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Testing the Cognitive Retroactive Transfer Hypothesis: Evidence from Moroccan University Readers

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Abstract

The extant study extrapolates the principles of the Cognitive Retroactive Transfer hypothesis, a theory of reading transfer between languages recently introduced to the literature, in an academic context. Forty-five freshmen are recruited from the English Department at the School of Arts and Humanities Ben M'sik (Hassan II University of Casablanca). The study employs a quasi-experimental design which involves two main phases: pre-intervention and post-intervention. The participants are selectively allocated to an experimental group (n=25) and a control group (n=20). The experiment measures the transferability of improved metalinguistic awareness from English (the foreign language "FL") to Arabic (the first language "L1"). To this end, a battery of reading tests is administered in both languages before and after the intervention. Upon completing the pretest phase, the experimental group receives a three-month training, targeting core metalinguistic skills. To compare pretest and posttest scores, a multivariate analysis of variance (MANOVA) is conducted to check the groups' overall differences across the set of reading skills before using Simple Group Contrasts (k-matrix) as a follow-up test to analyze the groups' performance on each reading skill. The results show a positive effect of the intervention on the experimental group's performance over all the skills except orthographic knowledge posttest scores which level off. The findings give more prominence to the CRT hypothesis which has been solely tested in children bilingual settings. The unchanged orthographic knowledge scores suggest the essential role of explicit print exposure and practice in developing spelling skills in another language. The ongoing research paper calls for adopting fine-grain and level-fitting pedagogical approaches to address reading difficulties at university levels.

Keywords: Cognitive Retroactive Transfer, Intervention, metalinguistic awareness, orthographic knowledge, print exposure

1. Introduction

Under the aegis of the Cognitive Retroactive Transfer theoretical framework, reading deficits across languages can be addressed by means of designated remedial courses. Through the implementation of a reading intervention, i.e., a series of reinforced lessons, struggling students would enhance their reading performance not only in the target language but also in their home languages (Abu et al., 2022). Although most studies investigating CRT spot the light on children with reading problems, expanding the theory's foundational underpinnings to improve adults' reading skills remains practically applicable and offers a promising avenue for future research.

In Morocco, and with the increasing number of the annual intake of new enrollees at the English Department in universities, professors may end up having students with low proficiency levels. Khtou (2020) argues that diminished language proficiency at this level can be ascribed to previous instructional practices at middle and high schools. This view is documented in several reports issued by official and non-governmental organizations. For instance, recent data from the Progress in International Reading Literacy Study (PIRLS, 2021) outlines a low score Moroccan schoolchildren aged 9 and 10 obtained across standardized reading tests. A 372-point score was recorded for these students, which did not meet the international average set at 500 points.

As they manage their way through post-secondary education, many Moroccan students of English do not self-report literacy issues. While facing academic challenges, these students may not be mindful of the seminal impacts reading problems exert on their scholastic accomplishments. As such, they are unlikely to be detected in their first year until they substantially face serious challenges such as flunking a course or failing to complete assigned requirements. Consequently, this creates anxiety and eventually causes students to drop out. An efficient learning strategy to tackle learning difficulties is through prioritizing academic support to customize students' reading needs not only in the foreign language but also in Arabic given its constitutional status as a national language (Moroccan Constitution, Article 5). Therefore, the present study utilizes methodological insights from the CRT hypothesis for the purpose of identifying struggling adult (university) readers as well as suggesting new pedagogical tools to help cope with reading hurdles.

