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The Association between K12 Freshmen's Attitudes towards the Medium of Instruction and their Performance in Science Subjects

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Abstract: Research has documented that students' proficiency in the medium of instruction predicts their performance in content subject areas mediated by this language (Ariyasinghe & Pallegama, 2013), while other researchers argue that students' beliefs about language learning influence their language proficiency (Horwitz, 1987, 2008). However, little research has investigated the relationship between students' beliefs about language learning and their performance in content subject areas. This study investigated how students' proficiency, beliefs about language learning, and their perception of ease of the four language modalities (listening, speaking, writing, and reading) influence their performance in Math, Science, and Physics grades in the national exam. 70 K12 freshmen majoring in Physics were administered a Test de Connaissances du Français (TCF), the (34-item) Beliefs about Language Learning Inventory (BALLI) (Horwitz, 1987), and an adapted questionnaire from Evans & Morrison (2011) that measures students' perceptions of ease in four skill areas: speaking, listening, reading, and writing. Correlation techniques were conducted in the Statistical Package for Social Sciences (SPSS) version 25. Results revealed that there is a moderate positive correlation between the respondents' scores in the three science subjects (Math, Science, and Physics) and the four language skills, and that students' performance in the three science subjects is positively associated with their TCF scores. Also, two BALLI components, Motivations & Expectations and the Nature of Language Learning, were found to be positively correlated to students' Maths and Physics scores and their performance in the Science exam, respectively. Findings of the current study suggest that students' beliefs and attitudes towards languages do not only affect their language proficiency, but also their performance in science subjects mediated by this language.

Keywords: language proficiency; BALLI; content subjects; students' performance; language skills

1.1 Introduction

In Morocco, most students undertake their tertiary education studies in a foreign language (French) in scientific disciplines. When instruction is carried out in a non-native language, students who perform badly in that language view the language as more difficult compared to the academic course, while those who do well perceive the other way around (Ariyasinghe & Pallegama, 2013). Students' performance in different disciplines has always been measured by their level of proficiency in that discipline. However, their learning is multidimensional and depends on several factors, including the environment in which they are learning and the resources they have available; and to cater to their multidimensional learning, their beliefs about language learning should have a place in the process of learning (Brown, 2009).

The purpose of this paper is to examine how students' competency, attitudes toward language learning, and perceptions of the ease of the four language skills (listening, speaking, writing, and reading) affect their performance on the national exam in Math, Science, and Physics.

2.1 Review of Literature

Beliefs about language learning are essential since they have been discovered to have a number of correlations with other individual differences linked to language learning (Horwitz, 2008). They are affected by different factors, such as the age of the learners, the stage they have attended during their process of learning (Horwitz, 1999), the cultural and ethnic origin of the learners, and the situations and settings in which they acquire the language (Dornyei, 2005; Wenden, 1999). These language beliefs have been shown to have an impact on both students' actions and their experiences (Horwitz, 1999). Arslan & Kafes (2021) emphasize that the relationship between learner beliefs about language learning and other variables like gender, age, and language proficiency level is dynamic, complex, and context-specific.

Research disclosed that students' beliefs about language learning affect their language proficiency (Al Momani & Al-Oglah, 2021). The researchers noticed a substantial link between the degree of English language proficiency and students' particular beliefs about learning the language. Also, Arslan & Kafes (2021) observed a subtle relation between students' language proficiency and different components of their beliefs about language learning. For instance, they found that the ability to learn a language improves with increasing language skills and that students who are fluent in a language believe that they have a great capacity for learning new languages.

Moreover, students' performance in academic disciplines is also linked not only to their language proficiency (Bifuh-Ambe, 2009, 2011; Braine, 2002) but also to the challenges they face with language skills (Aizawa et al., 2020; Andrade, 2006; Hellekjaer, 2010; Kırkgöz, 2005). While Andrade (2009) asserts that students with better language abilities face fewer difficulties in their academic studies, other researchers emphasize that lack of academic language proficiency, such as the learners' inability to write essays (Evans & Morrison, 2011), follow lectures (Hellekjaer, 2010), understand written material with different unknown words (Andrade, 2006), and participate in different speaking activities (Kırkgöz, 2005), affects students' performance in different disciplines.

3.1 Material and Method

Two questionnaires were used to collect data: BALLI (Horwitz, 1987) and students' perceptions of ease in four skill areas (Evans & Morrison, 2011). Also, participants were administered the Test de Connaissance du Français (TCF) to

mesure their proficiency in French.

