CHAPTER VI

Discussion, Conclusions and Recommendations

6.1. INTRODUCTION

The aim of this study was to examine the relationship between the intelligence scores of the Yemeni students and their age, sex and school achievement. For this purpose the Otis-Lennon Mental Ability Test Advanced Level Form K (OLMAT) was adapted on the Yemeni environment.

The schools where the study was conducted were selected randomly, and then two classes were selected randomly from each school. A total of 47 classes for both sexes were selected: 24 classes for boys, ten classes for tenth grade, seven classes for eleventh grade, and seven classes for twelfth grade. Out of 23 classes for girls, nine classes were for tenth grade, seven classes were for eleventh grade, and seven classes were for twelfth grade.

The total sample size was 1561 students, of whom 801 were boys and 760 were girls. 682 were from grade tenth, 466 were from grade eleventh, and 413 were from grade twelfth.
The OLMAT was translated into Arabic language and adapted on a sample of Yemeni students. The Arabic adaptation of OLMAT was administered to the study sample.

Difficulty values and discrimination values were estimated for each item. The reliability and validity of the test were established by different methods. The norms for grades tenth, eleventh, and twelfth and age groups of 15, 16, 17, 18, and 19 were established in the form of Percentile ranks, z-scores, T-scores, DIQ, and Stanines.

The differences between intelligence scores of students in different age were tested using ANOVA. The differences in intelligence scores between males and females and between high and low school achievement were tested using t-test.

The relationship (Pearson correlation coefficient, Point-biserial correlation coefficient) between intelligence scores of students and their age, sex and school achievement was tested.

Predicting school achievement by different subtests of mental ability was made by the stepwise multiple regression analysis.

The results obtained from data analysis were reported in the previous chapter. This chapter includes interpretation, discussion of those results, and implications of the findings of the study and recommendations for further research.
6.2 DISCUSSION

6.2.1. Discussion of the results of the psychometric properties of the items:

The item difficulty for the entire sample ranged from 0.25 to 0.81 with a mean of 0.50. The items’ difficulty in grade tenth ranged from 0.21 - 0.75 with a mean of 0.41, in grade eleventh it ranged from 0.21 - 0.83 with a mean of 0.51, in twelfth grade it ranged from 0.32 – 0.92 with a mean of 0.62.

The item difficulty for different subtest was calculated, it ranged from 0.32 to 0.81 for verbal comprehension with a mean of 0.56, from 0.30 to 0.68 for verbal reasoning with a mean of 0.46, from 0.26 to 0.70 for figural reasoning with a mean of 0.46, and from 0.25 to 0.78 for quantitative reasoning with a mean of 0.48.

As it is clear in Table 4-1, that the item difficulties means for the entire sample and for different subtests increase with increasing grades, it means that the items become easier with increasing grade (the item difficulty is defined in terms of the percentage of students who answer it correctly.

The item discrimination for the entire sample ranged from 0.24 to 0.78 with a mean of 0.44. The item discriminations in grade tenth ranged from 0.24 – 0.75 with a mean of 0.41, in grade eleventh it ranged from 0.35 – 0.83 with a mean of 0.51, in grade twelfth it ranged and from 0.34 – 0.88 with a mean of 0.53.
The item discrimination for different subtest in total sample was calculated, it ranged from 0.24 to 0.67 for verbal comprehension with a mean of 0.41, from 0.25 to 0.78 for verbal reasoning with a mean 0.42, from 0.28 to 0.70 for figural reasoning with a mean of 0.48, and from 0.26 to 0.78 for quantitative reasoning with a mean of 0.46.

As it is clear in Table 4-2 the high item discrimination was in twelfth grade and the less discrimination was in tenth grade. It was observed that the items of test were capable of discrimination at different levels of grades.