2. Literature Review

2.1 Cognitive Retroactive Transfer Hypothesis (CRT)

The Cognitive Retroactive Transfer hypothesis suggests a new mode of transfer from the additional languages (second/foreign) to the native language following remedial interventions. The Cognitive Retroactive Transfer theory evolves from and extends Cummins's (1991)' Interdependence Hypothesis, which postulates that proficient readers can tap into their first language background to facilitate the acquisition of other languages. This theoretical framework argues that individuals with fully-fledged literacy competencies in their native language can harness their linguistic and cognitive skills to expedite the learning process of additional languages. Another salient instance of convergence is featured in Koda's Facilitation Model (2005), a concept of transfer upon which the Cognitive Retroactive Transfer is premised. Within the scheme of reinforced interventions, the Cognitive Retroactive Transfer hypothesis provides practical tools to endow struggling readers with foundational linguistic abilities, enabling them to navigate reading deficiencies across typologically different languages (Abu Rabia & Wattad, 2022; Feder & Abu Rabia, 2022). This theory does not take cognizance of disparities attested at the writing systems as well as the directionality of the transfer process —whether from the first language (L1) to the second language (L2) or vice versa. Cogently put, the transfer of skills involves readers tapping into substantiated linguistic skills, including reading abilities, in one language to facilitate the learning of another. Such an assumption springs from the idea of "reading universals" which contends that all readers undergo the same learning-to-read experience (Koda, 2007, 2009). Reading, from this standpoint, is metalinguistic, requiring readers to link phonology (sound segments) with orthography

(written forms). It is, thus, metalinguistic awareness, a universally common aspect across all languages, that guides the transfer process.

Metalinguistic awareness is defined as the ability to reflect upon and manipulate the linguistic elements characterizing written and spoken language (Nagy & Anderson, 1999; Tighe et al., 2019). Metalinguistic skills are the foci of the theory of transfer embedded in the CRT hypothesis. The latter investigates the potential effects of practice and print exposure on improving metalinguistic abilities, such as phonological awareness, morphological awareness, orthographic knowledge, and comprehension, across typologically similar or distinct languages. Foremost among these reading skills is phonological awareness, which has received more attention than other skills (Burt & Heffernan, 2012). This is because phonological awareness is a robust predictor of reading, especially among children. In this vein, Wawire & Kim (2018) conducted a randomized control trial to investigate the effect of bilingual literacy instructions in Kiswahili (L1) and English (L2) on cross-language transfer of phonological awareness among first-grade learners. The findings yield a significant development in sound awareness in both languages after the intervention. Analogous results highlighting the transfer of phonological awareness between various languages are adumbrated in the literature: German and English (Mann & Wimmer, 2002), Farsi and English (Arab-Moghaddam & Sénéchal, 2001), French and English (Chiang & Rvachew, 2007), Italian and English (D'angiulli et al., 2001). The outcomes of these discoveries align with both the Interdependence Hypothesis (Cummins, 1991) and the Cognitive Retroactive Transfer hypothesis (Abu Rabia et al, 2013).

Unlike phonological awareness, the transfer of morphological awareness and orthographic knowledge from one language to another remains less consistent. On the one hand, few studies consider the transfer of morphological awareness across languages (Saiegh-Haddad & Geva, 2008). Other research studies postulate that the transferability of morphological awareness is unidirectional, i.e., it only takes place from the first language (L1) to the second language (L2) and not in the opposite direction: from L2 to L1 (Bindman, 2004; Jarvis & Odlin, 2000; Ramirez et al., 2010; Wang et al., 2009). They further suggest that such a straightforward direction of transfer is grossly determined by the complexity of the morphological systems under scrutiny. Transferring morphological awareness skills is expected from languages with more intricate morphemic structures (like Arabic and Spanish) to languages with simpler and transparent morphological systems (like English). On the other hand, there is no consensus in the literature regarding whether orthographic knowledge, i.e., spelling skills and awareness of written forms, is subject to cross-language transfer. This is due to the discrepancies featuring the writing systems of each language (Deacon et al., 2009). Only a limited body of research contends that transferred orthographic knowledge is the direct result of the similarities in the written forms of two languages or extensive print experience to the relevant writing systems. In this way, the preconditioned transfer of orthographic skills finds resonance in the Orthographic Depth Hypothesis (ODH) (see a condensed review of ODH in Abu Rabia & Shakour, 2014).

The findings outlined from child research on the transfer of metalinguistic awareness may not be directly generalized to an adult population. As learners grow older, the reliance of metalinguistic awareness becomes relatively diminished. However, a recent wave of research pinpoints to existing difficulties in manipulating structural features among adult students (Deacon et al., 2017; Parrila et al., 2007; Tighe et al., 2019). In this context, adult learners, particularly university students, demonstrate insufficient reading skills at the levels of phonological processing, spelling, and word identification skills. Hence, and in light of the present research, the researchers draw upon these perspectives that look at adult learners as struggling readers. The researchers also assume that there are differential magnitudes of metalinguistic awareness transfer across languages, which has been attested by the previously highlighted research.

