



Study on the Contribution of Multilingualism to Creativity

Compendium Part One

Multilingualism and Creativity: Towards an Evidence-base

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Introduction

This study was conducted during the period May 2008-June 2009 across all 27 EU Member States plus Norway and Turkey. It comprised an analysis of scientific literature, European and international. Input given by thirty Country Experts and a Core Scientific Research Team (CSRT) was set against five hypotheses, as given by the European Commission.

Towards an Evidence-base

This compendium consists of two sections:

- a commentary text, and
- an inventory of selected research publications.

The commentary is written for a broad audience. It is not a scientific evaluation of the separate publications examined, but is a synthetic overview of the relationship between multilingualism and creativity as revealed in rapidly evolving research evidence.

The commentary has been compiled by an inter-disciplinary team of language-focused specialists following a rigorous process of retrieval, analysis and appraisal of research readily available in the public domain. It provides *a broadly outlined response to the quest for evidence which tends to reveal the benefits of multilingualism for creativity*. It is not an evaluation of the general advantages and disadvantages of multilingualism, but acts as a scan of research reporting which directly or indirectly has bearing on links between multilingualism and creativity.

The inventory of research-based publications is linked to the following five hypotheses.

- There is a link between multilingualism and creativity
- Multilingualism broadens access to information
- Multilingualism offers alternative ways of organising thought
- Multilingualism offers alternative ways of perceiving the surrounding world
- Learning a new language increases the potential for creative thought.

The inventory provides summary information on these research-based publications, all of which are retrievable through various channels. Each entry is classified according to three categories: indicator, context, and source. Some entries also carry 'quotations of special interest' from the original source. These can be found in Compendium Part 2.

- *Indicator* is a summary statement of research results
- *Context* briefly situates the research
- *Source* is the full reference required to locate the publication.

Creativity, innovation and multilingualism are dynamic terms frequently understood differently within and across languages and contexts. One reason for this is that the key concepts underpinning each are of acute importance in different sectors of our societies, which leads to various interpretations ranging from highly specific attempts at scientific definitions to broad anecdotal usage.

This report uses definitions which were pre-determined by the original terms of reference of the call for tender, and adapted after subsequent consultation.

Operational Definitions of Key Terms

Creativity

The definition of *creativity* used here is 'imaginative activity fashioned so as to produce outcomes that are both original and of value' (NACCCE 1999: 30). It usually entails taking an existing concept and synthesising it with other concepts. This, in turn, is followed by an emergent process for creativity which can be considered as the ability to think of something new by extending conceptual boundaries. The term for this in cognitive psychology is '*creative conceptual expansion*'.

...creativity in its higher manifestation is the unique ability of individuals and the undiscovered mystery of the brain. However, if we define creativity as the ability of the individual to generate 'novel unusual ideas, to avoid stereotypic schemes in thinking, and to rapidly resolve problem situations' ... then it is reasonable to think that manifestations are encountered more frequently.
(Bekhtereva et al. 2001: 390)

Multilingualism

Multilingualism as used in this report is to be understood within the framework of European Commission documentation:

... the ability of societies, institutions, groups and individuals to engage, on a regular basis, with more than one language in their day-to-day lives.
(EC 2007:6)

This broad definition embraces the distinction made by the Council of Europe between 'multilingualism' and 'plurilingualism', where multilingualism refers more to social organisation, and plurilingualism to an individual repertoire of linguistic competence.

Multilingualism refers here exclusively to the presence of several languages in a given space, independently of those who use them:
for example, the fact that two languages are present in the same geographical area does not indicate whether inhabitants know both languages, or only one.
(Council of Europe: 2007a:17)

Plurilingualism, on the other hand, refers to:

The ability to use several languages to varying degrees and for distinct purposes is defined in the *Common European Framework of Reference for Languages* (p.168) as the ability 'to use languages for the purposes of communication and to take part in intercultural action, where a person, viewed as a social agent, has proficiency, of varying degrees, in several languages and experience of several cultures'. This ability is concretised in a repertoire of languages a speaker can use.
(Council of Europe: 2007a:17)

The distinction is significant since it is the notion of individual skills that is thought to lead to positive outcomes. These bring together the social and individual features subsumed in the European Commission's broad definition given at the outset.

