THE BENEFITS OF IMMERSION AND AN INTERNATIONAL BACCALAUREATE EDUCATION TO THE BRAIN

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isdenver.org
December 2024

Brain development and language acquisition

Becoming bilingual and biliterate has fascinating physiological impacts on the brain, among them the ability to:

- **Change neural pathways**
- **Increase the physical size of the prefrontal cortex**, and the overall density of both grey matter and white matter (Guo et al., 2020 & Pliatsikas et al., 2020)

We also know that quickly pivoting between two languages as an adult, Spanish to English, for example, but only when actively and unpredictably switching between languages (just like our students do at ISDenver), **improves brain health** and potentially **pushes back the average age of onset of dementia** by at least five years. (Kim et al., 2019 & Venugopal et al., 2024).

Also interesting when considering the benefits of bilingual education is that the **language center of the brain shares space with the music and visual arts area** in the prefrontal cortex. When an immersion language program, like the one at ISDenver, integrates an equally strong visual and performing arts program into the curriculum, it further enhances students' ability to learn.

A great showcase of this takes place during our signature celebrations. The Celebrations of Culture, as one example, demonstrate the trajectory of target language acquisition of students from K1 (our three-year-olds) to our 8th graders, showing **increased proficiency and the plasticity of the bilingual brain** over time. What's more, the celebrations unite the mastery of target language with creativity and performance, as culture is truly brought to life.

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The compelling benefits of the bilingual brain

The prefrontal cortex, which enlarges with additional language acquisition, is in charge of:

- Critical thinking
- Executive functioning
- Language
- Math
- Science
- Emotional intelligence and empathy (along with the amygdala)

Without getting too technical, grey matter in the brain is where you process sensation, learning, cognition, and even speech. White matter in the brain is where the fast connections live; this area provides connections critical to learning, focus, and problem solving.

If you aren't currently a bi-lingual speaker, there are studies showing that this, while a bit different, can happen with adult learners as well!

It takes more of a concentrated effort, but new connections can be made and there can be a small increase in brain mass (Berken et al., 2017.)

If you choose to learn alongside your kiddos, they will quickly surpass you - but it is a great chance to either dust off high school or college Chinese, French, or Spanish or dive into a brand new language!

ANGELA STARKS
Admissions Manager

Berken, J. A., Gracco, V. L., & Klein, D. (2017). Early bilingualism, language attainment, and brain development. *Neuropsychologia*, *98*, 220–227. https://doi.org/10.1016/j.neuropsychologia.2016.08.031

Critical Thinking

Critical thinking is enhanced by gaining that additional language but also through targeted teaching.

To maximize the benefit of the bilingual brain, ISDenver further layers **language acquisition** with the **International Baccalaureate (IB) framework** and **cycles of learning (inquiry, action, and reflection).**

> *Students at the ISDenver are intentionally taught to question everything, and not believe something at face value.*
>
> *They are taught how to research and how to know if something is presented accurately or is misinformation.*
>
> *Marzia Mauffrey,*
> *ISDenver Assistant Head of School for Academics, Director of Upper Primary.*

When I was teaching 4th grade, I remember a lesson where we were discussing ecosystems. Instead of just explaining the parts of an ecosystem, I had my students create their own imaginary ecosystems using a set of given species, climates, and natural resources.

One student came up with a desert ecosystem where a species of cactus developed the ability to store water for other plants. The class discussed whether this would work, what impact it would have on other species, and how it would change the balance of the ecosystem.

This activity was a great way to teach critical thinking because students had to apply their understanding of ecosystems to solve a problem. They weren't just memorizing facts—they were analyzing relationships, making predictions, and thinking creatively.

Critical thinking, in this case, was encouraged by asking open-ended questions and allowing students to explore "what if" scenarios. It was a fun way to engage them in higher-level thinking and helped them connect the content to real-world applications.

Steven Lamb,
ISDenver Education Technology Specialist

Executive Functioning

Executive functioning refers to the skills that give the ability to "plan ahead and meet goals, display self-control, follow multiple-step directions even when interrupted, and stay focused despite distractions…" (Harvard, 2024). That means bilingual students are at an advantage when it comes to tuning out the noise.

A recent study using fMRI[1] demonstrated bilingual learners' enhanced abilities to **concentrate on learning tasks**, even when distractions were introduced, as opposed to monolingual learners (Abou-Ghazaleh, et al., 2020 & Wu, et al., 2021). This includes those with some learning differences (Hardy et al., 2021). It is also believed that greater executive functioning abilities lead to **stronger reading and math skills.** Think about it—better attention to detail makes it easier to decipher those pesky letters and numbers.

