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Working Memory and Behavioural Problems in Relation to Malay Writing of Primary School Children

Sieak Ling-Teo, Kee Jiar-Yeo
Faculty of Education, Universiti Teknologi Malaysia, Malaysia

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ABSTRACT

Deficit in working memory is common among young children across multiple abilities. Teachers have pointed to poor memory as one contributing factor to inattentiveness and short attention spans as well as some behavioural problems among students. This study aimed to explore the relationship among working memory, externalizing and internalizing behavioural problems and Malay language (writing). A total of 469 children (aged 8 and 11 year-old) and 17 school teachers were involved in the current study. It was found that working memory, externalizing behavioural problems and internalizing behavioural problems played critical roles in affecting the scores of Malay language (writing) at school. Specifically, there were five predictor variables being found in the regression model namely verbal short-term memory, inattention, somatic complaints, visuospatial working memory and aggression. As a whole, the correlation for the five-factor model yielded a great result of 0.987.

Corresponding Author:

Teo Sieak Ling,
Faculty of Education,
Universiti Teknologi Malaysia,
81310 Skudai, Johor, Malaysia.
Email: shirleenteo@hotmail.com

1. INTRODUCTION

Many people across the globe take intelligence quotient (IQ) test and use the score as their academic achievement and job performance. The empirical studies repeatedly show that performance on intelligence tests is associated with student educational achievement. In Jencks et al.'s (1979) [1] study, eight samples from six longitudinal studies demonstrated the correlations ranging from 0.40 to 0.63 between cognitive test scores and amount of student's attainment. Apart from that, there were other authors who had also obtained the similar conclusions [2],[3].

Apparently, these findings manifest children with higher IQ scores do better on standardised achievement tests. They have higher school grades and are able to complete more years of education However, in recent study, it showed that an improvement in standardised test scores of students do not actually show an improvement in students' IQ. In other words, standardised test score may not correlate to higher IQ [4]. This situation leaves many questions unanswered as, in particular, an IQ score fails to explain reasons behind students with normal intelligence but have extreme difficulties in learning.

In 2005, Tracy Alloway discovered working memory (WM) to be a better test of ability than IQ as WM measures what the ability of an individual to learn but not what ones have learned [5]. It was found that WM is highly predictive in learning outcome, the scores in standardized tests of reading and math, six years later [6]. Thus, emergence of WM has become one of the most influential construct in learning at the later date. Deficit in WM does not only produce lifelong problems but also affects other aspects of behaviour and memory significantly [7]. It should be noted that deficit in the central executive component of WM may lead to attention problems that directly influences on students' learning and behaviour. According to Gathercole et

al. (2008), students with poor WM tend to have poor academic progress [8]. They find it difficult to follow multi-step instructions that are given by their teachers and they may fail to complete common classroom activities that require large amounts of information to be held in mind. Additionally, these students also tend to exhibit high levels of inattentive and distractible behaviour [9].

Additionally empirical research has also shown high correlation between internalizing, externalizing behavioural problems (EBP & IBP) and academic performance [10],[11]. According to Simpson et al. (2011), emotional and behavioural problems (BP) specifically anxiety and aggressive emotional were the factors that lead to impoverished scholastic performance and thus these always created the main problems to not only students but also educators [12]. Students with internalizing and externalizing BP are found to have less focus and lack of attention in classrooms [13]. If these problems are left undiagnosed, academic performance, social interactions, self-esteem, and life skills of the students will directly be influenced [14]. Subsequently, these students will fail to meet their success in their academic and eventually in their occupational life [15].

Writing can be considered as a complicated cognitive activity that requests the integration of a number of cognitive processes and memory components. Writing takes place with a planning stage, the writer would come out with the ideas and constructs a preverbal message that is in accordance to the ideas that the writer wants to convey. Then, the composer has to convert the ideas into words and erect grammatically right sentences that require retrieval of the semantic, syntactic, and morphological properties of words. Apart from relying on the executive, the planning phase involves the VS component as the writers visualize images and the translating phase entails the verbal component [16],[17].

