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THE EFFECTS OF SURFACE AND DEEP LEARNING STRATEGIES ON ACADEMIC ACHIEVEMENT IN ENGLISH AMONG HIGH SCHOOL STUDENTS: DO IMPLICIT BELIEFS OF INTELLIGENCE MATTER?

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ABSTRACT

This research was designed to examine the direct effects of surface and deep learning strategies on academic achievement in English among Sudanese high school students, and the indirect effects of them on the entity and incremental beliefs of intelligence. A quantitative research methodology was used, such as questionnaires with 28 items to collect the data. There were a total of 392 participants; all of them are high school students in Sudan. The data was analysed using the SPSS V.22 and AMOS 23. The findings of the structural equation modelling show there is a direct and significant effect of deep learning strategy, and there is no direct effect of a surface learning strategy on academic achievement in English. Regarding the mediation roles, both entity and incremental beliefs of intelligence did not play mediation roles in the relationships whether between surface strategy and academic achievement or between deep strategy and academic achievement in English among Sudanese high school students. Explanations for these results, as well as implications and recommendations, are discussed subsequently.

Keywords: *Academic Achievement in English, Surface Learning Strategy, Deep Learning Strategy, Implicit beliefs of Intelligence*

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INTRODUCTION

Despite the fact that the English language is not the mother tongue in Sudan, high academic achievement in English (AAE) is the cornerstone for the high school students in Sudan that guides them toward a promising future (Labi & Ahmed, 2005). Furthermore, the English language is considered one of the main subjects at schools in Sudan, where students are motivated to learn it in order to get great scores in school as well as to be ready for those promising chances in life. Years ago, some educational experts in Sudan realized that there is a considerable number of high schools students in Sudan struggled to write, read, listen and speak in English, therefore, to help them, educational experts recommended more researches and supplementary methods need that to be conducted (Alfadil, 2010; Elmahdi, Ali, & Hassan, 2015). Thus, this study may be considered as one of the scientific attempts to examine and to explore what may help Sudanese high schools' students in this matter.

LITERATURE REVIEW

Academic achievement (AA) is a crucial study area that schools and educational researchers concern about and are interested in finding out what are the set of variables that can influence it. AA is defined by Spinath (2012) as the general term for performance in intellectual domains taught at schools, colleges, and universities. Because of the multidimensionality of academic achievement as a central variable in the educational environment, it is difficult to investigate all factors that influence AA. Accordingly, it is not easy to evaluate all the associated materials and variables that are related to the AA in one study (Yengimolki, Kalantarkousheh, & Malekitabar, 2015).

One of the two models that influenced this study is Biggs's model of learning strategies (1987). It provided a theoretical framework of the relationships between teaching context, characteristics of the individual student, learning outcomes, and learning approach. Practically, the motive of the student for learning affects his/her learning strategy. Both deep and surface learning strategies may be used by students to inspire them at the tertiary level. The interaction between the content of the learning task and individual student characteristics influences the learning strategy (Biggs, 1987).

Deep-approach learning is defined as the commitment students have for the learning process. It is concerned with striving for understanding and applications of ideas and concepts. The principle that guides the deep-approach learning increases real interest by engaging with the study tasks properly, while the surface strategy emphasises the knowledge reproduction with an attempt to integrate information (Biggs, 1993; Thomas & Bain, 1984). Students who apply the surface strategy tend to understand the learning materials without going in-depth, deal with a problem without having interest; and they get worried about the time required to finish the studying task.

Learning strategies and its relationship with academic achievement have been studied from different perspectives, and various results were reported. For instance, it was reported that the use of studying strategies in language subject influences academic performance (Muelas & Navarro, 2015). It was further found that studying strategies are significantly related to students' academic outcomes at college (Weda, Samad, Patak, & Fitriani, 2018). Also, a study stated that learning approaches contributed to academic performance significantly (Tinajero, Lemos, Araujo, Ferraces, & Paramo, 2012). Regarding the correlation, it was reported that academic achievement significantly correlated with learning strategies (Seabi, 2011). Puteh et al. (2018) revealed that learning approaches are related to the grade point average positively (GPA). Several learning approaches effectively predicted

the academic outcomes of high school students (Yip, 2013). In contrast, it was found that there is no relationship between academic success and studying approaches (Cetin, 2015).