Executive functioning is a skill that needs to be developed throughout childhood and isn't solidified until adulthood. ISDenver's faculty understands this; our teachers are naturals at creating environments that enhance this particular ability through many avenues. My daughter's first-grade teacher, for example, sent home a homework folder on Mondays for the week ahead. Because students are largely early readers in that grade, a pictograph of which type of homework for each day was included in the folder. It was her responsibility to either follow the intended path or choose to vary from the path, but with intention. Simple tasks like this tap into and continue to enhance a student's ability to grow their executive functioning skillset.

In addition to the skills our teachers already possess, the school recently received funding that will specifically enhance executive functioning support. Beginning in January 2025, the Shari K. Most Institute for Student Success will begin serving as an expanded and dedicated resource for student support and learning at ISDenver. The key areas of focus for the Most Institute include:

- **Executive Functioning:** Dedicated student support and teacher coaching to develop executive functioning skills critical to academic success
- **English Literacy:** Dedicated support and implementation of the EBLI (Evidence-Based Literacy Instruction) approach, particularly to support students with dyslexia
- **Gifted & Talented (G&T) Support:** Teacher coaching and dedicated resources for effectively teaching and nurturing gifted students

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[1] Functional magnetic resonance imaging (fMRI) for the brain is frequently used for study purposes, but can also be used in brain mapping for certain surgeries. It is an imaging modality that shows increased activity to specific areas of the brain through the detection of small changes in blood flow.

What is executive function? How executive functioning skills affect early development. Center on the Developing Child at Harvard University. (2024, February 26). https://developingchild.harvard.edu/resources/what-is-executive-function-and-how-does-it-relate-to-child-development/

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Wu, Y. J., Chen, M., Thierry, G., Fu, Y., Wu, J., & Guo, T. (2021). Inhibitory control training reveals a common neurofunctional basis for generic executive functions and language switching in bilinguals. BMC neuroscience, 22(1), 36. https://doi.org/10.1186/s12868-021-00640-5

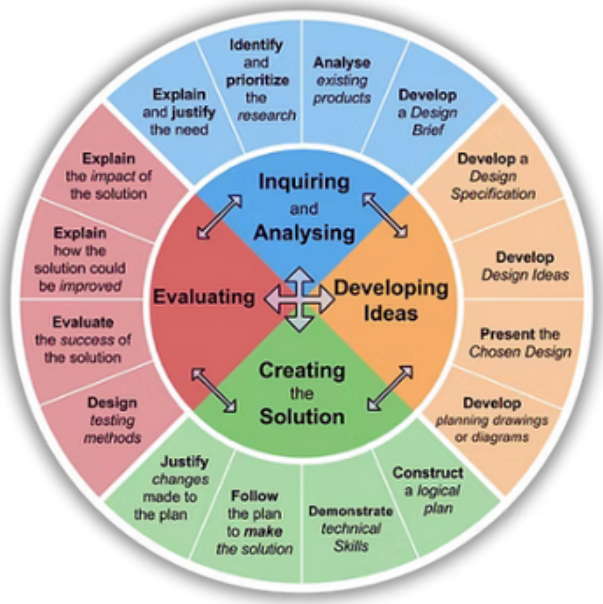
Language, math, and science

Language, math, and science are also easier to learn for bilingual children. According to Marzia Maiffrey, the Assistant Head of School for Academics at the International School of Denver, ***"85% of our students are above the international/national norm in their standardized math testing. This compares to 40% among Denver Public School students."*** The data of our 8th grade graduates is compelling. The average student graduating from ISDenver's 8th grade class is placed in 11th grade math. We also have several middle school students already studying high school level math.

Design, which is a compulsory component of the IB curriculum framework, is a perfect blend of art, math, science, engineering, and business.

Students follow the design cycle to:

- Apply practical and creative thinking skills to solve design problems
- Explore the role of design in both historical and contemporary contexts
- Consider their responsibilities when making design decisions and taking action.



In design, students:

- Ask big questions and wonder.
- Prototype and test their hypothesis.
- Fail in safe and supportive spaces.
- Reflect in their process journals and try again.

Students go through this process with a lens of helping others. In middle school, students research the 17 different United Nations sustainability goals, then choose one goal to focus on. In the "Do Your Bit" section, students learn to program microbits with one of these UN goals in mind. Not only are they learning about design cycle, but they go home thinking of bigger goals: how to scale up their project to make real world impact.