6.2.2. Discussion of the results of the test reliability and validity indices:

The reliability coefficients were obtained by test-retest, and split-half methods for the entire sample and for different grade levels. All the values of the reliability were satisfactory. Table 6-1 presents the reliability coefficients of the Arabic version of the OLMAT (in Yemeni environment) and the original version (in American environment) which was calculated by test-retest, and split-half for total sample and for grade levels.
Table 6-1: The test-retest and split-half reliability coefficients of the Arabic version of the OLMAT (in Yemeni environment) and the original version (in American environment) for grade levels.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Samples</th>
<th>Methods</th>
<th>Split-half Methods</th>
<th>Test-retest Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tenth (X)</td>
<td>682</td>
<td>Yemeni Version</td>
<td>0.87</td>
<td>0.74</td>
</tr>
<tr>
<td></td>
<td>14,380</td>
<td>Original test</td>
<td>0.95</td>
<td>0.93</td>
</tr>
<tr>
<td>Eleventh (XI)</td>
<td>466</td>
<td>Yemeni Version</td>
<td>0.86</td>
<td>0.88</td>
</tr>
<tr>
<td></td>
<td>12,895</td>
<td>Original test</td>
<td>0.95</td>
<td>0.94</td>
</tr>
<tr>
<td>Twelfth (XII)</td>
<td>413</td>
<td>Yemeni Version</td>
<td>0.91</td>
<td>0.82</td>
</tr>
<tr>
<td></td>
<td>11,866</td>
<td>Original test</td>
<td>0.96</td>
<td>0.94</td>
</tr>
<tr>
<td>Total sample</td>
<td>1561</td>
<td>Yemeni Version</td>
<td>0.92</td>
<td>0.83</td>
</tr>
</tbody>
</table>

Inspection of Table 6-1 shows that the reliability values obtained from Arabic version were slightly lower than those obtained from original version. The possibility for the slight differences may be due to the sample size. The large samples were used to calculate the reliability coefficients in original version of the OLMAT in American environment compared to the present ones.

The test validity was established by construct validity, concurrent validity and discriminant validity. The construct validity was established by correlating the item scores with total test scores, and with subtests. Also the correlations between the total test and each subtest and between the subtests were calculated. The results of those correlations (Table 4-3) revealed that the construct validity coefficients were fairly high.
The concurrent validity was established by correlating the test scores with school achievement scores for each subtest and for the total test. All of those correlations are significant at the 0.01 level. It is clear that the test has fairly high concurrent validity.

The discriminant validity was established by one way analysis of variance of the intelligence test scores for different levels of grade, and the results showed that there were significant differences in the mean intelligence scores of different grades.

As it is seen in Table 4-6 the mean intelligence scores for the twelfth grade was higher than the mean intelligence scores for eleventh grade and tenth grade. The mean for eleventh was higher than the mean intelligence scores for tenth grade. The findings of this study lend a support to the view that the test was capable of discriminating different levels of grades and that findings are consistent on the assumption that the mental ability increases with increasing age and grade levels.

6.2.3. **Discussion of the results of the differences between intelligence (mental ability) scores across age and relationship between intelligence scores and students’ age.**

The results of the differences between intelligence (mental ability) scores of students according to their age show that there were significant differences between all of mean scores for all age levels except between 15 and 16 year old students in subtests of verbal comprehension and figural reasoning. The possibility for this result may be the fact that most of the 15 and 16 years old students are in tenth grade, the
total number of the students in both 15 and 16 years old are 696 in the sample of the study and that 476 of them were in tenth grade. Also the results of differences between mean intelligence scores according to students’ age showed that there were no significant differences between intelligence scores of 18 and 19 years old students for the total test and each subtest. It is plausible to reason that most of the 19 years old students have learning difficulties and that is why they are still in the secondary school.

One of the findings of this study was that there were significant positive correlations between students’ intelligence (mental ability) scores and their age in total test and in all subtests and in the entire sample as well as in grade levels (tenth, eleventh, twelfth) at the 0.05 level, except the correlation between age and verbal reasoning subtest in the eleventh grade, there is positive correlation but not significant.

This result assumes that the mental ability increases with increasing age. The means of intelligence scores for total test and for each subtest increased with increasing age. These results of study are consistent with earlier studies as those of Ahuja (1971), Sharma (1972), Dolke (1975), Pillai (1987), Chakraborty (1979), Patel (1981), Al-Kofahi (1997), Lee and Lam, (1988), Codorniu-Raga and Vigil-Colet (2003).