On the other hand, the current study is also driven by Dweck and his colleagues' theoretical framework of implicit beliefs of intelligence (IBI) (Blackwell, Trzesniewski, & Dweck, 2007; Dweck, 2000; Dweck, Chiu, & Hong, 1995; Ehrlinger, Mitchum, & Dweck, 2016; Hong, Chiu, & Dweck, 1995). In general, the IBI refers to the beliefs of malleability and intellectual abilities. Individuals may have a fixed, entity belief of intelligence (EB); or a more malleable, incremental belief of intelligence (IB) (Dweck et al., 1995). Those who have the EB tend to view intellectual ability as something unalterable. Conversely, incremental theorists believe that intellectual ability is something that gradually develops over time (Champagne, 2015). The IBI is characterised by implicit since it is rarely demonstrated or communicated explicitly. Instead, the IBI provides an implicit framework that direct an individual's views of a personal characteristic (Champagne, 2015).

The IBI attested to have a significant influence on crucial educational performance such as achievement goals, beliefs in the effort, attributions, self-regulation, and the AA (Blackwell et al., 2007; Dweck et al., 1995; Dweck & Grant, 2008; Ehrlinger et al., 2016; Hong et al., 1995). The IBI is linked with the AA, in details, incremental belief (IB) tend to affect positively on the AA (Dinger & Dickhauser, 2013). For example, those who have IB, have problem-solving skills and increase their level of effort to get higher AA (Dweck & Leggett, 1988). More recently, it was found that the IB influenced the AA, even after controlling for prior stages of achievement (Tarbetsky, Collie, & Martin, 2016). Conversely, individuals with the entity belief (EB) tend to achieve lower levels of the AA (Martin, Bostwick, Collie, & Tarbetsky, 2017). Researches have also illustrated that students who hold an EB experience declined in performance when confronted with failure (Dweck & Leggett, 1988), as well as maladaptive strategies, decrease achievement (Martin et al., 2017). Besides, some researchers indicated that the IB is related to greater levels of verbal academic performance as well as the EB was also correlated with verbal academic achievement, but it is at a lower level (Costa & Faria, 2018).

Thus, the core purpose of this study is to test and to explore some of the expected factors what may affect academic achievement in English among high school students in Sudan. According to this purpose, the research objectives are as follow:

1. To examine the direct effect of surface learning strategy on academic achievement in English.
2. To explore the mediation role of entity belief of intelligence on the relationship between surface learning strategy and academic achievement in English.
3. To explore the mediation role of incremental belief of intelligence on the relationship between surface learning strategy and academic achievement in English.
4. To examine the direct effect of deep learning strategy on academic achievement in English.
5. To explore the mediation role of entity belief of intelligence on the relationship between deep learning strategy and academic achievement in English.
6. To explore the mediation role of incremental belief of intelligence on the relationship between deep learning strategy and academic achievement in English.

METHODOLOGY

Participants

High school students in Sudan were the target population which is estimated to number about (636156) students, and (116659) of them came from Khartoum City, Sudan (The triangular capital cities of Khartoum, Omdurman and Bahry) (Ministry of education in Sudan, 2012). The sample was selected from the triangular capital cities of Sudan because the population is scattered over a wide geographical area. It was not possible to choose a sample of individuals from the population, and a list of all interested members was not available; therefore, we used a cluster random sampling technique. Some schools, rather than individuals, were selected randomly. There was a total of 390 Participants in the present study, and it is considered an acceptable size according to the assumption of Krejcie and Morgan (1970) (Piaw, 2013).

Instruments

Students' AAE was measured by using Sudanese standardised achievement test (SSAT) of English made by the Ministry of Education in Sudan. The SSAT measures abilities that are acquired in educational institutions and are curriculum-based. More precisely, a standardised achievement test is an exam that is meant to evaluate skills and knowledge that were taught at school (Spinath, 2012).

In collecting the data, three questionnaires were compiled to form a single survey. Some guidelines, instructions and questions related to demographic information were presented at the beginning of the survey. The second section included an adapted LS survey. The third section consisted of an adapted IBI survey.