The language learner becomes plurilingual and develops interculturality. The linguistic and cultural competences in respect of each language are modified by knowledge of the other and contribute to inter-cultural awareness, skills and know-how. They enable the individual to develop an enriched, more complex personality and an enhanced capacity for further language learning and greater openness to new cultural experiences.
(Council of Europe 2007b: 43)

To summarise, the terms multilingualism and plurilingualism, as defined by the Council of Europe, are subsumed under the term 'multilingualism' for the purposes of this report.

What the term (plurilingualism) refers to is the capacity of individuals to use more than one language in social communication whatever their command of those languages.

This set of skills constitutes the complex but unique competence, in social communication, to use different languages for different purposes with different levels of command.

(Beacco J-C, 2005: 19)

Innovation

By understanding creativity as 'imaginative activity', we can view innovation as processes or outcomes which are both 'original and of value'. Therefore, **CREATIVITY GENERALLY PRECEDES INNOVATION.**

Creativity is the way an individual succeeds in changing his or her perception.

To innovate is to make something new in the system; whereas to be creative means thinking up a new system. Innovation is linked to action, creativity to thinking.

Innovation can be continuous; creativity will inevitably be discontinuous.

As Picasso said, to create you must break.

(de Brabandere 2005: 10)

Approaching Multilingualism and Creativity

Creativity and innovation have been a key focus of attention across the globe in recent years. This is partly due to the need to further develop human capital. Human capital includes those competences such as innovation and possessing knowledge which contribute to economic performance and social cohesion.

Innovation and knowledge have been recognised as the driving forces for sustainable growth in the framework of the Lisbon strategy for the future of Europe. Creativity is central to innovation. (EC 2009)

This has led to an examination of which features of human potential could be recognised and further developed as human capital so as to achieve desired socio-political goals.

The European Year of Creativity and Innovation 2009 gives special focus to creativity, innovation, and multilingualism. At this point in time, there is considerable anecdotal evidence for arguing that the ability to use more than one language leads to creative and innovative outcomes for individuals and the societies in which they live.

Anecdotal evidence can be very significant. It includes evidence that may not yet have been subjected to rigorous scientific analysis. This should not reflect negatively on the anecdotal evidence itself, but take into account that sufficient scientific studies have not yet been fielded. This is particularly the case with arguments about any possible advantages gained through multicultural diversity in social and working life.

Current insight into creativity requires further research. There is much speculation that there is **A LINK BETWEEN KNOWLEDGE OF LANGUAGES AND ENHANCED COGNITIVE ABILITY.**

For more than 2,000 years, philosophers and psychologists have been intrigued by the notion that language study may enhance an individual's general cognitive abilities (Bamford and Mizokawa, 1991: 413)

However, relatively little research exists which specifically focuses on any relationship between creativity and multilingualism. And this is at a time when creativity is viewed as a key driver for social and economic success in the Knowledge Society.

Natural language is a core feature of human cognition and great efforts have been made to understand its mental and neural representation and use. Although most of the research has been devoted to explore natural language in monolingual speakers, the fact that a substantial proportion of the human population speaks more than one language calls for deeper investigations that address how one brain handles two languages.
(Abutalebi & Costa 2008: 473)

Linking multilingualism to some form of specific added value such as 'creativity' is complex. One reason is due to the multi-dimensionality of language and the brain. Individuals do not live in a vacuum. Their capacity to think and act is determined by many surrounding influences. Indeed, some would argue that creativity is not an innate quality which individuals have, but something which is largely generated through interaction with the environment, including other people.