2.2 Empirical Research on CRT

Of late, a new line of research has shifted the focus on the transferability of reading skills from the first language to the target language. By way of reiteration, numerous studies consider children from

different linguistic backgrounds to assess the validity of the Cognitive Retroactive Transfer (CRT) hypothesis. Abu Arabia & Shakour (2014) undertake a study wherein two groups of poor readers enrolled in the 6th grade took a battery of readings tests before and after an English intervention program exclusively administered to the experimental group. Their findings culminate in recognizing a reverse transfer of reading skills from English (the foreign language FL) to Hebrew (the second language L2) and Arabic (the first language L1). The same examination is carried by the same pioneering authors (Abu Rabia & Sanitsky, 2010; Abu Rabia & Danon, 2012; Abu Rabia at al., 2013). These research studies revolve mainly around bilingual or trilingual children with a focus on struggling achievers.

Investigating potential transfer effects among struggling adult students with a record of persistent reading difficulties is still underexplored. A narrow scope of research casts the light on checking a CRT of skills among aged-students. As a case in point, Gonca (2016)' study checks the possibility of enhancing L1 reading proficiency through L2 reading courses. Her approach targets university students and employs a reading program with a design entailing pretests and posttests. Her research unveils compelling findings that substantiate the innovative theory of transfer in question. Andreou and Segklia (2019) contribute to this field by examining the impact of an L2 intervention on developing L1 decoding and spelling skills. Their findings indicate a positive correlation between the L2 intervention and L1 decoding skills but not L1 spelling (Andreou & Segklia, 2019). Atouf and Harrizi (2023) use the same measurements to check for a reverse transfer of skills from the target language to the first language. Their results give full credit to the Cognitive Retroactive Transfer theory (Atouf & Harrizi, 2023).

However, this underlined model of CRT is not complete and is, thus, critiqued for its failure to account for long-term literacy development. The methodological paradigm utilized presupposes a timeframe with two main phases in which the post-intervention stage is merely viewed as a baseline for comparison. There is no guarantee that the acquired or boosted skills during the intervention would be maintained in the long run. The researchers do not claim to introduce a refined methodology where we monitor the developmental process of reading abilities, since this would go beyond the scope of the current research paper. Ipso facto, it is within the above emerging body of research that our present paper is situated. By using a quasi-experimental approach, the researchers intend to extrapolate the precepts of CRT in an academic context, peculiarly among university students with reading difficulties. The researchers beg to address the following research question: would (FL) remedial courses have a positive effect on English (FL) and, by means of transfer, Arabic (L1) reading skills among the experimental group?

3. Research Methods

3.1 Research Design

The researchers employed a quasi-experimental design: the pre-test post-test non-equivalent group design, in which two groups (treatment and control) are not randomly assigned. The selection process was initially based on convenience sampling where seventy-five students were reached via their institutional emails. Placement in the reading program was predicated upon "shared" or "common" characteristics between the participants when completing the pretest measures (see the section below for more details). This is typical of quasi-experiments in which there is little chance to control for confounding variables, and, thus limiting generalizability of the findings (Cohen et al., 2018). Therefore, the pretests served as the hallmark against which The researchers defined the participants as "struggling readers".

3.2 Participants

The current experiment included first-year university students at the English Department in the School of Arts and Humanities Ben M'sik (Hassan II University of Casablanca). All students were taking a Reading Comprehension Course. Before administering the pretests, the participants were

required to complete a background questionnaire that looked into their literacy practices at school and at home. Inclusion criteria stipulated that only students who were struggling with the course could take part in the experiment. Exclusion criteria included participants who were not willing to be fully committed to the reading intervention program. The final sample consisted of 45 students who were purposively allocated to two groups: experimental (n=25) and control (n=20). The study encompassed both males and females with an approximate gender balance (Table 1):

Table 1: Gender Distribution in the Study

Gender	**Frequency**	**Percentage %**
Female	23	51,10%
Male	22	48,90%
Total	45	100

3.3 Ethical Considerations

To ensure that the experiment complied with research ethics, particularly with respect to institutional approval and informed consent. The study's general protocol and procedures were reviewed and approved by the Faculty of Letters and Humanities Ben M'sik as well as the head of the English Department. This was to ensure that the experiment conformed to the precautionary measures against Covid-19 (since the researchers conducted this study during the academic year 2021-2022). After creating a database for potential cohorts, a detailed email was sent to the students who were willing to join a specialized reading program targeting learning difficulties. Upon invitation, the participants were fully aware of the three phases of the experiments (pre-intervention – intervention – post-intervention) and were reassured that garnered data would be dealt with the utmost confidentiality.