WM and BP play a vital role in students' academic success, nevertheless not much concern is placed on this factor in Malaysia. It is reasonable to hypothesize that students' academic performance should therefore be enhanced and improved if schools or educators are able to define WM capacity as well as BP of students in the early stage. In addition, no adequate information or statistic on WM and BP in Malaysia is well-formed. Thus, an investigation on what are the variables of WM and BP which may have influenced on Malay language (writing) should be conducted hence to enlighten the educators and researchers in Malaysia. Parallel to the explanation above, the purpose of this study is to identify the relationship among WM, EBP, IBP and Malay language (writing) across the age groups of 8 and 11 year-old

2. RESEARCH METHOD

2.1. Participants

A total of 469 primary school children from four National Schools in an inner city of West Malaysia were involved in this study (8 year-old = 237; 11 year-old = 232). At the same time, 17 teachers (male = 1; female = 16) from these schools were also involved in this study. All the children were sharing the similar environment, geographic, social, cultural, demographic, socioeconomic, ethnicity and household risk factors as these four schools were located in the same neighbourhood.

2.2. Performance Measures

The following measures were executed and piloted by the researcher with another group of 17 primary school students with similar background. Content validity has been established by an expert panel which comprises three Educational Psychology lecturers, a Malay Language teacher and an English Language teacher. Reliabilities were estimated by test-retest reliability strategy and Cronbach alpha.

2.2.1. Automated Working Memory Assessment (AWMA)

The AWMA was used to measure the WM capacity of children. It consists of four subscales namely verbal working memory (V-WM), visuo-spatial working memory (VS-WM), verbal short-term memory (V-STM) and visuo-spatial short-term memory (VS-STM). Three tests were used to test on each subscale and they are shown in

2.2.2. Externalising Behavioural Problems Checklist (EBPC)

To assess children's externalizing behavioural problems, a questionnaire which consists of 22 items was developed. This questionnaire contains of four subscales namely aggression, delinquent, inattention and social skills. It was a teacher-rated questionnaire which the average time taken for administrating such questionnaire was around 7 minutes.

2.2.3. Externalising Behavioural Problems Checklist (EBPC)

To assess children's internalizing behavioural problems, a questionnaire which consists of 17 items was developed. This questionnaire contains of three subscales namely anxiety, somatic complaints and

withdrawal. It was also a teacher-rated questionnaire which the average time taken for administrating such questionnaire was around 3 minutes.

2.2.4. Malay Writing Scores

Malay writing scores of students will be obtained by collecting the year-end examination results from the concerned schools.

2.3. Procedures

Due to time constraints, the working memory capacity of the students were assessed in groups instead of on an individual basis thus certain modifications on the AWMA were conducted. The researcher initially divided the 12 the tests into two categories namely 'paper-and-pencil test' and 'listening test'. Students of the same age group, approximately of 25 students, would sit for the former test together however in the next session each of the students was requested to take up the 'listening test' in a quiet room individually.

For the 'paper-and-pencil test', there were altogether 9 tests that students need to complete on paper. Students were gathered in a computer room and sat in front of the smart board. Each of the students would be given a set of answer sheet that they need to fill in after they had read the questions of the AWMA from the smart board. Before the test was conducted, rules and regulations of the test were explained thoroughly to the students. Additionally, practice trails from each of the tests would be presented to the students hence to ensure they truly understood about the test. In order to prevent cheating in the test, the researcher came up with a rule of 'hands-up, pencil-off' that students were requested to put their hands up and left their pencils on table when the question was shown on the smart board. They were allowed to write down the answer only after the question had finished been shown on the smart board. By practising this method, the researcher was able to reduce the time taken from 45 minutes per student to 150 minutes per class of 25 students. It is needed to remark that students were given a short break in between the test.

As for the 'listening test', 3 tests were fallen in this test. Each of the students would be invited to a quiet room and be seated in front of the researcher. Again, practice trails for each test would be explained to the student before the test was begun. In this test, the researcher would read the question out and student was requested to hear the question and recall it verbally in the correct order to the researcher. No repetition was allowed in this test. The results would then be recorded by the research on the answer sheet. This test consumed approximately 5 minutes per student in answering all the questions. Once the students had finished their tasks, they were rewarded a bookmark as a token of appreciation for joining the assessment. As for the questionnaires, they were rated by the form teachers of the children who were involved in this study.

Table 1. The Tests of the AWMA

Verbal short-term memory (V-STM)	Visuospatial short-term memory (VS-STM)
a. Digit Recall	a. Dot Matrix
b. Word Recall	b. Mazes Memory
c. Non-word Recall	c. Block Recall
Verbal working memory (V-WM)	Visuospatial working memory (VS-WM)
a. Listening Recall	a. Odd One Out
b. Counting Recall	b. Mister X
c. Backwards Digit Recall	c. Spatial Recall

3. RESULTS AND ANALYSIS

Standard Multiple Regression with stepwise method was employed with the purpose to determine the factors that contributed to Malay language (writing) across the age 8 and 11 year-old. According to Diekhoff (1992), 'stepwise multiple regression' is the right choice to be used in answering this research question because only the significant predictor variables would be selected in the regression [18]. Moreover, problem of multicollinearity could be avoided as the strongly correlated variables ($r > 0.90$) would be taken out from the regression.