There are many factors which influence how knowledge of more than one language can lead to specific outcomes. Individuals are unique, and even if more than 50% of the world's population are 'bi- or multilingual' to different degrees we are barely scratching the surface in understanding the impact of knowing more than one language.

The term 'bilingual' refers to an individual who uses two or more languages or dialects in his or her everyday life, regardless of the context of use. Taking this definition into account, more than half of the world can be considered bilingual
(Giussani, Roux, Lubrano, Gaini and Bello, 2007: 1109)

There has been much work done on creativity from different perspectives, particularly in the field of artistic expression. But relatively little has been achieved with respect to the inner workings of the mind. **IT IS HIGHLY LIKELY THAT THE MULTILINGUAL MIND DIFFERS IN SOME RESPECTS TO THE MONOLINGUAL MIND**, but in what way and with what outcomes is at present an open question.

This report attempts to discover to what extent there is a difference between multilinguals and monolinguals with respect to creativity, if any, since the issue has not yet been scientifically addressed. It does not attempt to suggest that creativity cannot be achieved through monolingualism.

Finally, if there are differences in, for example, the neuro-circuitry of the monolingual and multilingual minds, does this actually lead to any advantage for one over the other? These are fundamental and substantial issues.

Creative products are in part a function of cognitive structures and processes; that is, the mind... it is clear that an understanding of some of the fundamental workings of the human mind is essential for an understanding of creativity.
Whenever there has been a creative discovery or invention,
it has always emerged as the result of human efforts or insights....
Understanding how the human mind functions is indispensable in understanding
the creative process.
(Smith 2008: 509-510)

The available evidence shows that we are at a very early stage of understanding the impact of multilingualism on the brain, and on any form of resulting outcome such as creativity. This is a normal state of affairs in any research cycle. There may not yet be any direct causal link between multilingualism and creativity, but there are various pathways opened up through knowledge of another language being considered as more likely to increase cognitive functioning, including creativity, than the reverse.

We live in dynamic times. European integration is growing in complexity and a new global socio-economic order is emerging. Part of this growing reality is the rise of a new linguistic

order, driven by the globally integrated nature of technological innovation and by human mobility. This has placed multilingualism in the spotlight. As Europe seeks to navigate these complex times and make constructive decisions, there is an urgent need to better understand to what extent **MULTILINGUALISM IS ONE OF THE LEVERS BY WHICH TO ENHANCE KNOWLEDGE-BASED ECONOMIES AND SOCIETIES.**

Creativity has led to various neuro-myths being circulated over recent years. Likewise, **MULTILINGUALISM HAS BEEN SUBJECTED TO MUCH MYTH-MAKING.** For example, over some years in certain academic circles it was argued that bilingualism leads to negative consequences for individuals and societies, and that it leads to diminished mental capacities. Today this is generally no longer believed to be the case.

Moreover, there may be forces which want to commercialise products and services, or otherwise argue cases which link creativity or multilingualism to some form of intrinsic gain. This pressure means that when we approach research which is contextually specific, as is much of the work done in this area, we need to handle it with caution.

Apart from the enormous amount of fluff out there, the study of creativity is, quite unfortunately, still dominated by a number of rather dated ideas that are either so simplistic that nothing good can possibly come out of them or, given what we know about the brain, factually mistaken. As cognitive neuroscience is making more serious contact with the knowledge base of creativity, we must, from the outset, clear the ground of these pernicious fossil traces from a bygone era.
(Dietrich 2007: 22)

The world is changing very rapidly. **RESEARCH ON THE RELATIONSHIP BETWEEN MULTILINGUALISM AND CREATIVITY MAY NOT YET HAVE HAD ITS EUREKA MOMENT,** but there is cause for cautious optimism, as the evidence described in this commentary reveals. In the European context there are widely held assumptions that there is a link between multilingualism and forms of added value such as creativity. These assumptions are reflected in European Commission output:

The ability to communicate in several languages is a great benefit for individuals, organisations and companies. It enhances creativity, breaks cultural stereotypes, encourages thinking "outside the box", and can help develop innovative products and services.
These are all qualities and activities that have real economic value.

