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Full Length Research Paper

The influence of curriculum diversification and ethnic culture on student cognitive functioning

Saad Shawer

Curriculum & Instruction Department Chair, College of Education, Ittihad University, RAK, P. O. Box 2286, UAE. E-mail: saadsaad71@yahoo.com, sshawer@ittihad.ac.ae, saadshawer@wsu.edu. Tel: 00971-72059911. Fax: 00971-72059982.

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This study examined the influence of curriculum diversification on student use of learning strategies; EFL Arab students' patterns of strategy use; and how they differ from other ethnic groups in their strategy use. The study made use of positivism at the levels of ontology (one form of reality), epistemology (detachment from the subjects) and methodology ('nomothetic'/ standardized research strategy ((survey) and instrument (questionnaires)). Data analysis involved percentages, means, one-way MANOVA (Lambda), and one-way ANOVA (Scheffe). Working with college students, the study concluded that course diversification influenced student use of compensation (but not memory, cognitive, meta-cognitive, affective, and social) strategies in favour of the scientific track of study. It also concluded that Arab learners were frequent users of meta-cognitive and social strategies but moderate users of memory, cognitive, compensation, and affective strategies. In addition, disagreement about ethnic cultures' patterns of strategy use still continued. The study recommended that clear identification of effective cognitive strategies and styles could guide classroom-level and school-level curriculum developments and innovations and facilitate curriculum implementation (instruction). Moreover, it recommended that research should focus more on influential cognitive functioning factors (e.g., cognitive strategies and styles) than ethnic cultures.

Key words: Cognitive strategies, learning styles, diversification, curriculum differentiation; foreign language learning

INTRODUCTION

Learning strategies have long been accepted as a major factor for effective language learning in general and English as foreign language learning (EFL) in particular since early 70s (Oxford, 1990a). Learners use cognitive strategies to facilitate information processing, whereas they employ meta-cognitive strategies to plan, organise and monitor their learning (Cohen, 1998; O'Malley and Chamot, 1990; Oxford, 1989; Shawer, Gilmore and Banks-Joseph, 2008).

Cognitive strategies are the 'steps or mental operations used in learning or problem-solving that require direct analysis, transformation, or synthesis of learning materials in order to store, retrieve and use knowledge' (Wenden, 1986, p. 10). Cognitive operations come into play when learners ask questions about, check and revise cognitive enterprises (Riding and Rayner, 1998) in addition to making analogies, memorization, repetition, writing things down, self-testing and inference (Hedge, 2000).

Meta-cognitive strategies, on the other hand, are 'general skills through which learners manage, direct, regulate and guide their learning, i.e. planning, monitoring and evaluating' (Wenden, 1998, p. 519). Meta-cognitive operations are, therefore, used to over-view, pay attention, set goals and objectives, organise, and self-monitor learning (Hedge, 2000). Further, meta-cognitive operations take the form of debriefing discussions and learning logs used for documenting learning progress (Rasekh and Ranjbary, 2003).

Programme diversification is concerned with matching curriculum to a particular track of learning. For example, secondary education students are diversified into several tracks, including general, technical and agricultural. The curriculum in each track differs significantly from those of the other tracks (Pollard and Triggs, 1997; Saez and Carretero, 1998); but it is unclear if different programmes of studies influence learners' development and use of particular strategies.

Though empirical research examined various variables, including motivation, proficiency, gender, age, language background, cognitive style and methods of teaching (Abu Shmais, 2003; Chamot, Barnhardt, El-Dinary and Robbins, 1996), no research has studied the relationship between programme diversification and learning strategy use. Moreover, very little research has studied the relationships between ethnicity and learning strategy use. This study, therefore, sought to examine the relationship between diversification programmes, ethnicity and EFL learning strategy use. Specifically, it sought to examine the patterns of strategy use among EFL Arabic-speaking learners through Oxford's (1990a) Strategy Inventory for Language Learning (SILL) as both a framework and data collection method. Discovering effective strategies could be used to train learners on how to use them to facilitate language learning in addition to developing compatible curricula with such effective strategies (Chamot and Kupper, 1989; O'Malley and Chamot, 1990; Oxford, 1990a).

LITERATURE REVIEW

This section reviews strategy use round three perspectives. It first examines the possible influence of cognitive strategies and styles on language learning. It second discusses the possible relationships between effective learner strategy use and programme diversification and curriculum differentiation. Finally, it meticulously examines the relationships between ethnicity and patterns of strategy. The section concludes with stating the research questions.

Learning strategies and learning styles

Since this study was concerned with identifying the strategies that enhance student learning, there was a need to highlight the relationship between learning strategies and learning styles. Learning style is the 'individual's preferred and habitual approach to *organising* and *representing* information' (Riding and Rayner, 1998, p. 15). From a psychological perspective, this means that each learner was born with a natural predisposition to approach learning in particular ways than others.