3.4 Measures

To measure the participants' level of metalinguistic awareness, which is a key predictor of reading proficiency, the researchers utilized a series of tests assessing reading skills in English (FL) and Arabic (L1). The administered tests included phonological awareness, orthographic knowledge, morphological awareness, and reading comprehension. The battery was made up of 16 tests in toto. Each language consisted of 8 tests administered before and after the intervention. The English reading measurements were adapted from the York Adult Assessment Battery-Revised (YAA-R) (Warmington et al., 2012), The Source: Curriculum Guide for Reading Mentors (Florida Department of Education, 2003), Teaching English Spelling: A Practical Guide (Shemesh & Waller, 2000). The Arabic Tests were excerpted from Qiyyas Al-Arabiya: A Standard Proficiency Test of Arabic Native Speakers. In contrast to the English tests, which were tailored according to the students' age and level, the Arabic tests needed to be fine-tuned, especially the phonological awareness test. There is a scarcity in standardized reading tests for adult native Arabic speakers, since most of these measures are only available for children. Therefore, the tasks in phonological awareness in Arabic were modeled on the English test.

3.5 Procedure

Upon completing the pretest phase, which lasted for three weeks, an intervention program was designated by the author to target the identified areas of weaknesses manifested by the students. The intervention was in the form of academic support specifically tailored to optimize the participants' performance in reading comprehension. Four components of metalinguistic awareness were addressed in the training, viz., phonics and spelling, word building, knowledge of grammar, and comprehension strategies. The implementation of the intervention was extended over a period of three month. At the end of the remedial lessons, the students sat for the same tests. The post-intervention phase was very critical in that it provided a baseline for comparing the two groups' scores before and after the intervention. The post-tests would also unravel potential impact of the intervention on developing reading skills in English (FL) and Arabic (L1) through transfer, eventually providing evidence for the

occurrence of a cognitive retroactive transfer of linguistic skills (Abu Rabia & Shakour, 2014; Feder & Abu Rabia, 2022).

3.6 Data Analysis

A number of statistical tests were used to check for overall differences in the groups' performance across the dependent variables (namely the four reading skills). First, a multivariate analysis of variance (One-way MANOVA) was undertaken to confirm the groups' differences after the intervention. The MANOVA test was performed to check whether the two levels of the independent variable (a 2 within-subject (time) x 2 between-subject (group) factors) were statistically significant. However, the multivariate analysis did not provide where the differences specifically lied. Subsequently, the researchers had to run a follow-up analysis- simple group contrasts (K-matrix) with the experimental group being the reference group (Level 2).

4. Results

4.1 Descriptive Statistics

The researchers used descriptive statistics (in the form of tables and charts) to depict the variations in the groups' responses before and after the reading program. Statistics included here show mean values and standard deviations. The researchers present each group separately:

Table 2: Means and Standard Deviations in Metalinguistic Awareness Skills in English and Arabic Before and After the Intervention for the Control Group:

Language	English		Arabic	
Metalinguistic Skills	Before	After	Before	After
	M (SD)	**M** (SD)	**M** (SD)	**M** (SD)
Phonological Awareness	**4,95** (1,90)	**5,10** (1,94)	**4,10** (1,12)	**4,35** (1,23)
Morphological Awareness	**3,75** (1,45)	**4,20** (1,51)	**3,50** (1,47)	**3,50** (1,19)
Orthographic Knowledge	**4,70** (1,59)	**3,95** (1,05)	**3,55** (1,39)	**3,70** (1,13)
Reading Comprehension	**3,85** (1,53)	**3,95** (1,28)	**4,10** (1,41)	**4,05** (1,00)

Table 3: Means and Standard Deviations in Metalinguistic Awareness Skills in English and Arabic Before and After the Intervention for the Experimental Group:

