Interpersonal intelligence: the ability to understand others and how they may feel, and to interact effectively with them; Intrapersonal intelligence: the ability to understand oneself and to develop a sense of self-identity; and Naturalist intelligence: the sensitivity to nature, natural objects, and natural phenomena. Like the VLSs questionnaire, the MIs scale was assessed using a 5-point Likert scale from not at all, very little, somewhat, like me, and to a great extent. The questionnaire was translated into Persian by two certified English-Persian translators to ensure that all the participants understood the items.

### 2.3 Data analysis

Using SPSS 26 software, the following techniques were applied to address the research questions:

• Establishing the reliability by Alpha Cronbach,

• K-S test for normality,

• Frequency report, One-way ANOVA, Pearson Correlation, and Multiple Regression

## 3. Results

### 3.1 Reliability tests

Cronbach's alpha procedure was performed to measure the reliability of VLS and MIs questionnaires (Table 1).

**Table 1:** Results of the Reliability Test

| | Variables | Cronbach's alpha (α>0.7) | N | Items |
|---|---|---|---|---|
| VLS | Getting the meaning of a new word | .741 | 360 | 6 |
| | Studying new vocabulary | .732 | 360 | 7 |
| | Making new vocabulary part of repertoire | .747 | 360 | 5 |
| | Total | .74 | 360 | 18 |
| MI | Verbal-linguistic | .712 | 360 | 10 |
| | Logical-mathematical | .711 | 360 | 10 |
| | Visual-spatial | .771 | 360 | 10 |
| | Bodily-kinesthetic | .776 | 360 | 10 |
| | Interpersonal | .757 | 360 | 10 |
| | Intrapersonal | .716 | 360 | 10 |
| | Musical | .737 | 360 | 10 |
| | Naturalist | .716 | 360 | 10 |
| | Total | .86 | 360 | 80 |

As shown in Table 1, Cronbach's alpha coefficient for vocabulary learning strategies and multiple intelligence and their components is greater than 0.7, signifying that each construct is sufficiently reliable.

### 3.2 Normality

The results of the Kolmogorov-Smirnov test (Table 2) proved that all significance values of the two variables and their components are more than 0.05($Sig. > .05$). Therefore, it can be claimed that the data collected from the tests had normal distributions.

**Table 2:** Results of Normality Test

| | Variables | Kolmogorov-Smirnov | | N | Items |
|---|---|---|---|---|---|
| | | Statistic | Sig. | | |
| VLS | Getting the meaning of a new word | .136 | .200 | 360 | 6 |
| | Studying new vocabulary | .101 | .075 | 360 | 7 |
| | Making new vocabulary part of repertoire | .168 | .097 | 360 | 5 |
| | Total | .130 | .153 | 360 | 18 |
| MI | Verbal-linguistic | .068 | .120 | 360 | 10 |
| | Logical-mathematical | .078 | .200 | 360 | 10 |
| | Visual-spatial | .091 | .200 | 360 | 10 |
| | Bodily-kinesthetic | .093 | .156 | 360 | 10 |
| | Interpersonal | .061 | .073 | 360 | 10 |
| | Intrapersonal | .076 | .080 | 360 | 10 |
| | Musical | .085 | .059 | 360 | 10 |
| | Naturalist | .088 | .110 | 360 | 10 |
| | Total | .079 | .140 | 360 | 80 |

### 3.3 Results of research question 1

The first question addressed the types of VLSs used by EAP students in online education. This study investigated three groups of vocabulary learning strategies: the strategies that students use to get the meaning of new vocabulary, the strategies that learners use to study new vocabulary, and the strategies that learners follow to revise vocabulary to keep them in their repertoire. A frequency report of the means was performed to examine the first research question (Table 3).

According to the results of Table 3, strategies for revising vocabulary to keep them in learners' repertoire were the most common VLS used by EAP students of engineering and medical Sciences. They used strategies for getting the meaning of a new word the least. EAP students of humanities also used strategies for revising vocabulary to keep them in learners' repertoire the most, but strategies for studying new vocabulary the least.

