

V CONCLUSION

Bilingual education started some decades ago but its benefits have not been acknowledged from the beginning and even today, it is still a controversial topic for parents. Some agree that bilingual education is positive whereas some others have the feeling that their children would be overwhelmed learning content in a language other than the one spoken at home. This study has shown that this is incorrect and that students learning content in a second language do have more developed cognitive skills than the students learning content in their native language. This study is evidence that bilingual education has a positive impact on the brain.

Bilingual students used to be regarded as being at a disadvantage in learning mathematics because of an assumed interference between their two languages, according to Clarkson (1992). Various studies (Dawe, 1983; Clarkson, 1992, 2006; Ríordáin & O' Donoghue, 2008) including this one, showed that the facts that people have believed are not supported. Results were found, showing that bilingual students did perform as well as or better than monolingual students on math tests. Bilingual education has to be encouraged in order to give the speakers the opportunity to improve in both languages and develop better cognitive skills.

Choosing a bilingual institution which provides content classes in a second language is the first step to a successful education. The study shows that after only 5 years of being part of a bilingual program (the participants were in their fifth or sixth year of the program), children already had developed a better ability to use

cognitive skills to complete tasks. They are advantaged over monolingual learners in velocity, memory, logical thinking and abstract reasoning. These skills are not only used in mathematics or in other subjects but as well in everyday life. Improving the ability to use cognitive skills will not only have an impact on academic education but also on the individual in general.

By increasing his cognitive skills, the individual also increases his self-esteem (Barrett, Webster & Wallis, 1999; Taylor & Montgomery, 2007). Researchers in psychology mentioned have studied the impact of cognitive skills on self-esteem and found that there was a correlation between the two aspects. This explains why psychology today uses cognitive-behavioral therapy to treat patients with low self-esteem, such as reported by Taylor & Montgomery. It can be said that indirectly bilingual education increases self-esteem, developing the cognitive skills which help the individual to have a better image of himself. Psychologists describe self-esteem as a fundamental aspect of a person's experience and quality of life (Crocker & Wolfe, 2001). A positive self-evaluation is a crucial predictor of one's general well-being. If parents want their children to become learners with a high level of self-confidence, they should see bilingual education as a chance to achieve this goal.

Choosing an institution which provides bilingual education is not an easy task. Parents should be aware that many schools in Mexico promise bilingual education but that actually means language classes only, such as grammar, conversation or listening comprehension. This kind of education is not considered bilingual education and therefore does not automatically generate the same

cognitive advantages found in this study. The study was based on the author's definition of true bilingual education, which means, that the participants of the bilingual group were taking content classes in a second language. They speak Spanish at home and have mathematics, biology, art classes etc. in German at school, which is the meaning of a true bilingual education. The impact of usual language classes (not content classes) on cognitive skills was not investigated in this study and therefore positive consequences from this kind of education are not guaranteed.

An important aspect regarding bilingual education is that the pupils need to have a high proficiency level of the language of education in order to benefit from positive development of cognitive skills (Ríordáin & O' Donoghue, 2008). The results of tests where the participants had to use cognitive skills to complete the tasks were related to the language proficiency level. In order to have a good performance in content classes, students should have high competences in both languages, the first and the second, as mentioned previously by several authors. This is why the participants of the study had to pass a language test which indicated if their linguistic level were high enough or not. In order to avoid that the child fails the test, it is preferable to choose a bilingual education program as early as possible. These kinds of programs usually start at the level, which means that the best moment to start being part of a bilingual program would be the first grade. The threshold level needs to be reached to facilitate the benefit of positive effects on the learner (Cummins, 1976, cited in Takakuwa, 2005). This encourages parents to choose a bilingual education option as early as possible.

Further research could be focused on the differences between gender in mathematics. Does Lipsett's statement (2008) about mathematical results defined by the equality of treatment between boys and girls play a role in Mexico? Or are the differences caused by other factors? This could be a basis for a new investigation in order to find an explanation for the differences of the results between boys and girls obtained in this study.

Another possible research area to investigate would be testing the participants in another content subject to see if the results in mathematics match those found in another subject, however, the four cognitive skills would need to be the same.

The difference between adults and children learning languages has been a topic on which researchers have focused a lot. It has interested linguists, especially those who believe in the critical period hypothesis¹ or those who want to contradict it. How would adults perform on mathematical tests where they need to use their cognitive skills to complete the tasks? Would the differences between monolingual and bilingual adults also be similar? Would gender be an important variable as well? These questions could be answered with a further investigation using adults for participants.

¹ Theory that explains why it is difficult to learn to pronounce a second language without foreign accent after puberty. The Critical Period Hypothesis is a biologically determined period in which the brain keeps its plasticity for acquisition of any language. Between the ages of three and the early teens, the child is more sensitive to stimuli and has some innate flexibility for the organization of brain functions. After puberty, the ability for acquisition and adjustment to the physiological demands of verbal behavior quickly declines (Lenneberg, 1967, cited in Nagai, 1997).

The participants came from an additive bilingual setting. Literature has shown that bilingualism must be additive in order for the speakers to benefit cognitively from their languages. Another research could use participants coming from a subtractive background in Mexico, for example, from a bilingual indigenous community. Comparing them to monolingual speakers, would they score lower? Do attitudes towards language define the amount of cognitive impact on the individual?

Bilingualism leads to a better use of the speaker's cognitive skills. Does multilingualism outperform bilingualism regarding the ability to use these cognitive skills? A further study could investigate if speakers of three languages are able to make an even better use of the skills than bilingual speakers. Does the number of spoken languages gradually increase the capacity of using the cognitive skills?

This study investigated four cognitive skills which are velocity, memory, logical thinking, and abstract reasoning but there are more than only four cognitive skills. The same participants could take tests in which they need to apply other skills. Are bilingual speakers good at using cognitive skills in general or are they only in the four investigated in this study?

Finally, the most important finding of this study is that children have more advantages in the cognitive aspects if they are bilingual. And if the child is not bilingual from birth on, parents should find a possibility to give him/her the chance to become one. Bilingual education is the solution for all children to become bilingual and better users of their own cognitive skills. Alladina already stated in

1985 that all children can benefit cognitively, linguistically, and culturally, from learning more than one language. The cognitive aspect that Alladina mentions has been shown in this thesis.

This study has been designed to find evidence to demonstrate the positive aspects of learning content in a second or foreign language. The question that can be asked now is how can parents be informed about the results of the study? The work is not done yet by stating the findings in this thesis; in order for parents to receive all this information, I will plan a conference at the bilingual institution to share my study and my results. I think that a conference is an excellent possibility to inform the parents, answer directly their questions and clarify their doubts. One of my goals, as I mentioned earlier, is to make people change their beliefs about bilingual education. This may occur if I speak directly to parents about the outcome of this thesis.