The LS questionnaire that was adopted was created by Biggs, Kember, and Leung (2001). The participants rated 20 items on a 5-point Likert scale (from 'never or only rarely true of me' to 'always or almost always true of me'). The SLS items are based on surface strategy and surface motive subscales, while the DLS is based on deep strategy and deep motive subscales scores were achieved. In each case, great scores reflected a higher tendency to endorse that learning strategy. Alphas for the DLS subscale and the SLS subscale were .76 and .75, respectively (Biggs et al., 2001).

The IBI questionnaire was developed by Dweck (2000) and was assessed using a self-report scale (Dweck, 2000). The questionnaire contains eight items, each assessed on a 6-point Likert-type scale (from 1 = strongly disagree, to 6 = strongly agree). A composite score was created by taking the average of each of the items, and excellent scores represent firmer EB. The total scores ranged from 1.0 to 6.0. Although this measure is often divided into an entity and incremental groups which were chosen to preserve the total score as a continuous variable, and the dichotomisation of a continuous measure is not recommended (Dormann et al., 2013). However, internal consistency was quite right ($\alpha = .93$).

Validity and Reliability

The measurement of validity and reliability were tested. Regarding validity, five professionals in psychology and education performed face validity. In order to raise the correlation between the constructs of the scale which called convergent validity (CV), the Average Variance Extracted (AVE) was tested. CV is achieved if the value of AVE gets the minimum level in each construct for the model.

AVE should be higher than 0.5 (Fornell & Larcker, 1981). Besides, the composite reliability (CR) and Cronbach's Alpha of the constructs were examined in order to assess the reliability. The range between 0.70 to 0.90 is a considerable value for Cronbach's Alpha, and the value of 0.7 and above for the CR showed an acceptable internal consistency (Hair, Hult, Ringle, & Sarstedt, 2016). Table 1 below presents loadings of scales items, Cronbach's Alpha, the CR and AVE.

Table 1
Results of Reliability and Validity of the Scale

Variable	Constructs	Items	Loadings	Cronbach's Alpha (>0.7)	Composite Reliability (CR)(>0.7)	Convergent Validity (AVE)(>0.5)
LS	SLS	L3	.818	0.90	0.93	0.61
		L4	.887			
		L7	.807			
		L8	.703			
		L12	.769			
		L15	.916			
		L16	.666			
		L19	.655			
		L20	.791			
	DLS	L1	.868		0.96	0.74
		L2	.875			
		L5	.877			
		L6	.793			
		L9	.808			
		L10	.921			
		L11	.712			
		L13	.927			
		L14	.882			
		L17	.923			
		L18	.869			
IBI	EB	I1	.802	0.71	0.91	0.72
		I2	.862			
		I4	.857			
		I6	.873			
	IB	I3	.892		0.93	0.77
		I5	.882			
		I7	.881			
		I8	.869			

Key: LS= Learning Strategy; DLS= Deep Learning Strategy; SLS= Surface Learning Strategy; IBI= Implicit Beliefs of Intelligence; EB= Entity belief of Intelligence; IB= Incremental belief of Intelligence

Table 1 shows the factor loadings confirmed that all constructs have adequate levels of convergent and discriminant validity. Moreover, the reliabilities of all the constructs were above 0.7. All composite reliability (CR) values are significantly higher than 0.7, which represents an acceptable level for exploratory research. The average variance extracted (AVE) values of all constructs are greater than 0.5; therefore, convergent validity is achieved. Thus, all the constructs and variables

used in this study are based on well-established instruments with high-reliability scores, and the internal consistency of each construct is substantiated to be very good.

Data Analysis

The following section illustrates comprehensive information regarding the demographic information, model fit assessment, and the results of hypotheses testing. The data was analysed using SPSS v.22 and AMOS 23.

Demographic Information of Respondents

The SPSS was used to perform the descriptive statistics analysis of the demographic data that are presented in Table 2 below.

Table 2
Respondents' Demographic Information

Items					
Gender	*N*	*%*	*Location of schools*	*N*	*%*
Male	200	51	Khartoum city	100	25.5
Female	192	49	Omdurman city	126	32.1
			Bahry city	166	42.4
Total	392	100		392	100

The table above shows that male respondents of 200 individuals (51%) were more than female with 192 people (49%). About 166 of the respondents (42.4%) lived in Bahry City, 126 of them (32.1%) lived in Omdurman City, while the rest of the respondents 100 (25.5%) lived in Khartoum City. Based on these statistics, the majority of the participants were in Bahry City. These three cities are called the triangular capital of Sudan.