**Table 3:** Descriptive Statistics of Variables

| Groups | VLS | Sum | Mean | Std. Deviation |
|---|---|---|---|---|
| Engineering | Getting the meaning of a new word | 263.00 | 2.1917 | .24885 |
| | Studying new vocabulary | 366.57 | 3.0548 | .68679 |
| | Making new vocabulary part of repertoire | 389.40 | 3.2450 | .44417 |
| Humanities | Getting the meaning of a new word | 266.00 | 2.2167 | .27552 |
| | Studying new vocabulary | 368.29 | 3.0690 | .70303 |
| | Making new vocabulary part of repertoire | 386.40 | 3.2200 | .45533 |
| Medical sciences | Getting the meaning of a new word | 252.83 | 2.1069 | .18561 |
| | Studying new vocabulary | 359.00 | 2.9917 | .60646 |
| | Making new vocabulary part of repertoire | 383.60 | 3.1967 | .48644 |

### 3.4 Results of research question 2

To examine the question (Can the differences in the students' VLSs be attributed to their specific disciplines?), a One-Way ANOVA was used to compare the means of three groups for each category of strategies. The descriptive results of the pretest scores are shown in Tables 4 and 5.

| Assumption of Homogeneity of Variances |
|---|
| $H_0$: Sig.≥0.5; The variance of the two variables is the same. |
| $H_1$: Sig.<0.5; The variance of the two variables is not the same. |
| Assumption of One-Way ANOVA Test |
| $H_0$: Sig.≥0.5; There is no significant difference in means. ($\mu_1=\mu_2=\mu_3$) |
| $H_1$: Sig.<0.5; There is a significant difference in means. ($\mu_1\neq\mu_2\neq\mu_3$) |

**Table 4:** Test of Homogeneity of Variances

| | Levene Statistic | Sig. |
|---|---|---|
| Getting the meaning of a new word | 2.779 | .063 |
| Studying new vocabulary | .699 | .498 |
| Making new vocabulary part of repertoire | .659 | .518 |

Before undertaking a one-way analysis of variance, the equality of variances was checked to ensure that the proper post hoc test would be used if the means were not equal. As exhibited in Table 4, the homogeneity of variances test appears to suggest equality of variance for all strategies in online platforms (Sig.05). Table 5 analyzes the equality of means.

**Table 5:** Descriptive Statistics of One-Way ANOVA

| Variables | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| Getting the meaning of a new word | Between Groups | .794 | 2 | .397 | 6.910 | .001 |
| | Within Groups | 20.503 | 357 | .057 | | |
| | Total | 21.296 | 359 | | | |
| Studying new vocabulary | Between Groups | .407 | 2 | .203 | .458 | .633 |
| | Within Groups | 158.713 | 357 | .445 | | |
| | Total | 159.120 | 359 | | | |
| Making new vocabulary part of repertoire | Between Groups | .140 | 2 | .070 | .328 | .721 |
| | Within Groups | 76.308 | 357 | .214 | | |
| | Total | 76.448 | 359 | | | |

The results of Table 5 demonstrate that the assumption of zero or equal means of the three educational disciplines is verified for studying new vocabulary and making new vocabulary part of repertoire, but it was rejected for getting the meaning of a new word as the significance level is lower than 0.05 standard error (Sig. = 001). Indeed, the different disciplines had significantly different means for getting the meaning of a new word, signaling that at least one of the educational disciplines differed significantly from the others on the relevant strategy.

The Tukey post hoc test (for variables with equal variance and the Tamhane test for variables with unequal variance) was used to identify the discipline with a greater or lesser mean. Tables 6 and 7 present the findings.