When learning tasks concur with learners' natural predispositions, they can easily process tasks because learners possess strategies that are compatible with their learning style. For example, a group of learners is predisposed to *organise* learning tasks into wholes (holistic), whereas other learners *organise* information into parts (analytic). By contrast, a third category of learners feels comfortable when *representing* information verbally (verbal), whilst a fourth category prefers to *represent* it in mental images (imagery). This is what this study in part sought to explore. For example, the six categories of the SILL revolve around these four main styles. If the students are frequent users of the fourth strategy (meta-cognitive) on the SILL, this indicates they organize tasks in wholes in addition to planning and monitoring their learning.

From a pedagogical perspective, coordination has to take place between learning style and strategy use in order for better language learning to occur. EFL teachers, therefore, need to supply auditory learners, who prefer to learn through listening, with relevant listening texts and supply visual-style students, who learn better through seeing written language, with a learning setting full of visual effects. Analytic students, who break down tasks into parts and holistic learners who better learn through whole language structures require strategies compatible with these styles. Kinaesthetic students who better learn through doing actions need a pedagogy that appeals to their habitual make-up. Field-dependent students prefer social interaction in the learning context, whilst field-independent students better respond to learning activities when they have autonomy and control over their learning. Both styles require particular pedagogy and strategies (Tomlinson, 1998).

It is clear then that learning style is the psychological make-up that makes learners prefer to approach learning in particular fixed ways than others, while learning strategies are the mental operations learners employ to process tasks incompatible with their habitual cognitive style (Shawer, Gilmore and Banks-Joseph, 2008). Some students prefer to deal with words rather than numerals, because they were born with a verbal cognitive processor. When faced with abstract tasks, including numerals, they need to develop strategies that enable them to learn mathematical tasks they do not naturally like to handle. This is what causes some people to feel comfortable at dealing with words while being uneasy with numbers. If the development of effective strategies is essential for effective learning, would diversification programmes of study impact the type of strategies developed?

Diversification and curriculum differentiation

Diversification is primarily intended to pay 'attention to the classroom with a heterogonous group of students; attending to special needs students; and helping to produce curricular adaptations for the diversification programme' (Saez and Carretero, 1998, p. 727). Differentiation is in line with diversification since both aim to achieve curriculum relevance. Differentiation involves adapting a course of study to match the specific needs of learners (Pollard and Triggs, 1997). However, diversification differs from differentiation in that diversification involves differentiation within its tracks. For example, students can be diversified into science and humanities tracks in secondary education that can be differentiated according to ability into slow or fast learners (Oakes, Gamoran and Page, 1992; Saylor and Alexander, 1966).

Curriculum differentiation seeks to address different student abilities and needs by categorizing them into low,

average and gifted. Students are differentiated on the basis of learning ability into mentally retarded, slow, average, fast or gifted learners. They are also differentiated because they deviate from average students in psychological or physical features. Moreover, differentiation could occur because learners differ in their *social* and *economic* backgrounds, since some come from culturally or economically deprived environments. Differentiation of students could also occur on the basis of overt behaviour and emotional stability (problem learners) into pre-delinquent, delinquent or socially maladjusted and emotionally disturbed (Saylor and Alexander, 1966). This study, however, was concerned only with examining the relationship between students' track of study (diversification) and their learning strategy use. Precisely, it aimed to explore if different programmes of study imply certain patterns of information processing.

The study could not unearth a single study that examined the relationship between course diversification and strategy use. However, various empirical studies examined almost all possible factors which could influence EFL learning strategy use. For example, Rahimi, Riazi, and Saif (2008) investigated some variables believed to affect Persian EFL college students' strategy use by means of the SILL. They found that proficiency levels and motivation were the major factors behind their strategy use whereas student gender and years of language learning were not. Using the SILL, Chen (2009) found significant differences between EFL Taiwanese students in their use of memory, cognitive, meta-cognitive, affective and social strategies due to grade levels. Moreover, Qingquan, Chatupote and Teo (2008) studied the differences in language strategy use between successful and unsuccessful EFL Chinese college students. They concluded that the success factor had a significant positive influence on the type of strategy used. Successful students used a wider range of learning strategies more than unsuccessful students. Moreover, successful students often used deep L2-based, active participation, and monitoring strategies while unsuccessful learners employed rote-learning memory strategies.