It is necessary to ensure all the variables are normally distributed as normality of all the variables has become the prerequisite of multiple regressions. Therefore, researcher examined the normality assumption for the variables through skewness and kurtosis test. To remark, all the Z values for both skewness and kurtosis should fall within the range from -2 to 2 [19].

Table 2 revealed the results of skewness and kurtosis test for all the variables to be included in multiple regressions. The output indicated the Z values for skewness were ranged from -1.602 to 0.017. Apart from that, the Z values for kurtosis have fallen within the acceptable region. Therefore, it can be concluded

that all the variables were normally distributed and thus researcher is allowed to use them in the multiple regression analysis.

Table 2. Skewness and Kurtosis for the Variables in Multiple Regression

Subscales	N	Skewness		Z-value	Kurtosis		Z-value
	Stat.	Stat.	Std. Error	for Skewness	Stat.	Std. Error	for Kurtosis
V-WM	469	0.005	0.113	0.044	-0.278	0.225	-1.236
VS-WM	469	0.101	0.113	0.893	-0.305	0.225	-1.356
V-STM	469	-0.042	0.113	-0.372	-0.352	0.225	-1.564
VS-STM	469	0.002	0.113	0.017	-0.399	0.225	-1.773
EB1	469	-0.073	0.113	-0.646	-0.268	0.225	-1.191
EB2	469	-0.181	0.113	-1.602	-0.129	0.225	-0.573
EB3	469	-0.104	0.113	-0.920	-0.441	0.225	-1.960
EB4	469	-0.116	0.113	-1.027	-0.378	0.225	-1.680
IB1	469	-0.054	0.113	-0.478	-0.407	0.225	-1.809
IB2	469	-0.059	0.113	-0.522	-0.416	0.225	-1.849
IB3	469	-0.100	0.113	-0.885	-0.342	0.225	-1.520
Valid N (listwise)	469						

Note: V-WM = verbal working memory, VS-WM = visuo-spatial working memory, V-STM = verbal short-term memory, VS-STM = visuo-spatial short-term memory, EB1 = aggression, EB2= inattention, EB3 = delinquency, EB4 = social skill, IB1 = anxiety, IB2 = withdrawal, and IB3 = somatic complain.

To define the significant predictor variables among the factor subscales of working memory, externalizing behavioural problems and internalizing behavioural problems towards criterion variable, Malay language (writing), stepwise multiple regression was conducted. In this analysis, the independent variables included V-WM, VS-WM, V-STM, and VS-STM and Malay language (writing) became the dependent variable.

Refer to Table 3, in Malay language (writing), there were five predictor variables (V-STM, EB2, IB3, VS-WM, and EB1) being found in the regression model at $p < 0.05$. V-STM was the single best predictor, EB2 was the next best predictor, and subsequently it was followed by IB3, VS-STM, and EB1. In other words, these five variables were the top five predictors that contributed the most to the students' Malay language (writing) score.

Table 3. Variables Entered / Removed of Stepwise Multiple Regression on Malay Language (Writing)

Mode	Variables Entered	Variables Removed	Method
1.	V-STM		Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to remove >= .100).
2.	EB2		Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
3.	IB3		Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
4.	VS-WM		Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
5.	EB1		Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a. Dependent Variable: Malay Language (Writing)

Note: V-STM = verbal short-term memory, EB2= inattention, IB3 = somatic complain, VS-WM = visuo-spatial working memory, and EB1 = aggression.

The excluded predictor variables in the model were shown in Table 4. Apparently, in the last column of the excluded variables table shown that the variables that failed to enter the model have $p > 0.05$. In addition, the values for partial correlation (< 0.90) and collinearity tolerance (< 2.00) revealed the data do not have any multi-collinearity problem.

