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Self-Efficacy and Socioeconomic Status as Impact Factors for Working Memory and Language Learning: A Review Paper

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Abstract: For elder adults all over the world, impairment of working memory (WM) — a kind of cognitive deficit induced by aging and diseases, is adversely affecting their lives. It is also known that WM has an important impact on students' academic success in English. Among children's studies, language learning has gradually received more attention with the process of globalization. Previous researches used several data collection methods, such as questionnaire, scale, task and test to measure variables. Pearson correlation and hierarchical regression were adopted to analyze effects of self-efficacy and family socioeconomic status (SES) on WM and language learning statistically. Through the review and summary of these studies, it is generally concluded that self-efficacy of the elderly is positively correlated with their WM functioning; there is a positive correlation between self-efficacy and English learning outcomes of university students; family SES is positively related to WM updating capability and English proficiency in children and adolescents. The significance of this paper lies in some implications based on results of existing studies. WM span of the aged can be regulated through intervention. Educators' more attention to students and purposive teaching strategies, and active parenting including more participation in kids' education and creating a good home language learning environment for children will be helpful to improve WM ability and language learning experience and attainment of students.

Keywords: working memory, language learning, self-efficacy, family socioeconomic status

1. Introduction

There are two hypothetical dependent variables, WM and language learning. WM can be perceived as the capability to retain and process information to think and act intelligently [1]. For school-aged children, WM functioning plays a significant role in predicting academic achievement independently of intelligence level [2]. In recent years, world's elderly population is increasing and the risk of cognitive deficits, including WM impairments raises. As a disorder related to aging, Alzheimer's disease particularly leads to these decays, which have a negative impact on the lives of older people [3]. With the process of globalization, more and more individuals, especially parents realize the importance of learning a foreign language, particularly English. In this article, impact factors for WM and language learning are self-efficacy and family SES. Self-efficacy is a person's perception of their capacity to execute actions for achieving the expected goal [4]. The concept of Memory self-efficacy

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(MSE) was generated because Bandura's self-efficacy theory was applied to memory field. MSE can be conceived as individual beliefs about their memory performance. Family SES refers to a family's position in the society measured through several indices that parental educational attainment, family income, employment status, occupational level, and prosperity [5].

2. Impact Factors for Working Memory

2.1. Self-efficacy

A previous study selected 197 US residents aged 55 to 84 years old through Amazon's Mechanical Turk (MTurk) platform [6]. Among them, 73.1% are female and 89.2% are Caucasians. They were well-educated and had a good work quality. Inspired by the advice to assess MSE through predicting and judging memory task performance and the Memory Self-Efficacy Questionnaire (MSEQ), the authors asked participants to rate their confidence ranging in 12 projects related to digit span WM tasks [7,8]. Regarding the measurement of WM ability, the study used the similar procedure to Wechsler Adult Intelligence Scale-Fourth Edition Working Memory Index (WAIS-IV) to generate digit strings and turned verbal memory task in WAIS-IV into a visual memory task through display on screen. The researchers created the bivariate correlation matrix to detect bivariate correlations between variables, and the results showed that WM was significantly positively correlated with MSE. Moreover, researchers performed hierarchical linear regression to examine the reliability of MSE in predicting WM performance. They introduced covariates, such as a history of illnesses, a neurological condition, an unconscious episode and a substance use disorder; age, gender, income, educational attainment, anxiety and depression. Then through comparing the explanation of variance in WM by MSE and these covariates, researchers found that MSE was the only variable that markedly affected WM performance. In addition, MSE was also studied as a mediator. Bootstrapping mediation analyses were used to detect whether MSE played an effective role in mediating the relationship between depression and WM, and between anxiety and WM. Indirect effect results were not significant, suggesting a direct association between MSE and WM.