Hong-Nam and Leavell (2007) examined the influence of monolingual and bilingual learning contexts on EFL college student strategy use through the SILL. The results indicated that monolinguals used compensation strategies most and affective strategies least whereas bilinguals used meta-cognitive strategies most and memory strategies least. They concluded that bilingual learning contexts had a positive influence on learning a new language. On the other hand, Alptekin (2007) found students taught in a tutored context made more use of meta-cognitive strategies, whereas those learning in a non-tutored context often used social strategies. In addition, compensation strategies were used most in both the tutored and non-tutored contexts. Other studies investigated the impact of strategy use on learning. For example, Cotterall and Murray (2009) reported a positive impact of meta-cognitive strategy use on students' self-regulation of learning and performance. Despite the abundance of studies on the factors influencing strategy use, none investigated the impact or the relationship between diversified programmes of study and learning strategy use.

Ethnicity and patterns of strategy use

Language learning strategies are worthy of study since research has proven a positive correlation between language improvement and strategy use (O'Malley and Chamot, 1990; Oxford, 1993; Rossi-Le, 1989; Rubin and Thompson, 1994). They play a significant part in processing and producing language. Language strategies facilitate language production in real-life communication and help learners process, store and retrieve information (Brown, 1994; Chamot and Kupper, 1989). As pointed out earlier, cognitive strategies are responsible for information processing whereas meta-cognitive strategies are used in planning, regulating and monitoring cognition (O'Malley, Chamot, Stewner-Mazanares, Russo and Kupper, 1985). Communication strategies which are 'the techniques learners use when there is a gap between their knowledge of the language and their communicative intent' also play an important role in facilitating communication (Wenden, 1986, p. 10).

However, some strategies are more suitable to particular language skills and tasks than others. The writing skill makes more use of planning, self-monitoring, deduction, and substitution, whereas the speaking skill benefits from risk-taking, paraphrasing, circumlocution, self-monitoring, and self-evaluation. On the other hand, listening comprehension depends on strategies of elaboration, inference, selective attention, and self-monitoring. Moreover, reading comprehension is best achieved through previewing, skimming, reading aloud, guessing, deduction, and summarizing. Research has shown that use of appropriate language learning strategies helps learners to develop specific skills and process cognitive tasks (Chamot and Kupper, 1989; Oxford, Park-Oh, Ito and Sumrall, 1993; Rasekh and Ranjbary, 2003). For example, Kasper's (1997) study indicated a positive relationship between EFL learners' meta-cognitive strategy use and their writing proficiency.

Although learners' ethnicity was accepted as a factor that influences language learning strategy use (Grainger, 1997), very little research addressed the issue. A few studies, however, showed that learners from certain ethnic backgrounds are predisposed to use certain strategies. For example, Asian students tended to use traditional cognitive strategies of repetition, rote-learning and rule-orientation (O'Malley and Chamot, 1990; Politzer and McGroarty, 1985). Taiwanese and Japanese students were more structured, analytical, and memory-based than other groups. Moreover, Japanese students

tended not to favour interaction (Rasekh and Ranjbary, 2003). Spanish learners also used traditional memory strategies (McGroarty, 1987).

Persian students used meta-cognitive strategies more frequently than the other strategies (Rahimi et al., 2008). Similarly, successful EFL college Chinese students scored high frequent use of meta-cognitive and social strategies (Qingquan et al., 2008). Moreover, monolingual EFL college Korean students used compensation strategies most and affective strategies least whereas their bilingual counterparts used meta-cognitive strategies most and memory strategies least (Hong-Nam and Leavell, 2007). Other studies found differences in strategy use between European and oriental students on three out of the six categories of the SILL (Grainger, 1997).

EFL Arabic-speaking learners have rarely been targeted in research. This study managed to locate a single study that focused on Arabic-speaking learners. Abu Shmais (2003) examined patterns of strategy use among EFL Arab college students in Palestine. The findings indicated that meta-cognitive strategies were the most frequently used type of strategy whist compensation strategies were the least used. Due to this paucity of research on Arabic speakers' learning strategy use, the need for further studies arises so that appropriate EFL courses and instruction can be improved. Specifically, this study sought to answer the following research questions:

1.) To what extent are patterns of strategy use (memory, cognitive, compensation, meta-cognitive, affective and social) determined by course diversification (Arabic, Community Service, Biology, and Mathematics departments)?
2.) What language learning strategies do EFL Arabic-speaking learners tend to use?
3.) To what extent do EFL Arabic-speaking learners differ from other ethnic learners in their learning strategy use?

METHODOLOGY

Paradigm and strategy

This study adopted the positivist paradigm so that it could verify the frequency of predetermined categories of strategies (Clarke, 1999; Guba and Lincoln, 1994). The researcher had a set agenda against which he wanted to record the subjects' responses. Survey research was subsequently used to describe and interpret the status quo (what is), because a survey can better describe what is going on. A cross-sectional survey design was particularly used to study different subjects at one point of time. 'A cross-sectional study is one that produces a 'snapshot' of a population at a particular point of time' (Cohen, Manion and Morrison, 2000, p. 175). To answer the research questions, this study sought to test the following null hypotheses.