Table 4. Excluded Variables of Stepwise Multiple Regression on Malay Writing

	Model	Beta In	t	Sig.	Partial Correlation	Collinearity Statistics Tolerance
1	V-WM	-.505[a]	-22.705	.000	-.725	.254
	VS-WM	-.109[a]	-5.447	.000	-.245	.619
	VS-STM	-.290[a]	-14.153	.000	-.548	.442
	EB1	-.218[a]	-8.073	.000	-.350	.318
	EB2	-.316[a]	-30.466	.000	-.816	.824
	EB3	-.192[a]	-8.118	.000	-.352	.415
	EB4	-.141[a]	-5.910	.000	-.264	.433
	IB1	-.192[a]	-8.617	.000	-.371	.460
	IB2	-.194[a]	-8.710	.000	-.374	.459
	IB3	-.214[a]	-8.424	.000	-.364	.356
2	V-WM	-.225[b]	-9.833	.000	-.415	.140
	VS-WM	-.117[b]	-10.952	.000	-.453	.618
	VS-STM	-.138[b]	-9.722	.000	-.411	.369
	EB1	.245[b]	12.281	.000	.495	.169
	EB3	.182[b]	10.352	.000	.433	.233
	EB4	.103[b]	6.518	.000	.289	.324
	IB1	.148[b]	8.678	.000	.373	.263
	IB2	.147[b]	8.566	.000	.369	.262
	IB3	.305[b]	16.422	.000	.606	.163
3	V-WM	.027[c]	.944	.346	.044	.067
	VS-WM	-.043[c]	-3.804	.000	-.174	.426
	VS-STM	-.011[c]	-.668	.504	-.031	.214
	EB1	-.051[c]	-1.414	.158	-.066	.044
	EB3	-.040[c]	-1.616	.107	-.075	.093
	EB4	-.007[c]	-.467	.641	-.022	.242
	IB1	-.018[c]	-.923	.356	-.043	.149
	IB2	-.019[c]	-.971	.332	-.045	.150
4	V-WM	.039[d]	1.371	.171	.064	.066
	VS-STM	.026[d]	1.403	.161	.065	.161
	EB1	-.073[d]	-2.037	.042	-.094	.043
	EB3	-.027[d]	-1.099	.272	-.051	.091
	EB4	-.020[d]	-1.277	.202	-.059	.232
	IB1	-.011[d]	-.591	.555	-.027	.148
	IB2	-.012[d]	-.612	.541	-.028	.148
5	V-WM	.035[e]	1.198	.231	.056	.065
	VS-STM	.027[e]	1.497	.135	.069	.161
	EB3	-.015[e]	-.610	.542	-.028	.085
	EB4	-.007[e]	-.413	.680	-.019	.186
	IB1	-.005[e]	-.270	.787	-.013	.144
	IB2	-.006[e]	-.295	.768	-.014	.144

a. Predictors in the Model: (Constant), V.STM
b. Predictors in the Model: (Constant), V.STM, EB2
c. Predictors in the Model: (Constant), V.STM, EB2, IB3
d. Predictors in the Model: (Constant), V.STM, EB2, IB3, VS.WM
e. Predictors in the Model: (Constant), V.STM, EB2, IB3, VS.WM, EB1
f. Dependent Variable: Malay Language (Writing)
Note: V-WM = verbal working memory, VS-WM = visuo-spatial working memory, V-STM = verbal short-term memory, VS-STM = visuo-spatial short-term memory, EB1 = aggression, EB2 = inattention, EB3 = delinquency, EB4 = social skill, IB1 = anxiety, IB2 = withdrawal, and IB3 = somatic complain.

Besides, according to Tabachnick and Fidell (1996), it was suggested that the value of standard residual should fall within ± 3 hence to avoid any extreme value or outlier [20]. Refer to Table 5, it revealed that standard residual of the data was 0.995 thus it had fulfilled the criteria.

Table 5. Residual Statistics of Stepwise Multiple Regression on Malay Language (Writing)

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	11.9586	96.3273	55.4307	18.36004	469
Std. Predicted Value	-2.368	2.227	0.000	1.000	469
Residual	-2.78428E1	16.43993	.00000	2.94696	469
Std. Residual	-9.397	5.549	0.000	0.995	469

a. Dependent Variable: Malay Language (Writing)

Table 6 demonstrates the correlation among criterion variable and included predictor variables. As a whole, the correlation for the five-factor model was at 0.987. More specifically, V-STM was the main factor that contributed 87.6% variance of the model. In model 2, with both V-STM and EB2, 95.9% of the variance was accounted for. As for model 3, V-STM, EB2 and IB3, 97.4% of the variance was accounted for. In model 4, V-STM, EB2, IB3 and VS-WM, 97.5% of the variance was accounted for. Finally, the combination of V-STM, EB2, IB3, VS-WM and EB1 has contributed 97.5% variance of model 5 towards Malay language (writing).