3.1.1 Participants
The participants in the current study were 70 K12 freshmen majoring in Physics.

Table 1. Participants in the study

Participants	Gender		School	
	male	female	private	public
Number	22 (31.4%)	48 (68.6%)	28 (40%)	42 (60%)

4.1 Results
4.1.1 Respondents' grades in the three science subjects and their scores in TCF
The descriptive statistics revealed that students' grades in the three science subjects are around the average grade (10/20). They scored higher in Science and Physics, while their grades in TCF are below the average. This means that the respondents in the current study are less proficient in French, the medium of instruction at school, while their performance in science subjects is moderate.

Correlation tests revealed that students' scores in Math, Physics, and Science national exams are positively associated with their TCF test scores (see Table 2). This means that students who scored better in TCF had better grades in Math, Physics, and Science national exams.
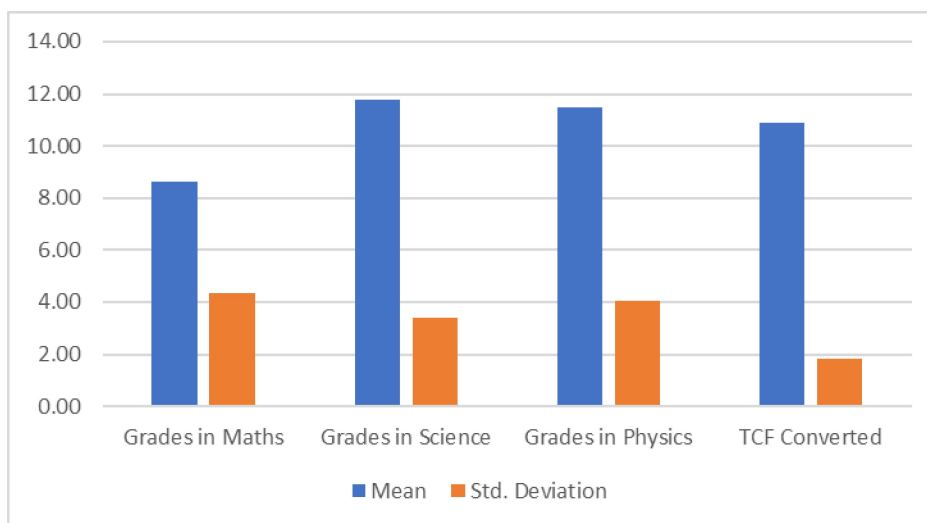

Figure 1. Students' Grades in TCF and the Three Science Subjects

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Table 2. Correlation between students' language proficiency and their scores in Math, Physics, and Science

	Grades in Maths	Grades in Science	Grades in Physics
Pearson Correlation	.518**	.559**	.592**
Sig. (2-tailed)	.000	.000	.000
N	70	70	70

**. Correlation is significant at the 0.01 level (2-tailed).

4.1.2 Students' perception of the ease in the four language skills

Figure 2 shows that the respondents face more difficulties in academic writing followed by academic speaking and listening.
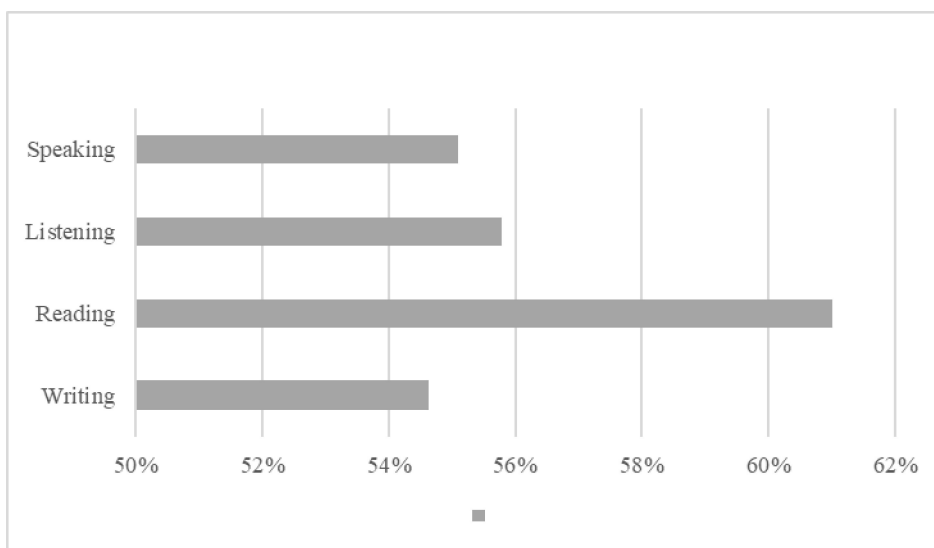