Model Fit and Hypotheses Testing by Structural Equation Modelling (SEM-AMOS)

This section presents the findings of the model fit, the regression weight, and hypotheses testing. Figure 1 below shows the model fit indices of the SEM using AMOS 23.

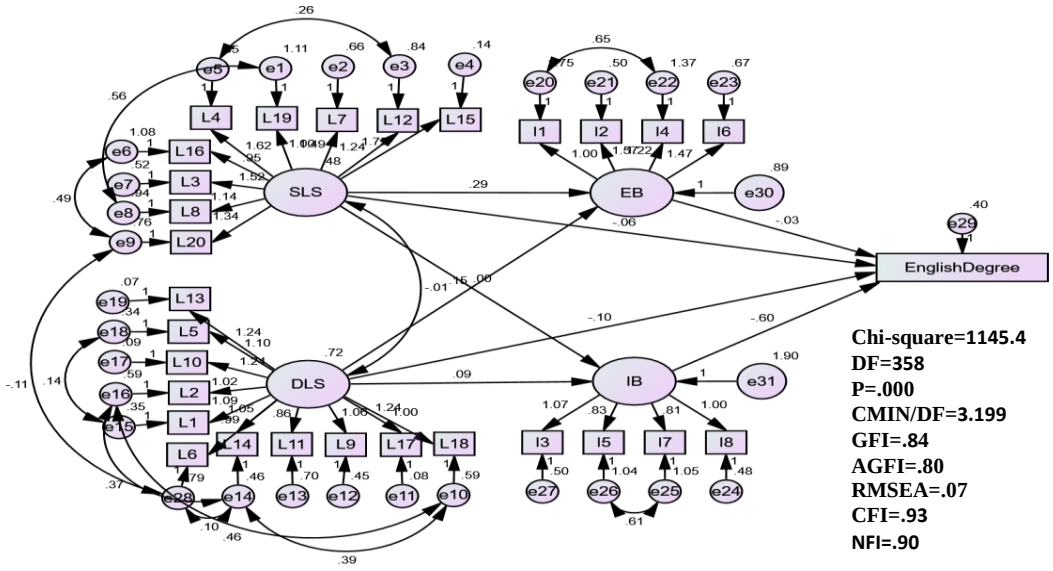

Figure 1. Model Fit

Model Fit

As presented in Figure 1 above, the results described that the value of P = .000 (>0.001) was significant; however, the findings also described that the Chi-square was 1145.4, with a degree of freedom (df) of 358; the Chi-square was above the value suggested by the parsimonious fit. The value of the RMSEA was .07, which was within the acceptable range (Schumacker & Lomax, 2016). The value of the CFI was .90 that was also considered as an acceptable value of model fit (Awang, 2014). Further, the relative chi-square (CMIN/DF) was 3.199, between the threshold value of 3.0 and 5.0 that was suggested by (Hair, Black, Babin, & Anderson, 2014). The GFI index is 0.84, and the AGFI index is 0.80 indicate a good model fit since it is close to 1. The figure above proved that the model had fulfilled the requirement of the good fit. The minimum level was achieved, and all values indicated acceptable fits according to the criteria of model fit, which is proposed by (Schumacker & Lomax, 2016).

Regression Weight

Table 3
The Standardised Regression Weights

Regression weights	Estimate
EB <--- SLS	.204
IB <--- SLS	.000
IB <--- DLS	.054
EB <--- DLS	.128
AAE <--- EB	-.024
AAE <--- IB	-.789
AAE <--- DLS	-.081
AAE <--- SLS	-.036

Key: LS= Learning Strategy; DLS= Deep Learning Strategy; SLS= Surface Learning Strategy; IBI= Implicit Beliefs of Intelligence; EB= Entity belief of Intelligence; IB= Incremental belief of Intelligence; AAE= Academic Achievement in English

The findings shown in Table 3 above indicate that the standardised beta estimate for the effect of the SLS on the EB was .204. Regarding the effect of the SLS on the IB, its standardised estimate was .000. Further, the standardised estimates for the effects of the DLS on the IB and the DLS on the EB were .054 and .128 respectively. Furthermore, the standardised estimates for the effect of the EB on AAE and IB on AAE were -.024 and -.789 respectively, while the standardised estimates for the effect of the DLS on AAE and SLS on AAE were -.081 and -.036 respectively.