There are no statistically significant differences at α 0.05 of the mean scores between the four programmes of study (Arabic, Community Service, Biology, and Mathematics departments) in student use of memory, cognitive, compensation, meta-cognitive, affective and social learning strategies.

There are no statistically significant differences at α 0.05 of the mean scores between EFL Arabic-speaking learners and learners from other ethnic backgrounds in their use of the six learning strategy types.

Two-tailed tests of statistical significance (($\alpha \div 2$) ($p = .05 \div 2 = .2.5$)) were used to test these hypotheses.

Context

The researcher was officially responsible for teaching the EFL course to the research samples. This was a compulsory university course that all the university students had to study in the first and second year. The materials were provided by the university in the form of a course book. Teaching and testing revolved round areas of reading, writing, grammar and translation. By the end of the course, the students in a group administration session were voluntarily asked to complete the questionnaire. The students were curious to participate to understand their ways of processing language learning. Individuals were not mentioned by name to maintain anonymity. In addition, confidentiality was assured through removing all information about students' identities (Burns, 2000; Burton, 2000). The teaching of the course and data collection lasted over a full semester.

Research instrument

This study used the Strategy Inventory for Language Learning (SILL) (Version 7) developed by Oxford (1990a). Ellis (1994) describes the SILL as the most comprehensive tool of its kind. The SILL questionnaire has been tested in different contexts and languages for almost 18 years. It is a self-scoring, paper-and-pencil, Likert scale inventory that requires subjects to self-report the frequency of their strategy use on a scale from one to five. The SILL inventory classifies frequency of strategy use according to the following key:

Very high strategy use	Always or almost always used	4.5 - 5.0
High strategy use	Generally used	3.5 - 4.4
Medium strategy use	Sometimes used	2.5 - 3.4
Low strategy use	Generally not used	1.5 - 2.4
Very low strategy use	Never, almost never used	1.0 - 1.4

The SILL is regarded as a valid instrument for researchers, having a Chronbach's Alpha reliability between 0.93 and 0.98 (Ehrman and Oxford 1990). Additionally, the SILL is tested for social reliability, being free of bias. Moreover, students answer it honestly (Oxford, 1996). Oxford identified six categories of learning strategies and a total of 50 strategies in Version 7 for EFL learners. The six categories are memory, mental processing (cognitive), compensation, organizing and evaluating (meta-cognitive), managing emotions (affective) and learning with others (social). Oxford further classified these six categories into direct and indirect strategies.

Direct strategies include memory, cognitive and compensatory. Memory strategies (9 items) deal with storing information into and retrieving it from memory. Cognitive strategies (14 items) are responsible for processing new information through incorporating it into existing schema. This involves operations of classification, analysis, revising and synthesizing of both new and existing information. Compensation strategies (6 items) are used when the learners feel a gap between their communicative intent and language knowledge. These include guessing, using gestures, describing difficult vocabulary and switching to the mother tongue (Ehrman and Oxford 1990).

Indirect strategies comprise meta-cognitive, social and affective strategies. Meta-cognitive strategies (9 items) are used for planning

planning, organizing, monitoring and evaluating learning tasks. Affective strategies (6 items) comprise the feelings, attitudes and motivation, which learners develop to decrease anxiety and internally motivate themselves to carry on learning. Social strategies (6 items) promote learning through interaction with others by asking questions and asking for clarification. This survey instrument asks respondents to rate the frequency of their strategy use on a scale from one to five, with five indicating strategies used all of the time and one indicating strategies of non or rare use (Ehrman and Oxford 1990). The researcher translated the SILL into Arabic to avoid language problems. As highlighted below, the translation was tried out and checked for reliability and validity.

Sampling

The questionnaire samples were randomly drawn from a known population and were intended to represent it. The research population involved the first-year candidate-teachers at four different departments: the Arabic Language, Community Service, Biology, and Mathematics, Al-Azhar University in Cairo. The researcher opted for the systematic random sampling strategy in a number of steps. First, he received a list of names of each department arranged in an alphabetical order. Second, he decided the sample size of each department through the table of sample size from Cohen et al. (2000, p. 94). For example, the Arabic department population of 160 students required a sample of (115). Third, a frequency interval was decided through this formula: F = N ÷ SN where *f* referred to the frequency interval, *N* referred to the population while SN meant the required number of each sample.
With regard to the Arabic Language department, the formula was 160 (the whole department population) ÷ 115 (required sample size as indicated by the Table of sample size) = 1.4 (rounded up to 1). For example, the researcher put a number that represented each name of the 160 students in a vessel to choose the starting number randomly. Number 18 was chosen by chance as the starting point of selection from 160 students. Since the frequency interval was 1, the researcher picked name number 18, skipped name 19, chose name 20, skipped name 21, selected name 22, and so on until the sample of 115 Arabic language students was complete. The researcher applied the same selection procedures to the Community Service department (45 ÷ 40 = 1.2 (rounded up to 1)), the Biology department, (45 ÷ 40 = 1.2 (rounded up to 1)), and the Mathematics department (40 ÷ 36 = 1). The students were all males, since the university imposed a single-sex education policy. Student ages ranged between 17 and 20. This study examined the influence of diversification on language learning strategy use because students' records showed that science tack students outperform humanities track students in language performance.