Another study discussed the correlation between WM and MSE in older adults [9]. In this study, 111 elderly residents of Nagasaki, Japan, took a curriculum centering in human memory and participants' MSE were assessed before and after courses, named as pre-MSE and post-MSE respectively, using the localized MSE questionnaire. And in the process, their WM span was measured by three memory tasks related to word, position, and symmetry. The results demonstrated that there was a moderate association between WM span and post-MSE. The data from study of Mashinchi et al. is cross-sectional, which could exclude a causal inference [6]. The directional relation that describes the effect of MSE on WM is indeterminate. What Otsuka and Miyatani did is an attempt in opposite direction to explore the effect of WM span on MSE [9]. It seems that findings of Otsuka and Miyatani's study and of Mashinchi et al.'s study could complement each other [6,9]. Using bivariate correlations, a previous study examined and found that the relationship between MSE and WM was not significant (r=0.9), which contrasts sharply with the conclusions of Mashinchi et al.'s research [6,10]. According to the latter, WM and MSE had a noticeable positive correlation. Mashinchi et al.'s paper refined the former's research methods, such as using hierarchical regression to test the predictive level of WM ability under the control of other variables, and for the first time, using bivariate correlations to detect the relationship between MSE and WM ability when taking important covariates into account [6].

The study of Mashinchi et al. certainly has some limitations [6]. There is a quite small and homogenous sample with only 197 participants and the majority of which are women and whites. And they have an overall high level of education and the access to the Internet to open an account, which makes the sample not broadly representative. Second, 108 people were not included since they

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did not finish the survey. The length of the survey — 21 minutes or so, might be too long. Moreover, the criterion for screening participants was not strictly regulated. Some people who did not meet the age requirement took advantage of the characteristics of online platforms to obtain monetary rewards.

2.2. Family Socioeconomic Status

Zhao et al.'s study selected 260 students with an average age of 13.35 in Western China, including 123 boys and 137 girls, using the cluster sampling method [11]. Most of them lived with parents in rural areas. The researchers employed the Family Affluent Scale (FAS) [12]. The parental educational attainment and occupational level, and monthly income per capita were then assessed. A self-anchoring scale was prepared to ask students their perceived SES. The SES level in the study was represented by the sum of the scores of these five measures. Higher scores represent a higher level of SES. The mother's and father's involvement in children's education was assessed by the questionnaire based on Grolnick and Slowiaczek's study and Keith et al.'s work, including intellectual involvement, emotional or motivational involvement and behavioral management involvement [13,14]. In addition, participating students employed the 5-point Likert Scale to indicate how often they observed their parents to implement these engagements. In Eprime 2.0, participants went through two running memory (RM) tasks — RM-1750ms and RM-750ms in sequence, which took about 20 minutes. Participants had to recall the last three digits of a series of given numbers. In the analysis, researchers took the average of two performance marks as the outcome measure. During this session, participants were constantly updating their WM content. SPSS-27 was used for statistical analyses. Pearson correlation analyses were conducted to examine the connection between dependent variables and ANOVA was performed on parental educational participation. Finally, with the predictor — SES level, criterion — RM task performance, and the mediator — each of the three types of parental education participation, the mediation analysis was carried out through the PROCESS macro [15]. SES level is significantly associated with various dimensions of parents' educational engagement as well as performance of RM tasks. Moreover, SES had important effects on RM performance both directly and indirectly. Only maternal behavioural and intellectual involvement markedly mediated the correlation between SES and RM task attainment. The study found a significant positive association between Chinese adolescents' family SES and their WM updating capability, and the relationship was mediated by mother's behavioral involvement.

Akhlaghipour and Assari's study used parental education and family income as independent variables, ethnicity, age, gender, and parental marital status as covariates, through the secondary analysis of data in Adolescent Brain Cognitive Development (ABCD) study, eventually concluded that in America, higher family income and parental education — indicating higher family SES, was related to better WM in children [16]. But these two measures had a weaker effect on WM in children from black households than children from white households. Compared to Zhao et al.'s work, this study similarly concluded that children's WM was positively associated with family SES [11,16]. Furthermore, it also considered the influence of racial difference and inequality.

As for the limitations of Zhao et al.'s study, both the assessment of noticed SES level and the estimation of the frequency of parental involvement in education were based on self-reports of adolescents [11]. They are not objective and reliable enough. Moreover, the sample is from the west of China, which is relatively poor and may not be universal throughout the whole country.