6.2.4. Discussion of the results of the differences between males and females in intelligence (mental ability) scores, and relationship between intelligence scores and students’ sex.
The finding of the differences between males and females in the intelligence scores in the entire sample showed that there were no significant differences between males and females in the intelligence scores in the total test and in all subtests, except for quantitative reasoning subtest. There was a significant difference between male and female subjects in quantitative reasoning scores. The mean of quantitative reasoning scores 7.45 for males was higher than mean score of 6.94 for females. In grade tenth there were no significant differences between males and females in the total test and in all subtests except quantitative reasoning subtest, there were significant differences in quantitative subtest (p< 0.05). The mean of quantitative reasoning scores 5.90 for males was higher than mean score of 5.15 for females.

In grade eleventh there were no significant differences between males and females in the intelligence scores for the total test and for all subtests. In grade twelfth there were significant differences between males and females in the total test and in all subtests (p < 0.01), the means of the total test and all subtests scores for males were higher than mean scores of females.

The results of the relationship between intelligence scores and students’ sex indicated that there were no significant correlations between intelligence scores and students’ sex in the total test and in all subtests for the entire sample except quantitative reasoning subtest. There is a significant correlation between students’ quantitative reasoning scores and their sex. In grade tenth there were no significant correlations between intelligence scores and students’ sex in the total test, and in all
subtests except the quantitative reasoning subtest there were significant correlations between quantitative reasoning scores and students’ sex at the 0.05 level.

There were no significant correlations between intelligence scores and students’ sex in grade eleventh in the total test and all subtests. There were significant correlations between intelligence scores and students’ sex in grade twelfth in the total test and in each subtest at the 0.01 level.

The literature dealing with sex differences in intelligence test or the relationship between intelligence test and sex is quite large. The findings of the present study is that there is no significant correlation between intelligence scores and students sex in the total test and in each subtest, and the fact that there are no differences between males and females in the total tests has been supported by many researchers (Aluja al et, 2000; Colom and Garcia-Lopez, 2002; Codorniu-Raga & Vigil-Colet, 2003) have studied sex differences in intelligence and they found sex differences in certain abilities, particularly spatial ones, but not in general intelligence.

The males scored significantly higher than females on the subtest of quantitative reasoning in the entire sample and in grade tenth. The males scored significantly higher than females on the subtest of verbal comprehension in grade tenth, this result is consistant with Maniam and Feroze (1973), who found that boys were better in reasoning ability than girls. Allik et al., (1999); and Lynn, (1994), and (1998) maintained that the I.Q. of adult males is more than 4 points higher than that
of adult females: for verbal and reasoning abilities the difference is slight but for spatial ability it is quite considerable.

In grade twelfth the males scored significantly higher than females in the total test and in different subtests. It is plausible to reason that the Yemeni society does not encourage the females to study or work.

However, this result is different from other earlier studies as those of Ahuja (1971), who concluded that sex norms have been worked out separately for boys and girls because of significant sex differences. Deshpande (1971), found sex difference in the average scores for boys and girls. According to Faroqi (1974), sex differences on PMT were found to increase with increasing age. Shamshada (1988) found that girls were superior to boys in intelligence and scholastic achievement. The findings of Lynn, Fergusson and Horwood (2005) revealed that boys scored significantly higher than girls on the subtest of information, vocabulary, block design and object.

6.2.5. Discussion of the results of the differences between intelligence (mental ability) scores with high and low school achievement and relationship between intelligence scores and students’ school achievement.

The results of the differences between intelligence scores with high and low school achievement showed that there was a significant difference between intelligence scores of students with high and low school achievement in the total test and in each subtest for entire sample and for all grade levels.
The results of the relationship between intelligence scores and school achievement are that there is a significant relationship between students’ intelligence scores and their school achievement in the total test and each subtest for entire sample and for all grade levels. It indicated that as intelligence scores increase school achievement also increase.

The findings of this study are consistent with earlier studies as those of Thakur (1979), Grossman et al (1983), Antonak et al (1982) and Cooper and Fraboni (1988). However, the present study produced results that are different from earlier studies as those of Mahanaz (1994) that found an insignificant correlation between academic achievement and IQ, and Diseth (2002) findings do not give much support for a relationship between intelligence and achievement.