RESULTS

The results of hypotheses testing were obtained in Table 4 below, and the analysis was done using AMOS 23. Six null hypotheses of this study were examined based on the results of the path coefficient (β), C.R value > 1.96 and p-value <0.05. These values were suggested by Hair et al. (2016) to help researchers accept or reject the tested hypothesis. The null hypothesis will not be accepted if the p-value is equal or less than the significant level of ≤0.05. In this case, the alternative hypothesis will be accepted while the null hypothesis was rejected (Hair et al., 2014). Table 4 presents the findings of the hypotheses testing.

Table 4
The Results of Hypotheses Testing

No	Hypotheses	Path Coefficient (β)	C.R – Value (>1.96)	P-Value (<0.001)	Decision
Ho1	SLS → AAE No direct and significant effect of SLS on AAE.	-.055	-1.049	.294	Accepted
Ho2	SLS → EB → AAE No indirect and significant effect of SLS on AAE via EB.	-.008	-.615	.473	Accepted
Ho3	SLS → IB → AAE No indirect and significant effect of SLS on AAE via IB.	.000	.000	.968	Accepted
Ho4	DLS → AAE No direct and significant effect of DLS on AAE.	-.101	-2.406	.016	Rejected
Ho5	DLS → EB → AAE No indirect and significant effect of DLS on AAE via EB.	-.004	-.571	.475	Accepted
Ho6	DLS → IB → AAE No indirect and significant effect of DLS on AAE via IB.	-.053	-1.039	.271	Accepted

Note: Significant level P<0.05.

Key: DLS= Deep Learning Strategy; SLS= Surface Learning Strategy; EB= Entity belief of Intelligence; IB= Incremental belief of Intelligence; AAE= Academic Achievement in English

The table above presents the analysis of the SEM, and the findings support Ho1, Ho2, Ho3, Ho5 and Ho6, while did not support Ho4. The following sections provide more clarification regarding the hypotheses testing based on the results of the table above.

The Effect of Surface Learning Strategy (SLS) on Academic Achievement in English (AAE)

The results accept the first null hypothesis Ho1. It is indicated that the null hypothesis Ho1 is accepted, and rejected the alternative one. The results of the effect between the SLS --> AAE were (β= -.055, C.R= -1.049, p< .294). The value of β referred to that there is no direct effect of the SLS on AAE. Furthermore, the C.R-value was lower than 1.96 and p-value was not significant. Based on these values, the null hypothesis was accepted. Therefore, there was no direct effect of the SLS on AAE among Sudanese High School Students.

The Mediation Role of Entity belief of Intelligence (EB) between Surface Learning Strategy (SLS) and Academic Achievement in English (AAE)

The results accept the second null hypothesis Ho2. It is indicated that the null hypothesis Ho2 is accepted, and rejected the alternative one. The results of the mediation role of the EB between the SLS and AAE were (β=-.008, C.R= -.615, p<.473). The value of β referred to that there is no indirect effect of the SLS on AAE via EB. Additionally, the C.R-value was lower than 1.96 and p-value was not significant. Based on these values, the null hypothesis was accepted. Therefore, there was no indirect effect of the SLS on AAE via the EB among Sudanese High School Students.

The Mediation Role of Incremental belief of Intelligence (IB) between Surface Learning Strategy (SLS) and Academic Achievement in English (AAE)

The results accept the third null hypothesis Ho3. It is indicated that the null hypothesis Ho3 is accepted, and rejected the alternative one. The results of the mediation role of the IB between the SLS and AAE were (β= .000, C.R= .000, p<.968). The value of β meant that there is no indirect effect of the SLS on AAE via IB. Further, the C.R-value was lower than 1.96 and p-value was not significant. Based on these values, the null hypothesis was accepted. Therefore, there was no indirect effect of the SLS on AAE via the IB among Sudanese High School Students.