3. Impact Factors for Language Learning

3.1. Self-efficacy

Ömer and AKÇAYOĞLU's research selected 344 English as a foreign language (EFL) learners with English proficiency at A1 level from a state university in Turkey using the non-probability criterion

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sampling technique [17]. At the beginning of the semester from October 2019 to January 2020, data on foreign language (FL) self-efficacy and foreign-language anxiety (FLA) was collected. A scale developed by YANAR and Bümen's work containing 34 questions was used to assess participants' FL self-efficacy, and FLA was measured using the 33-item Turkish version of Foreign Language Classroom Anxiety Scale (FLCAS), which has been developed by Horwitz et al.'s study originally [18,19]. Students' answers to these two scales were based on the five-point Likert scale. At the end of the semester, authors got records of students' English grades, which have been combined oral and written assignments and quizzes, and then used IBM SPSS Statistics version 22 to analyse the data. The results indicated that participants exhibited medium self-efficacy and anxiety. Next, after conducting a simple linear regression, it was discovered that there was a statistically significant correlation between EFL students' FL self-efficacy and their academic attainment in English. Enhanced FL self-efficacy could reflect an increased FL academic achievement. Pearson correlation coefficients revealed a moderate negative association between FL self-efficacy and FLA. The result of the study is that students with high level of self-efficacy also have low extent of FLA. This situation allows students to immerse themselves in a positive learning experience and predicts higher academic performance in FL. The limitations of this study mainly lie in the lack of representativeness and objectivity. The data for FL self-efficacy and FLA were gathered at only one university through students' self-reports, which were likely to be affected by social-desirability bias. Moreover, quantitative data is not rich enough. Future research is expected to incorporate participating students' previous grades, records of teachers' lesson observation and interviews with students as covariates in the process of data collection and analysis.

In another quantitative study, 767 students from a private university in Vietnam completed the 32-item Questionnaire of English Self-Efficacy (QESE) [20]. Participants rated themselves based on a seven-point Likert scale and were required to do the English language proficiency test in listening and reading at the end of four compulsory courses. Descriptive statistics indicated that both participating students' self-efficacy of using English, and their attainment of English language proficiency test were at a medium level. Pearson correlation coefficients showed that there was a high degree of association between the constructs measured by QESE and English proficiency test. In addition, compared to Ömer and AKÇAYOĞLU's research, Truong and Wang's study controlled students' background information and learning experiences such as their high school locations and years of learning English [17,20]. Under this condition, the results of stepwise multiple linear regression further illustrated a positive correlation between self-efficacy and English proficiency.

3.2. Family Socioeconomic Status

The sample of Luo et al.'s study consisted of 108 Spanish-English dual-language learners (DLLs) aged 3 to 5 years recruited in Florida [21]. In this study, SES was measured by the educational level of the kids' caregivers. Caregivers reported how often children read at home and how many children's books they had as indicators of the children's home literacy environment. The researchers employed the Quick Interactive Language Screener: English-Spanish version (QUILS:ES) to assess the children's current language knowledge — the level of comprehension of vocabulary and grammar, and their language learning process — the capability to learn new words. A hierarchical linear regression tested the impact of SES on the bilingual learning process and found that children from families with high SES performed better than those with low SES in learning new language items. In addition, this study identified and confirmed the mediating pathways through which SES influences the language learning process, implying that higher SES was associated with more affluent home linguistic environment, which provided children with more language learning opportunities and enhanced their ability to learn advanced knowledge of grammar and lexis. A limitation of the study is that the researchers only used the educational level caretakers as a measure of SES. Although it

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does have strong predictive power for holistic SES score, examining other indicators could lead to a more accurate assessment of SES. Additionally, the literacy environment was appraised only by frequency of reading and the number of books children could read, without considering other language-related activities children engaged in, such as reading other learning materials with other family members. This study is cross-sectional in nature, so it is not possible to conclusively determine a causal relationship that existing knowledge and home literacy environment affect language learning process and outcomes. Besides, the QUILS:ES employed in the study was a newly developed tool that needed to be further tested for specificity and sensitivity.

Another descriptive quantitative study conducted in Indonesia used simple random sampling technique to pick 29 students from the eighth grade of a junior high school [22]. After that, the study applied questionnaire to collect students' SES and obtained their English scores on the final examination of a prior semester from their English teachers. Pearson Product Moment Correlation in SPSS Program Version 23 was utilized to analyze the data on two variables and yielded the result that there was a moderate positive correlation between family SES and students' English attainment. Parents' SES had a positive and marked impact on students' achievement in English learning. Compared to Luo et al.'s work, the sample of this study is too small and unrepresentative, since there were only 29 people and the average SES level of students' families in this school was quite high [21,22]. Moreover, the description of the questionnaire for estimating SES was not specific enough, and students' English learning performance was obtained through checking existing reports instead of designing an additional test for them. Future research needs a larger sample scale with diversity, also including adolescents in indigent environments and moderately disadvantaged families. Participants should do the same test for English level at the same time in the same place under researchers' supervision. In addition, different teaching styles of teachers, educators' English proficiency and students' classroom behaviors can be considered as covariates.