**Table 6:** Post Hoc Test (Multiple Comparisons) for Getting the Meaning

| Dependent Variable | Post Hoc | (I) Academic Disciplines | (J) Academic Disciplines | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval Lower Bound | 95% Confidence Interval Upper Bound |
|---|---|---|---|---|---|---|---|---|
| Getting the meaning of a new word | Tukey HSD | Medical Sciences | Humanities | -.02500 | .03094 | .698 | -.0978 | .0478 |
| | | | Engineering | .08472* | .03094 | .018 | .0119 | .1575 |
| | | Humanities | Medical Sciences | .02500 | .03094 | .698 | -.0478 | .0978 |
| | | | Engineering | .10972* | .03094 | .001 | .0369 | .1825 |
| | | Engineering | Medicine | -.08472* | .03094 | .018 | -.1575 | -.0119 |
| | | | Humanities | -.10972* | .03094 | .001 | -.1825 | -.0369 |

In line with the results of Table (6), a significance level greater than 0.05 standard error acknowledges that the means of the two groups are similar. In other words, a significant difference in educational disciplines was identified between the groups highlighted in gray ($Sig < 0.05$). The results of homogeneous subsets are reported in Table (7) for a more extensive examination of heterogeneous groupings (gray highlighted).

**Table 7:** Homogeneous Subsets for Getting the Meaning

| | Academic Disciplines | N | Subset for alpha = 0.05 | |
|---|---|---|---|---|
| | | | 1 | 2 |
| Getting the meaning of a new word | Engineering | 118 | 2.1069 | |
| | Medical Sciences | 120 | | 2.1917 |
| | Humanities | 122 | | 2.2167 |
| | Sig. | | 1.000 | .698 |

The table displays the following range: Getting the meaning of a new word: Humanities = Medical Sciences > Engineering Studying new vocabulary: Humanities = Medical Sciences = Engineering Making new vocabulary part of repertoire: Humanities = Medical Sciences = Engineering

### 3.5 Results of research question 3

The third research question sought for a relationship between any category of strategies and any of the multiple intelligence types used by EAP students. Pearson correlation and multiple regression tests were undertaken to answer RQ3 (Tables 8 & 9).

| Assumption of Correlation Test |
|---|
| $H_0$: Sig.≥0.5; There is no significant relationship between the two variables. (r=0) |
| $H_1$: Sig.<0.5; There is a significant relationship between the two variables. (r≠0) |