Our science is also designed to be real world and thought provoking. Our students study challenging content in a way that aids in the connection between the materials and personal experiences. Hands-on activities and labs bring learning to life. In first grade, they learn about simple machines and make them in the maker's space to have a hands on understanding. Our first graders then find simple machine use in their own homes and daily lives. In 7th grade, students study the key features of rivers, model these features using stream tables, and then see them firsthand during a visit to the Colorado River and Grand Canyon. This approach challenges students to think deeply, ask questions, and make connections between classroom learning and the natural world. By pushing boundaries and fostering inquiry, our program helps students build the confidence and skills needed to explore science with curiosity and purpose.

Aaron Siegel,
ISDenver Middle School Faculty and Coach

Immersion and the IB Framework are a powerful duo.

Immersion and International Baccalaureate World Schools, like ISDenver, tap into the enlarged brain mass in several other interesting ways. The IB inherently lends to **critical thinking, emotional intelligence, and great communication skills**, all through student-driven activities. The IB has a group of principals (called learner traits) that are interwoven into units called programmes of inquiry. IB learners strive to be:

- Inquirers
- Knowledgeable
- Thinkers
- Communicators
- Principled
- Open-minded
- Caring
- Risk-Takers
- Balanced
- Reflective

In Middle School the IB learner profile traits are interwoven into the learning experiences and connections within the units. Students consider, for example:

- IB traits needed to be successful citizens,
- How using learner profile traits can better the understanding of content,
- Identifying traits in other people, e.g. *How did this scientist use open-mindedness to expand their field?*

As part of the shared IB experience, students develop internal motivation through **agency and choice**. By the time ISDenver students get to 3rd or 4th grade—when they will hear something they think is cool, they dig into it on their own accord because they are genuinely curious and have the tools needed to go deeper. Since they are taught the **tools to access, interpret, and apply the content**, rather than being asked to memorize the base content itself, students are also able to decipher what is misinformation and disinformation. Since they are supported both academically and socially and emotionally, students *really* care; not only do they want to make a difference in their worlds, but they are fully capable of doing so.

In 8th grade, for example, ISDenver students complete a capstone project that serves as the culmination of their International Baccalaureate (IB) experience. Each student selects one of six IB Global Contexts and designs a service project inspired by it. These projects **integrate classroom learning**, **identify real-world connections**, and **focus on creating practical, meaningful impact.**

One student with childhood epilepsy chose to raise awareness about the condition. She collaborated with the Epilepsy Foundation to develop educational content. Through this work, she became a youth ambassador, continuing her advocacy well beyond 8th grade. Another student currently is researching the effects of music on the brain with plans to use music to positively impact the elderly.

In closing, my mom and clinician hats unite

I'm lucky—my kiddos had dramatic changes (for the better) once we started at ISDenver. I don't think most parents get to experience a more "traditional" learning environment prior to coming here and then the positive change that takes place with ISDenver's multi-modal style of learning.

I also understand the long-term commitment of an IB program combined with immersion education; because of how the neural pathways develop and because of the time that it takes, this style of learning doesn't change the brain or how the brain functions after a single year or after a few years. It takes **repetition and time** for the brain to develop to **reap these benefits that will last a lifetime**.

About the author

Angela Starks brings a unique blend of expertise and passion to the Admissions Team at the International School of Denver. Before joining ISDenver, Angela spent over two decades in the medical field—12 years as a pediatric nurse practitioner and 10 years as an intensive care nurse. She holds an MPH from Emory University and a doctorate in Health Systems Leadership from the University of Colorado.

Angela began her career at Children's Hospital Colorado as one of the first nurse practitioners in the Pediatric ICU. Six years later, her fascination with the brain and its development led her to transition to inpatient neurology. During her time in neurology, Angela played a pivotal role in creating a multidisciplinary brain injury clinic and building a robust inpatient neurology team.
After leading her team through the challenges of the COVID-19 pandemic, Angela desired to be more present and available for her family. She left clinical medicine to join the Admissions Team at ISDenver where her son and daughter were already students in the Spanish program. Wearing the hats of medical professional, brain expert, parent, and Admissions Manager, Angela loves to speak about the beauty of the bilingual brain.

About the International School of Denver

Established in 1977, the International School of Denver is a bilingual, immersion, International Baccalaureate World School for preschool through 8th grade students with programs in Chinese, French, and Spanish. The International School of Denver exists to create a more compassionate and curious world, one student at a time.

Learn more about the International School of Denver.

Multilingual Education.
Global Mindset.
Extraordinary Impact.