The Effect of Deep Learning Strategy (DLS) on Academic Achievement in English (AAE)

The results reject the fourth null hypothesis Ho4. It is indicated that the null hypothesis Ho4 is rejected, and accepted the alternative one. The results of the effect between the DLS --> AAE were (β= -.101, C.R= -2.406, p<.016). The value of β meant that there is a direct effect of DLS on AAE. Further, C.R-value was more than ±1.96, and the p-value was significant. Based on these values, the null hypothesis was rejected. Therefore, there was a direct effect of the DLS on AAE among Sudanese High School Students.

The Mediation Role of Entity belief of Intelligence (EB) between Deep Learning Strategy (DLS) and Academic Achievement in English (AAE)

The results accept the fifth null hypothesis Ho5. It is indicated that the null hypothesis Ho5 is accepted, and rejected the alternative one. The results of the mediation role of the EB between the DLS and AAE were (β= -.004, C.R= -.571, p<.475). The value of β meant that there is no indirect effect

of the DLS on AAE via the EB. Further, the C.R-value was lower than 1.96 and p-value was not significant. Based on these values, the null hypothesis was accepted. Therefore, there was no indirect effect of the DLS on AAE via EB among Sudanese high school students

The Mediation Role of Incremental belief of Intelligence (IB) between Deep Learning Strategy (DLS) and Academic Achievement in English (AAE)

The results accept the sixth null hypothesis Ho6. It is indicated that the null hypothesis Ho6 is accepted, and rejected the alternative one. The results of the mediation role of the IB between the DLS and AAE were (β=-.053, C.R= -1.039, p<.271). The value of β meant that there is no indirect effect of the DLS on AAE via the IB. Moreover, the C.R-value was lower than ±1.96 and p-value was not significant. Based on these values, the null hypothesis was accepted. Therefore, there was no indirect effect of the DLS on AAE via the IB among Sudanese high school students.

DISCUSSION

Surface learning strategy (SLS) has no direct effect on academic achievement in English (AAE), as illustrated in the findings. In line with this, several types of research raised that academic achievement (AA) and examination grades were negatively correlated with surface strategy (Diseth & Kobbeltvedt, 2010; Toraman, Özdemir, Aytug Kosan, & Orakci, 2020). In other words, there is an inverse relationship between the SLS and AA (Hasnor, Ahmad, & Nordin, 2013), and the SLS has a significant negative effect on AA (Chen, Chiu, & Wang, 2015).

Result of the other direct hypnosis showed that deep strategy had a direct and significant effect on academic achievement in English, which is consistent with what has been proven by numbers of studies that deep learning strategy positively correlated and associated with academic achievement (Chan, 2010; Jayawardena, Hewapathirana, Banneheka, Ariyasinghe, & Ihalagedara, 2013; Toraman et al., 2020). However, there is a study found that there was no significant direct relationship between deep learning (DLS) and AA (Suphi & Yaratan, 2012). The AAE among Sudanese high school students is directly affected by the DLS while it is not affected directly by the SLS.

Both entity and incremental beliefs of intelligence did not play mediation roles, whether between the SLS and the AAE or between the DLS and the AAE. Despite the proven direct effect of the IB on the AA (Blackwell et al., 2007; Chen et al., 2015; Dweck & Master, 2009; Martin et al., 2017), the incremental belief of intelligence could not be a proper mediation factor when Sudanese high school students apply either the SLS or the DLS in order to achieve a desired academic achievement in English.

CONCLUSION

The results of the structural equation modelling highlights that there is a direct and significant effect of deep learning strategy, and no direct effect of surface learning strategy on academic achievement in English. Regarding the mediation roles, there were no indirect effects of surface or learning strategies on academic achievement in English through entity belief of intelligence. Moreover, the incremental belief of intelligence did not play a mediation role in the relationships between the SLS or the DLS and AAE among Sudanese high school students.

In one way or another, the findings of this study may have valued implications for Sudanese High School Students, such as their parents, English teachers, educational policymakers in the Ministry of Education, researchers, educational psychologists and counsellors. Furthermore, knowing the importance of deep learning strategies and how to use them may help Sudanese High Schools' students to achieve the desired outcomes in the English language. However, the non-significant effects of the incremental belief of intelligence as a mediator in this study could directly facilitate English learners in their achievements. Therefore, this study recommends that students of the English language of the Sudanese high school need to pay more attention and give consideration to the LS and the IBI in order to help them achieve high scores in English.

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