**Table 8:** Results of Pearson Correlation between MIs and VLSs

| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Getting the meaning of a new word | Pearson Correlation (r) | 1 | .031 | .149** | .354 | -.040 | -.050 | -.009 | -.083 | -.084 | -.019 | .001 | -.082 | -.063 |
| | | Sig. (2-tailed) | | .556 | .004 | .000 | .447 | .346 | .866 | .117 | .113 | .721 | .991 | .122 | .232 |
| | | N | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| 2 | Studying new vocabulary | Pearson Correlation (r) | .031 | 1 | .210** | .817 | .001 | -.015 | .013 | -.001 | -.010 | .018 | -.008 | .063 | .012 |
| | | Sig. (2-tailed) | .556 | | .000 | .000 | .990 | .781 | .804 | .982 | .850 | .730 | .880 | .234 | .827 |
| | | N | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| 3 | Making new vocabulary part of repertoire | Pearson Correlation (r) | .149** | .210** | 1 | .677 | .062 | .167 | .138 | .198 | .001 | .155 | .141 | .087 | .166 |
| | | Sig. (2-tailed) | .004 | .000 | | .000 | .237 | .001 | .009 | .000 | .987 | .003 | .007 | .099 | .002 |
| | | N | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| 4 | VLS | Pearson Correlation (r) | .354** | .817** | .677** | 1 | .021 | .059 | .075 | .075 | -.028 | .084 | .064 | .066 | .073 |
| | | Sig. (2-tailed) | .000 | .000 | .000 | | .696 | .266 | .157 | .158 | .593 | .111 | .228 | .211 | .166 |
| | | N | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| 5 | Verbal-linguistic | Pearson Correlation (r) | -.040 | .001 | .062 | .021 | 1 | .361 | .398 | .355 | .404 | .464 | .385 | .550 | .668 |
| | | Sig. (2-tailed) | .447 | .990 | .237 | .696 | | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| | | N | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| | | Pearson Correlation | -.050 | -.015 | .167** | .059 | .361 | 1 | .590 | .497 | .370 | .473 | .434 | .520 | .733 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **6** | Logical-mathematical | Pearson Correlation (r) | .346 | .781 | .001 | .266 | .000 | | .000 | .000 | .000 | .000 | .000 | .000 | .000 |
| | | Sig. (2-tailed) | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| | | N | -.009 | .013 | .138** | .075 | .398 | .590 | 1 | .477 | .380 | .567 | .451 | .578 | .769 |
| **7** | Visual-spatial | Pearson Correlation (r) | .866 | .804 | .009 | .157 | .000 | .000 | | .000 | .000 | .000 | .000 | .000 | .000 |
| | | Sig. (2-tailed) | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| | | N | -.083 | -.001 | .198** | .075 | .355 | .497 | .477 | 1 | .388 | .618 | .385 | .422 | .722 |
| **8** | Bodily-kinesthetic | Pearson Correlation (r) | .117 | .982 | .000 | .158 | .000 | .000 | .000 | | .000 | .000 | .000 | .000 | .000 |
| | | Sig. (2-tailed) | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| | | N | -.084 | -.010 | .001 | -.028 | .404 | .370 | .380 | .388** | 1 | .450 | .235 | .505 | .637 |
| **9** | Interpersonal | Pearson Correlation (r) | .113 | .850 | .987 | .593 | .000 | .000 | .000 | .000 | | .000 | .000 | .000 | .000 |
| | | Sig. (2-tailed) | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| | | N | -.019 | .018 | .155** | .084 | .464 | .473 | .567 | .618 | .450 | 1 | .524 | .618 | .820 |
| **10** | Intrapersonal | Pearson Correlation (r) | .721 | .730 | .003 | .111 | .000 | .000 | .000 | .000 | .000 | | .000 | .000 | .000 |
| | | Sig. (2-tailed) | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 | 360 |
| | | N | .001 | -.008 | .141** | .064 | .385 | .434 | .451 | .385 | .235 | .524 | 1 | .383 | .650 |
| **11** | Musical | Pearson Correlation (r) | .991 | .880 | .007 | .228 | .000 | .000 | | | | | | | |
| | | Sig. (2-tailed) | 360 | 360 | 360 | 360 | 360 | 360 | | | | | | | |
| | | N | -.082 | .063 | .087 | .066 | .550 | .520 | | | | | | | |
| **12** | Naturalist | Pearson Correlation (r) | .122 | .234 | .099 | .211 | .000 | .000 | | | | | | | |
| | | Sig. (2-tailed) | 360 | 360 | 360 | 360 | 360 | 360 | | | | | | | |
| | | N | | | | | | | | | | | | | |
| | | Pearson | | | | | | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **13** | Multiple Intelligence | Correlation (r) | -.063 | .012 | .166** | .073 | .668 | .733 |
| | | Sig. (2-tailed) | .232 | .827 | .002 | .166 | .000 | .000 |
| | | N | 360 | 360 | 360 | 360 | 360 | 360 |

According to Table 8 and the correlation test assumption, no relationship was found between strategies for getting the meaning of a new word and studying new vocabulary, and multiple intelligence and its dimensions. But, a small positive relationship was found between making new vocabulary part of the repertoire and multiple intelligence ($Sig. < .05$); logical-mathematical, visual-spatial, bodily-kinesthetic, musical, and intrapersonal dimensions of intelligence had a relationship with making new vocabulary part of the repertoire.

Further, a multiple regression test was used to investigate if MI types can predict EAP students' VLS use (Tables 10 & 11). Before reporting the regression results, Table 9 presents the descriptive results of examining the relevant variables.