Moreover, the Arabic department students were also studied because they, like other department students, need English for communication and post-graduate research.

Validation, reliability and data analysis techniques

Though the SILL is an established valid instrument, four EFL professors examined the SILL content and agreed it met the research purpose (Bloom, Fischer and Orme, 1995). Since the SILL was translated into Arabic, the researcher checked it for reliability to make sure that the wording had the same meaning for all the subjects. He used reliability as internal consistency to ensure that the subjects' performance on all the SILL items was consistent. He wanted to make sure that performance is not improved on some sections rather than others.

Though split-half, Kuder-Richardson and Alpha coefficient all check internal consistency and require instruments to be run once, Kuder-Richardson and Alpha coefficient differ from split-half in that both do not require splitting the test into two sections. Moreover, Kuder-Richardson is suitable only for dichotomous types of instruments (e.g., yes/ no questions), whereas Alpha coefficient is suitable for scaled instruments where each item carries a different weight which is the case in this research. It checks the variances of all items from the first to the last. It is clear that the SILL involved items that carried different weights and therefore was suitable for checking it for reliability (Gall, Borg and Gall, 1996). The researcher used SPSS, version 14, to calculate the reliability as internal consistency of the SILL. Cronbach's Alpha of the SILL was (0.86), which is above the cut-off of 0.80 set by Gall et al. Reliability for this questionnaire was conducted on a sample of 40 students.

One-way multivariate analysis of variance (MANOVA) examined the difference between sets of means of six dependent variables. Assumptions that underpin the use of MANOVA were not violated. For example, the size of each cell was greater than the number of the dependent variables. In addition, homogeneity, univariate and multivariate normality and linear relationships among all pairs of dependent variables were addressed (see the result section). Based on the MANOVA significant F-ratio, one-way analysis of variance (ANOVA) was used to find out which levels of the four independent variables (groups) were significantly different on each of the six dependent variables. For this purpose, the post-hoc Scheffe test of multiple comparisons was used. Assumptions of population normality and homogeneity of variance that underpin the use of ANOVA were also maintained through data screening before conducting the analysis (also see the result section). Descriptive statistics including percentages were also used to determine the patterns of strategy use.

RESULTS

Data analysis was presented in three sections. Each section addressed one research question.

Course diversification and patterns of strategy use

This section addressed this first research question: To what extent are patterns of learning strategy use (memory, cognitive, compensation, meta-cognitive, affective and social) determined by course diversification (Arabic, Community Service, Biology, and Mathematics departments)? Table 1 show that the MANOVA homogeneity of variance was established, since the Box's M test was not significant at .001 (Coakes and Steed 2007). Table 1 also indicates that homogeneity of variance for each of the dependent measures was not violated apart from a marginal value of the cognitive variable (p = 0.05). The univariate Levene's test of homogeneity of variance was not significant for the remaining five dependent variables (p ≤ 0.05). Therefore, the null hypothesis assuming group equality of variance was accepted apart from the cognitive variable.

Table 2 indicates that a number of multivariate/ MANOVA tests of significance (Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root) were all significant (p ≥ 0.05). This meant that course diversification across the four groups had a significant multivariate effect for the six categories of strategy use. According to Gall et al. (1996), ANOVA was used because the MANOVA F-ratio was significant in order to

Table 1. Box's M equality of covariance matrices and Levene's equality of error variances tests.

M test (MANOVA)			Levene's test (ANOVA)				
Box's M	**F**	**Sig.**	**Strategy**	**F**	**df1**	**df2**	**Sig.**
93.925	1.399	0.020	memory	.094	3	226	.964
			cognitive	2.643	3	226	.050
			compensation	.561	3	226	.642
			Meta-cognitive	.257	3	226	.857
			affective	.587	3	226	.624
			social	1.872	3	226	.135

Table 2. MANOVA/multivariate tests.