Table 6. Model Summary of Stepwise Multiple Regression on Malay Language (Writing)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	0.936[a]	0.876	0.876	6.54230	
2	0.979[b]	0.959	0.959	3.78646	
3	0.987[c]	0.974	0.974	3.01561	
4	0.987[d]	0.975	0.974	2.97287	
5	0.987[e]	0.975	0.975	2.96283	1.814

a. Predictors: (Constant), V.STM
b. Predictors: (Constant), V.STM, EB2
c. Predictors: (Constant), V.STM, EB2, IB3
d. Predictors: (Constant), V.STM, EB2, IB3, VS.WM
e. Predictors: (Constant), V.STM, EB2, IB3, VS.WM, EB1
f. Dependent Variable: Malay Language (Writing)

Refer to Table 7, it can be concluded that all the five predictor variables (V-STM, EB2, IB3, VS-WM and EB1) were the significant factors towards the criterion variable (Malay language writing) where [$F(5, 463) = 3594$, $p < 0.05$].

Table 7. ANOVA of Stepwise Multiple Regression on Malay Language (Writing)

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	141834.613	1	141834.613	3314	.000[a]
	Residual	19988.385	467	42.802		
	Total	161822.998	468			
2	Regression	155141.826	2	77570.913	5410	.000[b]
	Residual	6681.172	466	14.337		
	Total	161822.998	468			
3	Regression	157594.327	3	52531.442	5777	.000[c]
	Residual	4228.671	465	9.094		
	Total	161822.998	468			
4	Regression	157722.186	4	39430.546	4461	.000[d]
	Residual	4100.812	464	8.838		
	Total	161822.998	468			
5	Regression	157758.607	5	31551.721	3594	.000[e]
	Residual	4064.391	463	8.778		
	Total	161822.998	468			

a. Predictors: (Constant), V.STM
b. Predictors: (Constant), V.STM, EB2
c. Predictors: (Constant), V.STM, EB2, IB3
d. Predictors: (Constant), V.STM, EB2, IB3, VS.WM
e. Predictors: (Constant), V.STM, EB2, IB3, VS.WM, EB1
f. Dependent Variable: Malay Language (Writing)

The significant results from the above indicated that the five-factor regression model can be generalised to the related population. Based on Table 8, an equation was formed from the information given. Model 5: Malay language writing = -53.840 + 1.209 (V-STM) -5.229 (Inattention) + 6.570 (Somatic Complain) - 0.058 (VS-WM) -1.566 (Aggression). The five predictor factors in the regression model were identified significant where $\beta = 0.976$, $t = 68.052$, $p < 0.05$ (V-STM); $\beta = -0.440$, $t = -33.010$, $p < 0.05$ (EB2); $\beta = 0.318$, $t = 8.674$, $p < 0.05$ (IB3); $\beta = -0.047$, $t = -4.080$, $p < 0.05$ (VS-WM); $\beta = -0.073$, $t = -2.037$, $p < 0.05$ (EB1).

Table 8. Coefficient of Stepwise Multiple Regression on Malay Language (Writing)

Model		Unstandardized Coefficients B	Std. Error	Stand. Coefficients Beta	T	Sig.
1	(Constant)	-60.628	2.039		-29.740	.000
	V-STM	1.161	0.020	0.936	57.565	.000
2	(Constant)	-29.008	1.571		-18.459	.000
	V-STM	0.996	0.013	0.804	77.481	.000
	EB2	-3.758	0.123	-.316	-30.466	.000
3	(Constant)	-63.820	2.462		-25.925	.000
	V-STM	1.223	0.017	0.986	71.143	.000
	EB2	-5.512	0.145	-0.463	-37.981	.000
	IB3	6.303	0.384	0.305	16.422	.000
4	(Constant)	-56.356	3.121		-18.057	.000
	V-STM	1.221	0.017	0.985	71.990	.000
	EB2	-5.252	0.159	-0.442	-33.123	.000
	IB3	5.336	0.456	0.258	11.703	.000
	VS-WM	-.0530	0.014	-0.043	-3.804	.000
5	(Constant)	-53.840	3.347		-16.087	.000
	V-STM	1.209	0.018	0.976	68.052	.000
	EB2	-5.229	0.158	-0.440	-33.010	.000
	IB3	6.570	0.757	0.318	8.674	.000
	VS-WM	-.0580	0.014	-0.047	-4.080	.000
	EB1	-1.566	0.769	-0.073	-2.037	.042

a. Dependent Variable: Malay Language (Writing)

Note: V-STM = verbal short-term memory, VS-WM = visuo-spatial working memory, EB1 = aggression, EB2= inattention, and IB3 = somatic complain.