**Table 9:** Descriptive Statistics for MI Types and VLS Categories

| Groups | Variables | Mean | Std.Deviation |
|---|---|---|---|
| Medical sciences | Getting the meaning of a new word | 2.1917 | .24885 |
| | Studying new vocabulary | 3.0548 | .68679 |
| | Making new vocabulary part of repertoire | 3.2450 | .44417 |
| | VLS | 2.8305 | .32550 |
| | Verbal-linguistic | 3.1525 | .39915 |
| | Logical-mathematical | 3.3233 | .42103 |
| | Visual-spatial | 3.2783 | .42883 |
| | Bodily-kinesthetic | 3.5158 | .42188 |
| | Interpersonal | 3.1000 | .40042 |
| | Intrapersonal | 3.3583 | .41960 |

| | | | |
|---|---|---|---|
| | Musical | 3.2075 | .37977 |
| | Naturalist | 3.2175 | .44940 |
| | Multiple Intelligence | 3.2692 | .30982 |
| Humanities | Getting the meaning of a new word | 2.2167 | .27552 |
| | Studying new vocabulary | 3.0690 | .70303 |
| | Making new vocabulary part of repertoire | 3.2200 | .45533 |
| | VLS | 2.8352 | .32373 |
| | Verbal-linguistic | 3.1542 | .38933 |
| | Logical-mathematical | 3.3517 | .38128 |
| | Visual-spatial | 3.2650 | .42479 |
| | Bodily-kinesthetic | 3.4458 | .44152 |
| | Interpersonal | 3.0625 | .38042 |
| | Intrapersonal | 3.3408 | .44467 |
| | Musical | 3.3133 | .38609 |
| | Naturalist | 3.2125 | .38623 |
| | Multiple Intelligence | 3.2682 | .28977 |
| Engineering | Getting the meaning of a new word | 2.1069 | .18561 |
| | Studying new vocabulary | 2.9917 | .60646 |
| | Making new vocabulary part of repertoire | 3.1967 | .48644 |
| | VLS | 2.7651 | .28965 |
| | Verbal-linguistic | 3.1042 | .38071 |
| | Logical-mathematical | 3.3592 | .43647 |
| | Visual-spatial | 3.2442 | .42343 |
| | Bodily-kinesthetic | 3.5258 | .46626 |
| | Interpersonal | 3.1158 | .38436 |
| | Intrapersonal | 3.4225 | .47127 |
| | Musical | 3.2625 | .40854 |
| | Naturalist | 3.2133 | .48193 |
| | Multiple Intelligence | 3.2809 | .31230 |

Based on the results of Table 10, the Durbin-Watson index is between 1.5 and 2.5. Accordingly, the preconditioning of the regression is established. Table 10 shows that the greatest impact was obtained for the engineering group.

**Table 10:** Results of Model Summary

| Group | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
|---|---|---|---|---|---|
| Medical sciences | .193 | .037 | -.005 | 2.22624 | 1.831 |
| Humanities | .266 | .071 | .030 | 2.24253 | 1.887 |
| Engineering | .336 | .113 | .074 | 2.34085 | 1.985 |
| Total | .219 | .048 | .034 | 2.26729 | 1.902 |

According to Table 11, ANOVA result was significant for the engineering group and also for all samples in the total group.

**Table 11:** Results of ANOVA for MI Types and VLS

| Group | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| Medical sciences | Regression | 21.924 | 5 | 4.385 | .885 | .494 |
| | Residual | 565.001 | 114 | 4.956 | | |
| | Total | 586.925 | 119 | | | |
| Humanities | Regression | 43.501 | 5 | 8.700 | 1.730 | .133 |
| | Residual | 573.299 | 116 | 5.029 | | |
| | Total | 616.800 | 121 | | | |
| Engineering | Regression | 79.293 | 5 | 15.859 | 2.894 | .017 |
| | Residual | 624.674 | 112 | 5.480 | | |
| | Total | 703.967 | 117 | | | |
| Total | Regression | 91.417 | 5 | 18.283 | 3.557 | .004 |
| | Residual | 1819.780 | 354 | 5.141 | | |
| | Total | 1911.197 | 359 | | | |

Further, the significance level of the regression test was not significant for any of the research variables in any discipline. This means that each of the variables alone had a significant effect on the dependent variable, but together they weakened each other's effect. This is because the intensity of the relationship between the variables in the correlation test was weak, which results in the non-significance of the regression between those variables (Table 12).