Language	English		Arabic	
Metalinguistic Skills	Before	After	Before	After
	M (SD)	**M** (SD)	**M** (SD)	**M** (SD)
Phonological Awareness	**5,84** (1,72)	**9,80 (1,95)**	**3,88** (0,97)	**8,20** (1,58)
Morphological Awareness	**4,52** (1,41)	**6,84** (1,28)	**4,04 1**(,39)	**6,16** (1,17)
Orthographic Knowledge	**4,48** (1,22)	**6,40** (1,15)	**4,04** (1,20)	**4,44** (1,58)
Reading Comprehension	**3,56** (1,19)	**6,80** (1,41)	**3,84** (1,37)	**5,92** (1,35)

Table 3 shows the mean scores and standard deviations for the tested metalinguistic components before and after the intervention for the experimental group. During the pretest phase, the participants in the experimental group demonstrated stable mean scores across the set of dependent variables in the two languages. In English, the mean values are phonological awareness (5.84; SD=1.72), morphological awareness (4.52; SD=1.41), orthographic knowledge (4.48; SD=1.22), and reading comprehension (3.56; SD=1.19). However, after the intervention, the mean scores of all metalinguistic skills in English positively increased (phonological awareness: M= 9.80(SD=1.95); morphological awareness: M=6.84 (SD=1.28); orthographic knowledge: M=6.40 (SD=1.15); reading comprehension: M=6.80 (SD=1.41)).

Similarly, there is a marked upward rise of mean scores in Arabic skills except for orthographic knowledge mean values which level off (before M=4.04, SD=1.20; after M= 4.44, SD=1.58). It appears that the improvement in metalinguistic skills was more pronounced in phonological awareness in both languages. This is in line with Wawire & Kim (2018)'s study:

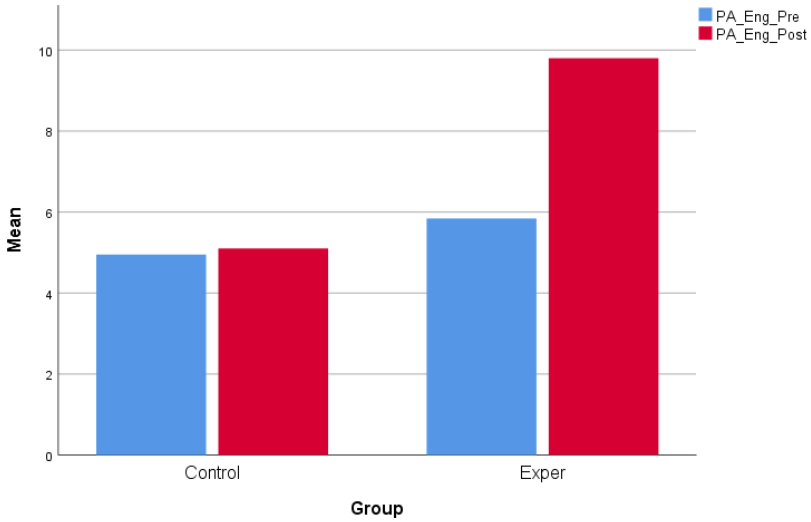

Figure 1: Mean Scores of English Phonological Awareness Before and After the Intervention (Control vs. Experimental Groups).