6.2.6. Predicting School Achievement by Different Subtests of mental ability (intelligence).

The stepwise multiple regression analyses with school achievement (dependent) and different subtests (verbal comprehension, verbal reasoning, figural reasoning and quantitative reasoning) (independent) showed 56.4 percent variation in school achievement is explained by the verbal comprehension, verbal reasoning and figural reasoning. The 55.2 per cent of the variance is explained by verbal comprehension and verbal reasoning and 48 percent of the variance is explained by verbal comprehension alone. The beta coefficient indicated that the three subtests (verbal comprehension, verbal reasoning and figural reasoning had significant effect
on school achievement \( (p<.01) \) but the fourth subtest (quantitative reasoning) did not have significant effect on school achievement. The highest beta weight is that of the verbal comprehension subtest which contributed most to the school achievement and is, therefore the best predictor. This result is supported by Antonak et al (1982), who found that, the best predictor of achievement was the I.Q.

On the basis of the results, the OLMAT advanced level form K Arabic adaptation has a satisfactory reliability and validity to be used in the Yemeni environment.

The eighty items of the test have fairly moderate degree of difficulty and moderate degree of discrimination. The intelligence mean scores according to the student’s age showed significant differences for total test and for each subtest except 15 and 16 old students age in two subtests: verbal comprehension and figural reasoning showed no differences. Also 18 and 19 year old students’ mean scores showed no differences in each subtest and in the total test. The intelligence scores showed significant relationship with students’ age in each subtests and in the total test. Intelligence scores differ significantly between males and females, and there is no significant relationship between intelligence scores and the students’ sex.

The intelligence scores of the students with high and low school achievement differ significantly, and a significant relationship between intelligence test scores and school achievement was found.
6.3. CONCLUSION:

The Otis-Lennon Mental Ability Test advance level form K was translated into Arabic language and was standardized on the Yemeni secondary school students.

In the adaptation, some changes were made to suit the test to Yemeni culture. The test was administered to 35 students for studying the clarity of the items, instructions and fixation of time limit. Also it was administered to 252 students for item analysis. The final version of the test was administered to 1561 (801 males, 760 females) students selected from grades tenth to eleventh. The reliability coefficients were obtained by test-retest method, split-half method, and Cronbach Alpha formula for the entire sample and for different grade levels. Construct, concurrent and discriminant validity were established and were found to be significantly high. The reliability and validity results revealed that the Arabic version of OLMAT advanced level form K was highly reliable and valid.

Age norms and grade norms were derived for the entire sample and for different age and different grade levels by various types of scores, like Percentile Ranks, z-scores, T-scores, Deviation IQ (DIQ) and Stanines.

Significant relationships were found between students’ intelligence scores and their age, for total test and for all subtests. No significant relationship was found between students’ intelligence scores and students’ sex and between the three subtests (verbal comprehension, verbal reasoning, and figural reasoning) and
students’ sex. Only the fourth subtest, quantitative reasoning had a significant relationship with gender.

Significant relationships were also found between students’ intelligence scores and their school achievement, for total test and for all subtests.

The regression analyses showed that 56.4 percent variation in school achievement is explained by the verbal comprehension, verbal reasoning and figural reasoning, and the highest beta weight is that of the verbal comprehension subtest which contributed a lot to the school achievement and is, therefore the best predictor.

The results of the relationships between intelligence scores and age, sex, and school achievements supported and it demonstrates that the OLMAT advanced level form K is suitable for Yemeni students.

6.4. RECOMMENDATIONS FOR FURTHER RESEARCH:

1- Since the present study dealt with the relationship of the intelligence test with age, sex, and school achievement of secondary school students of Sana’a city in Republic of Yemen, another study can be undertaken on different states and cities, different stages of the education as kindergarten, primary schools, and universities.

2- Adaptation and standardization of some famous intelligence test in the Yemeni environment.
3- Construct and standardization of intelligence tests for Yemen students.

4- This study focused on the relationship of mental ability test with age, sex and school achievement for secondary school students through adaptation and standardization of the OLMAT. But there are many variables like adjustment, creativity, and personality characteristics which are important in students life. It will be worthwhile to undertake a deeper investigation into relationship between intelligence tests and these variables.