**Table 12:** Coefficient Result for MI Types and VLS

| Group | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| Medical sciences | (Constant) | 12.415 | 2.137 | | 5.810 | .000 |
| | Logical-mathematical | .855 | .670 | .162 | 1.275 | .205 |
| | Visual-spatial | -.333 | .708 | -.064 | -.470 | .640 |
| | Bodily-kinesthetic | .231 | .655 | .044 | .353 | .725 |
| | Intrapersonal | -.074 | .731 | -.014 | -.102 | .919 |
| | Musical | .467 | .663 | .080 | .704 | .483 |
| Humanities | (Constant) | 11.800 | 2.217 | | 5.323 | .000 |
| | Logical-mathematical | 1.217 | .737 | .204 | 1.651 | .101 |
| | Visual-spatial | .439 | .645 | .082 | .680 | .498 |
| | Bodily-kinesthetic | .645 | .630 | .125 | 1.024 | .308 |
| | Intrapersonal | -.605 | .648 | -.118 | -.933 | .353 |
| | Musical | -.427 | .631 | -.072 | -.677 | .500 |
| Engineering | (Constant) | 9.481 | 2.172 | | 4.365 | .000 |
| | Logical-mathematical | -.300 | .618 | -.054 | -.487 | .627 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Visual-spatial | -.259 | .685 | -.045 | -.378 | .706 |
| | Bodily-kinesthetic | .994 | .610 | .191 | 1.629 | .106 |
| | Intrapersonal | .796 | .687 | .154 | 1.158 | .249 |
| | Musical | .651 | .680 | .109 | .958 | .340 |
| Total | (Constant) | 11.103 | 1.248 | | 8.896 | .000 |
| | Logical-mathematical | .400 | .383 | .072 | 1.044 | .297 |
| | Visual-spatial | .018 | .385 | .003 | .047 | .963 |
| | Bodily-kinesthetic | .701 | .360 | .135 | 1.948 | .052 |
| | Intrapersonal | .047 | .390 | .009 | .121 | .904 |
| | Musical | .304 | .372 | .052 | .818 | .414 |

## 4. Discussion

Using the research questions as a framework, this section presents the discussion and interpretation of the findings.

### 4.1 Addressing research question 1

Research question 1 focuses on vocabulary learning strategies that Iranian EAP learners report using. Prior to the interpretation and discussion of the results, it should be restated that the VLSs survey applied in this study was extracted from Kulikova's modified VLSs questionnaire (2015). According to him, the strategies are classified as the following:

**Table 13:** Taxonomy of Individual VLSs

| VLSs | VLS taxonomy |
|---|---|
| Getting the meaning of a new word | |
| 1. Looking the word up in a bilingual dictionary (English-Persian dictionary) | *Cognitive* |

| | |
|---|---|
| 2. Looking the word up in a monolingual dictionary (English-English dictionary) | *Cognitive* |
| 3. Searching for it in Google to find its meaning in different dictionaries | *Cognitive* |
| 4. Asking the teacher to translate it | *Social* |
| 5. Asking the classmates to translate it | *Social* |
| 6. Asking the friends via whatsApp group or other social media devices to translate it | *Social and cognitive* |
| 7. Guessing the meaning from the context | *Cognitive* |
| Studying new vocabulary | |
| 1. Reviewing the newly learned terms with my classmates | *Social and* |
| 2. Repeating them aloud | *memorization* |
| 3. Repeating them silently | *Memorization* |
| 4. Writing them repeatedly | *Memorization* |
| 5. Connecting the words to their synonyms/antonyms | *Memorization* |
| 6. Translating them into Persian in the course book. | *Memorization(association)* |
| 7. Writing example sentences for the new words. | *Cognitive* |
| | *Cognitive* |
| Making new vocabulary part of repertoire | |
| 1. Keeping lists of learned words and revising them regularly. | *Memorization* |
| 2. Using newly learned words as much as possible when writing | *Cognitive* |
| 3. Writing new words of flash cards and hanging on the wall | *Memorization* |
| | *Memorization* |
| 4. Keeping vocabulary notebook and reviewing continuously | *Memorization* |
| 5. Making vocabulary cards and studying them every now and then | |