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.970	1176.222(a)	6.000	221.000	.000
	Wilks' Lambda	.030	1176.222(a)	6.000	221.000	.000
	Hotelling's Trace	31.934	1176.222(a)	6.000	221.000	.000
	Roy's Largest Root	31.934	1176.222(a)	6.000	221.000	.000
group	Pillai's Trace	.197	2.616	18.000	669.000	.000
	Wilks' Lambda	.807	2.736	18.000	625.568	.000
	Hotelling's Trace	.234	2.852	18.000	659.000	.000
	Roy's Largest Root	.208	7.734(b)	6.000	223.000	.000

a Exact statistic; c Design: Intercept + group
b The statistic is an upper bound on F that yields a lower bound on the significance level.

find out which diversification tracks were significantly different on each of the six variables. Post-hoc ANOVA tests of multiple comparisons were used for this purpose. As shown in Table 1 above, ANOVA homogeneity assumptions were not violated since Levene's test was not significant for the six dependent variables ($p \gtrsim .05$) apart from one (*cognitive*: $p = 0.05$). Furthermore, population normality was not violated either since the four groups were drawn from a normally distributed population. The four groups showed no skewness or kurtosis as both approached zero. Using a Kolmogorov-Smirnov statistic with a Lilliefors significance level resulted in a significance greater than 0.05 which assumed normality.

As shown in Table 3, the ANOVA F-ratios for the memory, cognitive, meta-cognitive, affective and social (but not compensation) dependent variables were not significant ($p \leq 0.05$). The null hypothesis, stating similar student use of memory, cognitive, meta-cognitive, affective, and social strategies across the four groups, was therefore accepted. Given these F-ratios, the null hypothesis stating equal *memory*, *cognitive*, *meta-cognitive*, *affective* and *social* strategy use across the four groups was accepted. This indicated that students in the humanities track of study (Arabic and Community Service) did not differ in their strategy use from the scientific track (Biology and Mathematics). Nor did it indicate differences in strategy use within both tracks. In other words, programme diversification did not result in differences between the humanities and scientific tracks in student use of memory, cognitive, meta-cognitive, affective, and social strategies. Moreover, all students who shared the same programme (department) were also similar in their use of these strategies.

In contrast, the ANOVA was significant for the compensation strategies variable ($p \geq 0.05$). This provided evidence to accept the alternative hypothesis indicating differences between the four groups in their use of compensation strategies. The possible differences between the four groups on this dependent variable (compensation) were then examined via the Scheffe post-hoc test to determine where the differences lie and the direction of differences. It should be noted that there was no need to make post-hoc multiple comparisons for the other five dependent variables (memory, cognitive, meta-cognitive, affective, and social strategies) because ANOVA values were not significant. Post-hoc multiple comparisons are used only to determine the direction of differences. In these five dependent variables case there were no differences in the first instance to determine in favour of which one.

Table 4 shows significant F-ratios of compensation strategies (dependent variable) ($p \leq 0.05$) between the

Table 3. ANOVA F-ratios.

		Sum of squares	df	Mean square	F	Sig.
Memory	Between Groups	106.716	3	35.572	1.324	.267
	Within Groups	6072.866	226	26.871		
Cognitive	Between Groups	500.749	3	166.916	2.513	.059
	Within Groups	15010.834	226	66.420		
compensation	Between Groups	280.170	3	93.390	6.523	.000
	Within Groups	3235.674	226	14.317		
meta-cognitive	Between Groups	24.419	3	8.140	.160	.923
	Within Groups	11485.412	226	50.820		
Affective	Between Groups	85.821	3	28.607	1.835	.142
	Within Groups	3522.771	226	15.587		
Social	Between Groups	84.107	3	28.036	1.208	.308
	Within Groups	5246.193	226	23.213		

Table 4. Scheffe multiple comparisons between four groups on compensation strategy use.

Dependent variable	(I) group	(J) group	Mean difference (I - J)	Std. error	Sig.	95% Confidence interval	
						Lower bound	Upper bound
compensation	1	2	.93913	.69457	.610	-1.0172	2.8955
		3	-2.11087(*)	.69457	.028	-4.0672	-.1545
		4	-1.86087	.73045	.093	-3.9183	.1966
	2	1	-.93913	.69457	.610	-2.8955	1.0172
		3	-3.05000(*)	.84608	.005	-5.4331	-.6669
		4	-2.80000(*)	.87578	.018	-5.2668	-.3332
	3	1	2.11087(*)	.69457	.028	.1545	4.0672
		2	3.05000(*)	.84608	.005	.6669	5.4331
		4	.25000	.87578	.994	-2.2168	2.7168
	4	1	1.86087	.73045	.093	-.1966	3.9183
		2	2.80000(*)	.87578	.018	.3332	5.2668
		3	-.25000	.87578	.994	-2.7168	2.2168

four groups as follows:

- Arabic (group 1) and Biology (group 3) in favour of Biology students
- Community Service (group 2) and Biology in favour of Biology students
- Community Service (group 2) and Mathematics (group 4) in favour of Mathematics students

Given these significant F-ratios, the null hypothesis indicating equal use of compensation strategies across the four groups was rejected. The alternative hypothesis that indicated differences in the use of compensation strategies between these groups was therefore accepted.