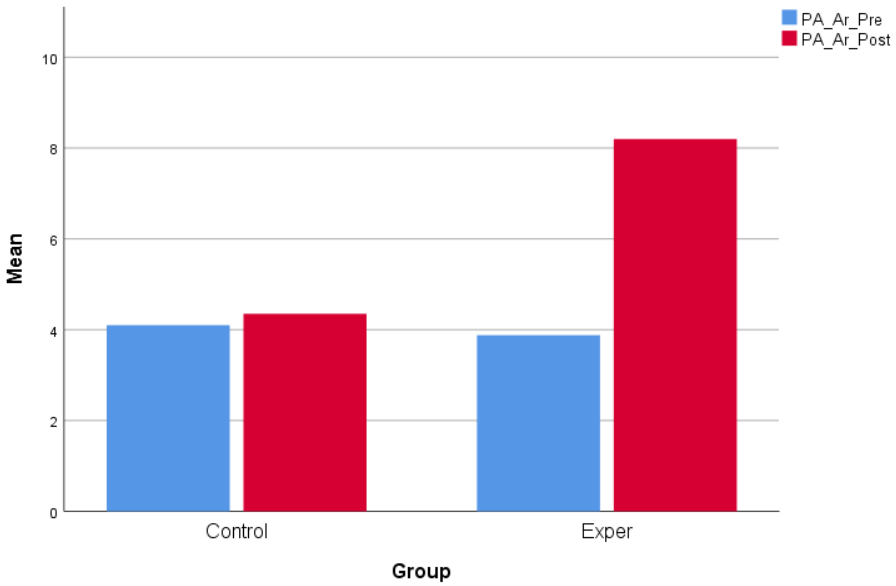

Figure 2: Mean Scores of Arabic Phonological Awareness Before and After the Intervention (Control vs. Experimental Groups).

4.2 Inferential Statistics

Before the intervention, the test of between-subjects effects showed no statistical significance. In phonological awareness, the effect of the group factor was not statistically significant $F = 2.697$, $p = 0.108$, $\eta^2 = 0.059$. Likewise, English morphological awareness recorded the following value: $F = 3.219$, $p = 0.080$, $\eta^2 = 0.070$. In Arabic, for example, orthographic knowledge did not statistically suggest any positive effect of group $F = 1.595$, $p = 0.213$, $\eta^2 = 0.036$ (that was also the case in the other

metalinguistic constructs). The absence of statistical significance in the pretests met the assumption of homogeneity of variance across the groups, putting, thus, all the participants on an equal scale before receiving focused reading instructions. The multivariate analysis, however, carried out after working out the posttest scores were indicative of overall differences among the groups.

Significant differences were found among the group factor on the set of dependent measures, Wilks' λ = 0.078, F (16, 28) = 20,793, p < .001. The multivariate Eta Square (η^2) based on Wilk's λ (η^2 = .92) was quite strong. Our question was answered: there was an effect of the time factor (the intervention) on the group factor (significant different groups' scores on the set of measured variables in both languages). To provide fine-grained analysis of the two groups' performance before and after the intervention, the researchers further reconfigured the MANOA test by adding simple group contrast analysis. The treatment group was used as a reference group (Level 2):

Table 4: Simple Group Contrast Results of the English Tests (K-Matrix) before the intervention

Group Simple Contrast[a]			Dependent Variables			
			Pre_ PA_Eng	Pre_ MA_Eng	Pre_ OK_Eng	Pre_ RC_Eng
Level 1 vs. Level 2	Contrast Estimate		-0,89	-0,77	0,22	0,29
	Hypothesized Value		0	0	0	0
	Difference (Estimate - Hypothesized)		-0,89	-0,77	0,22	0,29
	Std. Error		0,542	0,429	0,42	0,406
	Sig.		0,108	0,08	0,603	0,479
	95% Confidence Interval for Difference	Lower Bound	-1,983	-1,635	-0,628	-0,529
		Upper Bound	0,203	0,095	1,068	1,109

a. Reference category = 2

Table 5: Simple Group Contrast Results of the Arabic Tests (K-Matrix) before the intervention

Group Simple Contrast[a]			Dependent Variables			
			Pre_ PA_Ar	Pre_ MA_Ar	Pre_ OK_Ar	Pre_ RC_Ar
Level 1 vs. Level 2	Contrast Estimate		0,22	-0,54	-0,49	0,26
	Hypothesized Value		0	0	0	0
	Difference (Estimate - Hypothesized)		0,22	-0,54	-0,49	0,26
	Std. Error		0,312	0,429	0,388	0,417
	Sig.		0,484	0,215	0,213	0,536
	95% Confidence Interval for Difference	Lower Bound	-0,409	-1,405	-1,272	-0,581
		Upper Bound	0,849	0,325	0,292	1,101

a. Reference category = 2

The K-matrix results demonstrate no significant difference between Level 1 (the control group) and Level 2 (the experimental group) on the set of measured variables in English. For instance, the contrast estimate is -0,89 in phonological awareness suggesting that the control group scored 0,89 units lower than the experimental group with no statistical significance implied (p=0.108). The same thing applies to morphological awareness where the estimate contrast is -0,77 before the intervention, revealing no distinction in the performance of both groups over this skill. The 95% Confidence Interval (CI) includes both negative and positive values (-1,635, 0,095) which means that the observed effect, at this stage, is