Source: Kulikova (2015)

As the analysis of the descriptive data showed (Table 3), making new vocabulary part of the repertoire was found to be the most common strategy used by Iranian engineering and medical students on online platforms; that is, when the students are exposed to a new word, they desire to make the new vocabulary part of their repertoire by keeping lists of learned words and revising them regularly, using newly learned words as much as possible when they write, writing new words of flash cards and hang on the wall, keeping vocabulary notebook and reviewing continuously, and making vocabulary cards and studying them now and then. However, getting the meaning of a new word is the least common strategy used by engineering and medical students; that is, when the students are exposed to a new academic word in online class, they don't take advantage of strategy variety. In other words, the students less frequently use looking up the word in a bilingual dictionary, looking up the word in a monolingual dictionary, searching for the new vocabulary in Google to find its meaning in different dictionaries, asking the teacher to translate the new word, asking the classmates to translate it, asking the friends via WhatsApp group or other social media devices to translate the new word, and guessing the meaning from the context.

In the field of humanities, similar to other groups, the students often utilize strategies for making new vocabulary part of their repertoire; however, they less frequently use strategies for studying new vocabulary. In other words, they don't benefit from the diversity of the techniques for studying the new vocabulary, including reviewing the newly learned terms with their classmates, repeating them aloud, repeating them silently, writing them repeatedly, connecting the words to their synonyms/antonyms, translating them into Persian in the course book, and writing example sentences for the new academic words. But similar to the engineering and medical students, the strategies of making new vocabulary part of repertoire were popular among the humanities students.

In line with our results, Soodmand Afshar et al. (2014) reported that "repeating the new word orally several times," and "studying the spelling of the new word and writing new English words several times" were frequently applied by medical students. Hashemi and Hadavi (2015)

also reported dictionary strategy as one of the less favorite strategies among EFL learners, which is similar to our findings. In another study, Amirian and Heshmatifar (2013) revealed that the participants don't use social strategies as a frequent practice which confirms the findings of the present study. Kameli and Mostapha (2012) noted that "repetition of the word silently several times" is one of the most common strategies among Persian EFL learners. In the same vein, the repetition strategy was found to be highly favored by all (good and poor) learners in Soodmand Afshar's (2010) study, and was among the top five strategies used by the best learners. Based on the findings of O'Malley et al. (1985), successful Asian learners (including good Iranian EFL learners) tend to adopt and use mechanical vocabulary learning strategies, such as repetition and memorization. On the other hand, Amirian and Heshmatifar (2013), Noor and Amir (2009), Al-Omairi (2020), Hashemi and Hadavi (2015), and Kameli and Mostapha (2012) reported guessing meaning as the most favorite strategy used by the participants. However, the students of the present study less frequently guess the meaning from the context. Mutalib et al. (2014) also showed that Malaysian students primarily relied on discovery strategies such as asking friends and teachers, referring to dictionaries and guessing words. This is, though, inconsistent with our findings.

### 4.2 Addressing research question 2

The second research question examines whether the differences in the use of vocabulary learning strategies in online contexts can be attributed to the students' specific disciplines. According to the results, the assumption of zero or equal means was verified for "studying new vocabulary" and "making new vocabulary part of repertoire". It was rejected for "getting the meaning of a new word"; i.e., the significance level is lower than 0.05 standard error (Sig. = 001). Namely, the intended EAP disciplines had significantly different means for "getting the meaning of a new word" in the online context. In other words, at least one of the educational disciplines differed significantly from the others regarding the use of strategies for getting the meaning of new vocabulary. Table 7 indicates that Engineering students use different strategies to get the meaning of new vocabulary.