This finding showed that students who followed a humanities track (Arabic and Community Service) used compensation strategies less than their counterparts who followed a scientific track (Biology and Mathematics).

On the other hand, the results showed no differences in compensation strategy use between students of the same track as follows:

- No differences in compensation strategy use between Arabic (group 1) and Community Service (group 2) (humanities track)
- No differences in compensation strategy use between Biology (group 3) and Mathematics (group 4) (science track)

This meant that same track students used almost the same compensation strategies. Moreover, this meant that course diversification equally impacted student cognitive functioning in terms of compensation strategies. In other words, students who join a science track tend to make more use of compensation strategies whereas those who join a humanities track tend to make little use of compensation strategies. Although differences were found generally between the humanities track and science track in favour of the science track, no significant F-ratio ($p \geq 0.05$) was found between the Arabic department (a humanities track) and Mathematics department (a science track) in their use of compensation strategies use:

Table 5. Strategy use levels of frequency use.

Strategy	N	Items	Lower limit	Upper limit	Sum	%	Mean	Rank	Frequency use
Meta-cognitive		9	2070	10350	6597	64	39	1	Upper-intermediate
Social		6	1380	6900	4439	64	29	1	Upper-intermediate
Compen-sation		6	1380	6900	4054	59	25	2	intermediate
Cognitive		14	3220	16100	9014	56	19	3	intermediate
Memory	230	9	2070	10350	5706	55	18	4	intermediate
Affective		6	1380	6900	3698	54	16	5	intermediate

Arabic-speaking learners' most frequent learning strategy use

This section addressed this second research question: What language learning strategies do EFL Arabic-speaking learners tend to use? Table 5 indicates that Arab students were upper-intermediate users of meta-cognitive and social strategies (64 %) whereas being intermediate users of compensation, cognitive, memory, and affective strategies (59, 56, 55 and 54% respectively).

These results clearly indicated that, Arabic-speaking learners tended to use almost all the six strategies at a moderate level in their attempt to learn English. However, the results showed that these learners tended to favour meta-cognitive and social strategies most. The third research question was answered by comparing this study's empirical findings in this section with those of related previous research studies in the discussion section.

DISCUSSION

The current study examined the influence of curriculum diversification on student cognitive functioning (through using learning strategies), the patterns of strategy use that EFL Arab learners tended to use, and the influence of ethnic cultures on student cognitive functioning. Each of these issues is discussed below.

The influence of curriculum diversification on student cognitive functioning

The findings provided clear answers concerning the influence of curriculum diversification on student cognitive functioning in terms of learning strategy use (first research question). The results indicated that course diversification did not result in differences between or within the two tracks (four groups) in their use of memory, cognitive, meta-cognitive, affective and social (but not *compensation*) strategies. The results, however, revealed differences between the humanities and science tracks in favour of the science track in *compensation* strategy use and that such differences were between the two tracks rather than within the groups of each track.

The very surprising finding was that no differences were found between the Arabic Department (humanities track) and Mathematics Department (science track). This contradicted the very finding of compensation strategy use. Why there were differences between the two tracks, whereas no differences were found between the Arabic Department (humanities track) and Mathematics Department (science track) in their use of compensation strategies. Since there were differences between the humanities track and science track in favour of the latter, the researcher expected to also find differences between the two groups in the humanities track and their counter-part groups in the science track in favour of each group in the science track, but this was not the case. The study could not provide explanations for this lack of difference between these two particular groups (Arabic and Mathematics).

Future research needs to account for such a contradiction. Since this study did not manage to locate a single study examining the influence of curriculum diversification on strategy use, future research needs to confirm or challenge the current findings.

Patterns of learning strategy use

With regard to the patterns of learning strategies that Arab students tended to favour, the findings seemed convergent (second research question). The findings indicated that Arab learners were upper-intermediate users of meta-cognitive and social strategies while intermediate users of compensation, cognitive, memory, and affective strategies. These results concurred to some extent with Abu Shmais's (2003) study who found EFL Arab learners in Palestine high users of meta-cognitive strategies, upper-intermediate users of social, affective, cognitive, and memory strategies, while low users of compensation strategies.

These findings probably indicated that Arab learners seemed to be effective language learners, due to using meta-cognitive strategies most, since previous research indicated that frequent users of meta-cognitive strategies, achieve higher proficiency levels than users of traditional strategies (e.g., Cotterall and Murray, 2009; Kasper, 1997; Oxford, 1990b; Qingquan et al., 2008). This study could not explain why the research sample tended to favour meta-cognitive strategies. It, however, ruled out the

impact of strategy training since none of the students was trained in meta-cognitive strategy use.