Figure 2. Students' perception of ease in the four language skills

A significant correlation was detected between students' perception of ease in academic reading and their scores in the four subjects. Also, moderate associations were established between students' scores in TCF, Math, and Physics and their ease in other language skills, while no relation was disclosed between students' scores in Science and other language modalities (see Table 3).

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Table 3. Correlation between students' scores and their perceived ease of the four language skills

		Writing	Reading	Listening	Speaking
Grades in TCF	Pearson Correlation	.333**	.540**	.376**	.284*
	Sig. (2-tailed)	.005	.000	.001	.017
	N	70	70	70	70
Grades in Maths	Pearson Correlation	.283*	.475**	.363**	.325**
	Sig. (2-tailed)	.018	.000	.002	.006
	N	70	70	70	70
Grades in Science	Pearson Correlation	.064	.263*	.116	.116
	Sig. (2-tailed)	.596	.028	.340	.338
	N	70	70	70	70
Grades in Physics	Pearson Correlation	.252*	.433**	.282*	.292*
	Sig. (2-tailed)	.035	.000	.018	.014
	N	70	70	70	70

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

4.1.3 Students' beliefs about language learning

Correlation techniques also revealed that a significant positive connection was found between Motivation & Expectations and students' scores in TCF, Math, and Physics. Nature of Language Learning was found to be positively associated with scores in TCF and Science (see Table 4).

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Table 4. Correlation between students scores in the exams and their beliefs about language learning

		DLL	FLA	NLL	LCS	ME
Grades in TCF	Pearson Correlation	.266*	.208	.325**	.319**	.586**
	Sig. (2-tailed)	.026	.084	.006	.007	.000
	N	70	70	70	70	69
Grades in Maths	Pearson Correlation	.117	.020	.230	.294*	.426**
	Sig. (2-tailed)	.334	.870	.055	.013	.000
	N	70	70	70	70	69
Grades in Science	Pearson Correlation	.109	.096	.325**	.082	.269*
	Sig. (2-tailed)	.369	.427	.006	.500	.025
	N	70	70	70	70	69
Grades in Physics	Pearson Correlation	.135	.044	.181	.152	.392**
	Sig. (2-tailed)	.267	.716	.133	.208	.001
	N	70	70	70	70	69

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

5.1 Discussion

Some components of students' beliefs about language learning (Motivation & Expectations and Nature of Language Learning) were found to be positively associated with their language proficiency and their performance in Math, Physics, and Science. This indicates that motivation and the nature of language learning may affect students' language proficiency and their performance in science subjects. Our findings are in line with those of Arslan & Kafes (2021), who detected a link between students' levels of language skills and different aspects of their beliefs about language learning.

Also, the findings of the current study identified that respondents found academic writing to be the most challenging skill. They also disclosed that their proficiency in the medium of instruction is positively associated with their performance in science subjects mediated by that language, and there is a positive association between students' perceived ease of the four language skills (especially reading) and their language proficiency and performance in science subjects. This entails that proficient students in the medium of instruction face fewer challenges in the four language skills and perform better in the science subjects mediated by that language. Findings of the current study lay further support to previous studies that found positive associations between students' performance in academic disciplines and their language proficiency (Bifuh-Ambe, 2009, 2011; Braine, 2002), and the challenges they face with language skills (Aizawa et al., 2020; Andrade, 2006; Hellekjaer, 2010; Kırkgöz, 2005).

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6.1 Conclusion

The current study findings lay further support to previous ones and reveal that students' proficiency and the challenges they face in the medium of instruction and their beliefs about language learning can affect their performance in academic disciplines. From the findings of the current study, we suggest that students should be well equipped with the necessary language skills in the medium of instruction in order not to be hampered by that language while studying science subjects that are mediated by that language. Also, the challenges students face in language skills should be identified to reinforce their language abilities in these skills. This study reveals that while language proficiency may affect students' performance in academic disciplines, their performance can also be affected by the challenges students face in the four language skills and their beliefs about language learning.

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