not statistically significant (p=.08). Orthographic knowledge and reading comprehension tests' scores are no exception (orthographic knowledge: CE= 0.22, p=0.60; reading comprehension: CE= 0.29, p=0.47). Akin to English, and as far as Arabic metalinguistic skills are concerned, the participants' pretest scores are well below par. There is no distinction between Level 1 and Level 2 on the variables being measured before the intervention (phonological awareness: CE= 0,22, p=.48; morphological awareness: CE= -0,54, p=0,21; orthographic knowledge: CE=-0,49, p=0,21; reading comprehension: CE= 0,26, p=0,53).

Table 6: Simple Group Contrast Results of the English Tests (K-Matrix) after the intervention

Group Simple Contrast[a]			Dependent Variables			
			Post_ PA_Eng	Post_ MA_Eng	Post_ OK_Eng	Post_ RC_Eng
Level 1 vs. Level 2	Contrast Estimate		-4,7	-2,64	-2,45	-2,85
	Hypothesized Value		0	0	0	0
	Difference (Estimate - Hypothesized)		-4,7	-2,64	-2,45	-2,85
	Std. Error		0,586	0,416	0,333	0,407
	Sig.		.000	.000	.000	.000
	95% Confidence Interval for Difference	Lower Bound	-5,881	-3,478	-3,121	-3,67
		Upper Bound	-3,519	-1,802	-1,779	-2,03

a. Reference category = 2

Table 7: Simple Group Contrast Results of the Arabic Tests (K-Matrix) after the intervention

Group Simple Contrast[a]			Dependent Variables			
			Post_ PA_Ar	Post_ MA_Ar	Post_ OK_Ar	Post_ RC_Ar
Level 1 vs. Level 2	Contrast Estimate		-3,85	-2,66	-0,74	-1,87
	Hypothesized Value		0	0	0	0
	Difference (Estimate - Hypothesized)		-3,85	-2,66	-0,74	-1,87
	Std. Error		0,431	0,355	0,42	0,363
	Sig.		.000	.000	0,085	.000
	95% Confidence Interval for Difference	Lower Bound	-4,718	-3,377	-1,587	-2,601
		Upper Bound	-2,982	-1,943	0,107	-1,139

a. Reference category = 2

The contrast estimate values of the post-test scores are marked by an exponential improvement in the performance of the experimental group (Level 2) as opposed to the control group. This remarkable upward trend is evident across various levels of reading skills (post-phonological awareness: CE=-4,7, CI (-5,8 to -3,5), p<.000; post-morphological awareness: CE=-2,64, CI (-3,4 to -1,8), p<.000; post-orthographic knowledge: CE= -2,45, CI (-3,1 to -1,7), p<.000; reading comprehension: CE=-2,85, CI (-3,6 to-2,03), p<.000). The contrast results suggest that on average the experimental group scored 2 units higher than the control group across all the English reading tests. Table 4 above displays a conspicuous development of Arabic reading skills after the intervention within the treatment group. The analysis yields significant contrast effects between the two Levels (1 & 2) across various skills, excluding Arabic orthographic knowledge which remains stable over the two phases. Such improvement is more pronounced in phonological awareness which indicates that participants in the experimental group scored 3,85 units higher than their counterparts in the control group. Similarly, morphological

awareness and reading comprehension in Arabic are statistically significant, suggesting a difference in the observed effects (post-morphological awareness: CE=-2,66, p<.000; post-reading comprehension: CE=-1,87, p<.000).

5. Discussion

The principles of the Cognitive Retroactive Transfer hypothesis are fully confirmed in the extant experiment. Our findings are in accordance with previous research studies investigating the CRT across various contexts, including adult students (Abu Rabia & Shakour, 2014; Andreou & Segklia, 2019; Atouf & Harrizi, 2023; Feder & Abu Rabia, 2022; Gonca, 2016). Additionally, the current study's findings give support to the Orthographic Depth Hypothesis which preconditions transfer of spelling skills across typologically distinct orthographies as in the case of English and Arabic.