4. DISCUSSION

From the findings, the predictors for Malay language (writing) included V-STM, inattention, somatic complains, VS-WM, and aggression. The combination of these five predictors has contributed 97.5% variance of the regression paths structure. ANOVA of Stepwise Multiple Regression on Malay writing has evidenced all the five predictor variables were significant in the final model.

The roles of WM in written language production are ambiguous. Nevertheless, it was believed that all the steps involved in writing a language place very heavy demands on WM, especially on the executive and verbal components [16],[17]. Specifically, V-WM and V-STM contributes to writing by briefly storing phonological representations of the words or sentences under construction [21]. As for the VS-WM, it is involved much in the planning phase of written language production and during recalling definitions of concrete nouns [22]. In other words, it is hypothesized that V-WM supports necessary processes in written language production whereas VS-WM supports optional associated with the planning of image-based conceptual content.

As descripted in other studies, the findings in this study were consistent with the abovementioned findings where V-STM play a critical role in written language production however the results on the role of V-WM in present finding are inconsistent with several studies that found V-WM is a crucial element in influencing the written language production [23]-[25]. It may be the case that the definition task studied here makes little demands on V-WM as a standardized time was given to the children in accomplishing the writing task. This tentative conclusion is contingent on further study with writing tasks that spare longer time to finish. Just in line with the past findings, the results on VS-WM add support to the dual coding theory of language production and memory proposed by Sadoski and Paivio (2001), [26]. In a nutshell, the current findings further ensure the importance of verbal and visual WM in language production.

Children with emotional and behavioural problems tend to underperform in their studies as compared to their typically developing peers. As expected, in the current study, inattention has demonstrated as one of the most influential predictors of Malay writing in the model. This is because there are abundance of literature evidenced that children with attention problems are more likely to have written expression difficulties than children without attention problems as they have weak executive function (EF) and WM [27]-[29]. To remark, written language production requires high levels of attention apart from memory resources, linguistic and transcription skills in order to hold thoughts of content in mind, as the same time remembering and writing letter forms, identifying correct spellings, and thinking of suitable words and phrases [30].

From the academic perspective, research demonstrates that children with higher levels of somatic complaints are highly correlated with poorer school attendance and school refusal behaviour [31]. In order to avoid classroom activities, children with anxiety disorders tend to visit their school nurse frequently with a variety of somatic complaints and even refuse to attend school due to somatic complaint [32],[33]. Therefore, with the high rate of absenteeism, spending more time in the nurse's place, and fail to pay attention during

the lesson, it is believed that children with somatic disorders perform poorly in their academic achievement. In the present study, somatic complaints have become the predictor of Malay writing where it is believed that children with more somatic complaints try to avoid writing tasks.

Apart from that, from the current study, it was also found that aggression had become one of the predictor variables that influence the performance of children in their writing tasks. Just in line with the past findings, the strong association between academic failure and aggression was found [34],[35]. However, no direct relationship was found between aggression and written language production in the past literature.

5. CONCLUSION

In conclusion, this study provides an important glimpse of the roles of working memory and behavioural problems in relation to written language production. The findings of this study have further supported that WM is highly predictive in learning outcome as compared to IQ scores. Besides, the results have also successfully identified the factors of EBP and IBP that influence the learning ability of Malay language (writing). In a nutshell, the five predictors being found in this study include verbal short-term memory (V-STM), inattention (EB2), somatic complaints (IB3), visuospatial working memory (VS-WM) and aggression (EB1). To remark, teachers and educators should pay more attention on these variables hence to help their children in obtaining better grade in written language production.

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BIOGRAPHIES OF AUTHORS

Teo Sieak Ling is a tutor. She attained her first degree in UK BSc. (Hons) Degree in Business & Management from University of Bradford and M.Ed. (Educational Psychology) from Technology University of Malaysia. She was awarded as the best students in her master studies. Currently, she is a PhD candidate in Technology University of Malaysia. Her research focus is mainly on educational psychology, working memory, behavioural problems and stress.

Yeo Kee Jiar is an Associate Professor in Faculty of Education, University Technology of Malaysia. She attained her B.Ed (Hons.) in Linguistic from University Science of Malaysia and master and PhD in Educational Psychology from University Technology of Malaysia. Her research and publications are related to her interest in educational psychology, reading readiness and special education.