4. Discussion

Considering the results of Mashinchi et al.'s study and Otsuka and Miyatani's work together, a conclusion can be yielded that self-efficacy in the domain of memory, that is, one's beliefs in memory, is positively correlated with WM span and WM performance [6,9]. The sample in both studies are older adults. Early research showed that as the elders age, they become less and less confident about their memory abilities [23]. However, current findings claim that after performing WM span task, older adults' MSE was adjusted to a level adapted to their WM spans. There are also inspirations for neuropsychologists that interventions that help enhance MSE might also be helpful in improving WM ability, meaning that if an individual's WM performance and MSE are not good, then the intervention can be implemented to enhance MSE and then improve WM ability consequently. Regarding another effect factor for WM — SES, Zhao et al.'s work and Akhlaghipour and Assari's study conducted research among Chinese adolescents and American children separately, and the overall conclusion obtained is a positive relation between family SES and WM [11,16]. Furthermore, differential effects of SES exist in America, implying that the same level of family SES will bring unequal outcomes for children. As an indicator of SES, maternal educational involvement plays a more important role in executive functioning's development, which has a specific and pivotal component — WM updating ability. Enlightened by a finding that environmental influences are more forceful for children from low-SES family than high SES background, the implication is that mothers from families with low SES can try to address disadvantage through engaging more in children's education [24].

Both Ömer and AKÇAYOĞLU's study and Truong and Wang's study are quantitative studies targeting effects of self-efficacy on language learning [17,20]. The overall conclusion is that self-efficacy is an extremely effective predictor of EFL learners' attainment and is positively correlated with English proficiency. With self-regulation and FLA also treated as variables, FL self-efficacy was

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found to be positively linked with self-regulation and negatively linked with FLA. The following implication for language educators is that teachers are supposed to adopt strategies such as mentoring students in person, encouraging students to think about how to solve problems and guiding students to reflect on learning process, to promote self-regulation and self-efficacy of learners, which contributes to reducing students' anxiety in learning language [25]. Subsequently, learners' academic performance will be improved. SES is not only positively correlated with WM, but also has an impact on language learning. Findings of Luo et al.'s study and Rahmayani et al.'s research can be broadly summarised as the higher the family SES, the stronger the children's English language skills, which is mainly manifested in the form of higher academic achievement and better performance in learning new language items [21,22]. In addition, a richer family literacy environment serves as a mediation role to improve children's language skills. Therefore, caregivers and educators need to ameliorate home literacy environment through more literacy activities, such as verbal storytelling and reading book materials. Simultaneously, they should pay attention to develop children's deeper understanding and linguistic awareness. This is useful to bridge the SES gap between families.

5. Conclusion

There have been many studies exploring influencing factors for WM and language learning. This article puts two topics together to discuss how two common impact factors — self-efficacy and family SES are associated with WM and language learning. Studies using older individuals as sample concluded that self-efficacy was positively correlated with WM. Self-efficacy of the elderly had been adjusted after experiencing WM tasks. While, for university students, enhanced self-efficacy can reflect an improvement in their English learning achievement. The indirect effect is that higher self-efficacy can also reduce anxiety in the process of language learning, which helps improve performance on language test. The effect of family SES on school-age children and adolescents is significant, manifesting itself as a positive relation with their WM updating ability and language skills respectively. As a mediator, maternal educational engagement contributes more to WM level. A rich home literacy environment plays an important mediating role in the elevation of children's language proficiency. This paper provides some practical suggestions that passive beliefs of elder people about their WM function can be changed by guiding them to perform WM tasks regularly; teachers can boost students' confidence and self-regulation in language learning through more communication and guidance, and then anxiety will be alleviated; mothers in low-SES families need to involve themselves in their children's education. Besides, families should become more language learning-conscious to provide more linguistic activities for their children.

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