The notable transfer of phonological awareness skills between English and Arabic supports the notion that reading is a universal process that necessitates the use of phonology as a decoding threshold for encoded written information (Arab-Moghaddam & Sénéchal, 2001; Chiang & Rvachew, 2007; D'angiulli, Siegel, & Serra, 2001; Mann & Wimmer, 2002). In other words, once developed in one language, readers are more likely to use their knowledge of the acquired sound system to read in other languages irrespective of the direction (i.e., from L1 to L2/FL or vice versa).

The positive transfer triggered at the level of morphology challenges the shared view in that literature propounding that morphological awareness in solely transferrable in a unidirectional manner (i.e. from the first language to the target language) and across transparent morphologies (Bindman, 2004; Jarvis & Odlin, 2000; Ramirez, Chen, Geva, & Kiefer, 2010; Saiegh-Haddad & Geva, 2008; Wang et al., 2009). The English morphological system is transparent compared to the more complex Arabic morphological system. Such discoveries provide empirical evidence for such mode of transfer and find resonance in previous works (Atouf & Harrizi, 2023; Deacon et al., 2009).

Other aspects of this transfer include optimizing students' comprehension strategies in both languages after the intervention. Fundamental strategies, such as higher-level order thinking skills, prove to be transferred across languages when addressed by means of streamlined instructional support. Nonetheless, the stagnated orthographic knowledge scores suggest that print exposure in one writing system is not sufficient enough to bring about a cross-language transfer between distinct orthographies (Abu Rabia & Sanitsky, 2010; Deacon et al., 2009).

6. Conclusion

To conclude, the present study investigates the applicability of the Cognitive Retroactive Transfer hypothesis among university students who are categorized as struggling readers (by means of the implemented measures). Our findings corroborate insights from previous research studies which lend support to the CRT hypothesis which contends that core metalinguistic constructs, such as phonological awareness and morphological awareness, are transferrable between language pairs. Our findings further implicate that academic support in the form of interventions may very well inform instructional practices at the university level.

7. Implications and Recommendations for Future Research

There are several implications springing from the present research paper. To begin with, a general caveat should be raised in terms of admitting new students into language programs at university, since students' poor proficiency may remain unidentified. This is clearly suggested by the pretest scores. The latter showcases students' low achievement in core metalinguistic awareness skills that are rudimentary for reading as well as academic success. Before the commencement of the reading program, our population demonstrated insufficient metalanguage to deal with the tests in both English and Arabic.

This implies that the status of Arabic, which is the first language in Morocco as stated by the 2011 constitution, is seriously deteriorating at all levels of education. The reading issues articulated at this phase (pre-intervention) reflect the students' record of failures to achieve reading proficiency in primary, middle, and secondary education. It may also reflect the gap between what students know about English as a foreign language, imparted differently at university, and what they actually expect. With this being considered, part of the solution can be found in implementing specialized interventions for freshmen at the English Department. This is to instill self-awareness of the import of (meta-) linguistic abilities in enhancing literacy across different languages. Such an implication reflects the growing need to improve learning outcomes, which has been at the heart of the higher education reforms outlined in the National Charter (2000-2001). The study's findings inform foreign language policies in Morocco as they may provide a top-down approach to grapple with academic failures. Data about students' low literacy achievements are often collated from primary, middle, and high schools. The unique contribution of this study lies in its focus on university-level reading skills, offering a valuable extension to existing literature. Therefore, practitioners in the field can build upon insights from this experiment to develop standardized measurements to identify poor readers and design in-person or multimodal interventions aimed at addressing specific reading needs.

Future research is invited to duplicate the current experiment across various learning environments, especially within academic settings. A new flow of research can further investigate the effects of multimodal interventions on both digital and print reading. An emerging and promising field of research is now looking into learners' attitudes in digital environments, particularly their levels of comprehension. With the rise of technology and with the increasing number of electronic gadgets' users, it is exigent to examine readers' capacity to comprehend printed written information. The present paper only explores the effect of in-person supplementary courses on developing the target language reading competencies and the corollary effect this intervention may have on developing similar skills in Arabic (L1). As revealed by the results and findings, reading skills prove to be transcendent beyond languages (with the exception of orthographic knowledge, which is language-specific), giving more credit to the Cognitive Retroactive Transfer hypothesis.

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