Regarding the relationship between the strategy types and the study area, Afshar et al. (2014) investigated Iranian EAP and EFL undergraduate students. They came up with an insignificant difference in the choice and the use of VLS by the groups. However, Bernardo and Gonzales (2009) conducted a study on the popular vocabulary learning strategies among baccalaureate learners of five majors: 1) hospitality management, 2) engineering and computer science, 3) liberal arts and education, 4) allied medical science and 5) business education in Philippine university. They deduced significant differences in the use of social and determination strategies across the five disciplines. Their findings, though, revealed insignificant differences in the use of metacognitive, cognitive, and memory strategies across the five disciplines. Gu (2002) also investigated the impact of gender and discipline on Chinese EFL learners' VLSs. She claimed that academic major is a less potent background factor than gender in determining learning results and using VLSs. Durrant (2009), however, concluded that the vocabulary needs of students in Arts and Humanities characteristically differ from those of students in other academic majors.

### 4.3 Addressing research question 3

Pearson correlation and multiple regressions were used to test if there is any relationship between the variables of MIs and VLSs. The results indicate that there is no correlation between getting the meaning of a new word and studying new vocabulary, and MI types. Regarding making new vocabulary part of repertoire, however, a small positive correlation was observed between the strategies and some bits of MIs (logical-mathematical, visual-spatial, bodily-kinesthetic, musical, and intrapersonal) only among the engineering students. Put differently, logical-mathematical, visual-spatial, bodily-kinesthetic, musical, and intrapersonal intelligence may act as predictors of VLS use among the engineering group; any change in logical-mathematical, visual-spatial, bodily-kinesthetic, musical, and intrapersonal dimensions of intelligence affect their practice in making the new vocabulary part of the repertoire. ANOVA results also confirmed the link between the use of VLSs and MIs only for the engineering group and all samples in the total group. Ahour (2015) also found a relationship between MI and vocabu-

lary learning knowledge; linguistic and natural intelligence made a statistically significant contribution to the prediction of vocabulary learning knowledge. This finding is in line with the results of Razmjoo et al. (2009), who reported a statistically significant correlation between linguistic and natural intelligence, and the prediction of vocabulary learning knowledge. The use of VLS by the female learners, however, was well predicted by bodily and naturalist intelligence. Abbasian and Shirazifard (2016) came up with a meaningful association between EFL learners' MI types and English language proficiency. They concluded that the students with accommodated learning styles and MI types performed better in learning English as a foreign language than those taught in a traditional curriculum.

Based on the results obtained by Zafarghandi and Amini (2019), it is clear that the bodily, natural, and interpersonal bits of intelligence are strongly predictive of determination, social, and memory strategies. However, natural intelligence negatively predicts social strategies. Overall, different categories of strategies are significantly related to bits of intelligence. In line with the findings of this study, a weak positive correlation was already reported by Fardad et al. (2015) between MI scores and vocabulary knowledge and by Javanmard (2012) between vocabulary test performance and bodily-kinesthetic intelligence.

## 5. Conclusion

The present study sought to explore Iranian EAP learners' VLS profiles in online education concerning the role of MIs. The results showed that they use a few strategies for coping with the new vocabulary whereas learners' differences lead to different approaches to learning a language in general and lexicon in particular. According to the results, the learners of the present study are unaware of the techniques they should use in vocabulary learning. Students should employ more vocabulary learning strategies to facilitate their vocabulary learning. With only modest extra effort, they can integrate various learning techniques and improve their overall vocabulary acquisition ability. Strategy training in the Iranian context may help the students get familiar with VLSs and apply them to overcome difficulties with studying and learning harsh academic and

technical words. Moreover, strategy training enhances learners' independent and autonomous learning, leading to the development of taking responsibility for their own learning (Shi, 2017).

The continuous search on Google to get the meaning of the new word by students of the three disciplines emphasizes the role of IT in current education. Seemingly, the Internet and technology make the learners needless of any other type of strategies. However, incorporating diverse tactics plays a significant role in studying, learning, and achievement. Finally, the lack of a strong relationship between VLSs and MIs calls the Iranian EAP stakeholders to take action toward multiple intelligence-based teaching and learning. Lei et al. (2021) argued that multiple intelligence helps students achieve the goal of adaptive development. They believe the use of MI can provide gifted students with proper development and growth opportunities. Using MIs in education also can support students with problems and provide appropriate methods for their learning.

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