The influence of ethnic culture on student cognitive functioning

The influence of ethnic culture on student cognitive functioning (through learning strategies) yielded inconclusive results (the third research question). Addressing this issue required comparisons between the second research question findings and those of previous research. The current study's findings indicated that Arab learners were upper-intermediate users of meta-cognitive and social strategies, while intermediate users of compensation, cognitive, memory, and affective strategies. The question here is: do all Arab students use high-cognitive functioning (meta-cognitive) strategies?

Although the current study's findings agreed with Abu Shmais's (2003) conclusions about Arab students, research is too far from linking strategy use to ethnic culture for several reasons. For example, Abu Shmais found Arab students use compensation strategies least, whereas students in the current study were moderate users of compensation strategies. This meant that though they were similar in meta-cognitive strategy use, they differed in compensation strategy use. Moreover, previous research was also far from agreement. For example, EFL Asian learners (oriental) were frequent users of cognitive and memory strategies, using repetition and rote-learning strategies most and rehearsing language rules (O'Malley and Chamot, 1990; Politzer and McGroarty, 1985). Although Arab students are oriental learners, like Asian students, they favoured meta-cognitive and social strategies, emphasizing the planning, monitoring and evaluation of learning as well as interaction with other language learners.

On the other hand, Spanish students, who are European, were also frequent users of memory strategies (McGroarty, 1987). This contradicted Grainger's (1997) conclusion about the differences between European and oriental students in their patterns of strategy use. This study's results, therefore, concurred with those reached by Rahimi et al., (2008) who found EFL Persian learners frequent users of meta-cognitive strategies and with those of Qingquan et al. (2008) who also found EFL Chinese learners frequent users of meta-cognitive strategies. Similarly, the current research findings concurred with those of Oxford et al. (1990) and Sheorey (1998) who found oriental learners in China, Korea, and even Taiwan and Japan frequent users of meta-cognitive strategies. On the other hand, the current study's results as well as those of, for example, McGroarty (1987); Qingquan et al. (2008); Rahimi et al. (2008) contradicted those of Grainger's study and other studies that point to cultural strategy use stereotypes.

There is clear dissonance in research findings which indicates a need for further research to examine the relationship between ethnicity and patterns of learning strategy use. Future research hypotheses should be either null or non-directed (two-tailed). Current research evidence showed differences among ethnic groups in strategy use but failed to establish strategy patterns that exclusively characterize particular cultural groups. Therefore, the current study's null hypothesis (no differences between cultural groups in strategy use) was accepted because the differences between ethnicities were to a large extent contradictory. However, this did not mean that future researchers should not form two-tailed hypotheses. The current study, therefore, could neither explain why Arab learners used meta-cognitive strategies most nor why they differed from other cultural groups because research findings were inconclusive. Groups from both oriental and western learners used almost the same high (meta-cognitive) and low (memory) learning strategies.

Further comparative studies need to draw specific differences between specific ethnic learners' strategy use and the reasons for their particular strategy use. Moreover, generalizing the current study's results to other contexts, including Arab contexts, should be with caution since the research sample was meant to represent just the institution where the study was conducted.

The current study's results cast serious doubts on the assumption of an unmediated deterministic relationship between national/ethnic culture and cognitive functioning. More recognition should therefore be given to the complex and diverse influences of particular educational experiences and disciplinary cultures. Holliday (2005) and Palfreyman and Smith (2005) view with some suspicion the attempt to establish deterministic relationships between ethnic culture and cognitive functioning. For example, individual differences (due to cognitive style and affective motivation) have already proved to be more decisive for the use of learning strategies than learner ethnicity. That said, the current study was conducted on the basis that Arab learners have hardly been targeted for study and that the current research sought to confirm or rule out cultural factors.

CONCLUSIONS AND RECOMMENDATIONS

Given the evidence drawn from this research, this study concluded that course diversification rarely influenced EFL learners' patterns of strategy use with regard to memory, cognitive, meta-cognitive, affective, and social strategies. In contrast, the study concluded that scientifically-diversified courses result in more use of compensation strategies than humanities programmes. The study also concluded that EFL Arab learners were frequent users of meta-cognitive and social strategies while moderate users of all the other strategies. This added to the already existing disagreements of research with regard to cross-ethnic differences but at the same time gave the current study ground to conclude that a re-

lationship between ethnicity and cognitive functioning is perhaps very difficult to establish. Reaching causal relationships between particular strategies use and improved performance between and within ethnic groups, genders, subjects, and diversified tracks of study can guide future curriculum developments and facilitate curriculum implementation (instruction).

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