Language and creativity are mental faculties which form part of the natural skills of human beings. In business, multicultural and multilingual teams are often created to solve problems, find innovative solutions and develop new goods and services. This approach is based on the idea that those who speak several languages have a broader perspective which can lead to fresh and innovative approaches. Multicultural teams can bring different perspectives to problems, leading to new solutions that foster creativity and innovation.
(EC 2009)

We are now in a period when scientific insights on the working of languages in the brain are rapidly expanding.

... the study of bilingualism, with its distinct approaches (from linguistics to neuroscience), has experienced an exceptional growth in the last decade. For example (research) reveals that in the 1986–1996 period 1 171 entries have listed the word "bilingual" as a topic, while in the period 1997–2007 that number was more than double: 2 716.
Abutalebi & Costa, (2008: 473)

This is partly due to the fact that researchers can now look inside the brain using neuroimaging techniques such as functional magnetic resonance imaging (fMRI), positron emission topography (PET), and functional near-infrared spectroscopy (fNIRS). These, and other techniques, enable us to see the physical structure and activities in the brain on a scale not possible earlier. Biomedical research on the neurosciences only emerged as a distinct discipline after the 1970s.

We are now at a threshold stage where research conducted in rigorously controlled laboratory settings is at a crossroads with research conducted in largely non-laboratory contexts.

The advances in cognitive neuroscience in just the past two decades that are relevant to creativity have been breathtaking and they have brought unprecedented understanding and predictive power about how the mind works.
(Dietrich 2007: 27)

Yet, currently available research still does not prove a solid, incontrovertible link between multilingualism and creativity, nor does it demonstrate any incontrovertible link between monolingualism and creativity.

However, there is an increasing body of evidence pertaining to a wide variety of people, in various cultural environments, and using different languages, revealing enhanced functioning of individuals who use more than one language, when compared to monolinguals. This suggests **A GREATER POTENTIAL FOR CREATIVITY AMONGST THOSE WHO KNOW MORE THAN ONE LANGUAGE**, when compared with monolinguals.

Approaching the Evidence-base

The synthesis leading to this evidence-base has concentrated on scientific research that highlights the potential relationship between multilingual skills and creative processes. This research stems mainly from the cognitive sciences. No attempt has been made to address the links between multilingual skills and artistic creation since the scope and range of implications would be too vast.

The evidence available which supports the notion that multilingualism is linked to creativity is equivocal, although it is subject to multiple interpretations. However, by grouping together findings from different research disciplines over the last thirty years, it is possible to note the formation of evidence clusters.

These evidence clusters point towards specific forms of 'difference' between monolingualism and multilingualism. The clusters comprise research which argues that knowing more than one language results in people developing specific forms or conditions which could be linked to what is widely interpreted as 'creativity'. The contents of these clusters constitute indicators.

The indicators have to be handled with extreme caution because **CREATIVITY IS A MULTI-DIMENSIONAL PHENOMENON**. This means that it is useful to look at the impact of knowing more than one language in relation to processes which might potentially lead to creativity. Multilingualism is only one factor which impacts on creativity.

When interpreting these clusters it is necessary to assume the following:

Research

- may involve different understanding of terms such as creativity. There is no consensual definition of this term. It may also focus on one single attribute which may or may not be one of the stepping stones which can lead to enhanced creativity.
- may involve very different types of multilingualism, from partial competence in a second language, through to high competence in three or more languages. The most common focus compares monolinguals with bilinguals, but here the understanding of 'bilingualism' may differ with respect to the level of competence in each of the two languages.

- focuses on individuals who have learned a second or third language at different stages of their lives. This may involve using two languages in the family from a very early age, through to learning a language when an adolescent or adult. For instance there is controversy over the point at which multilingualism may have any recognisable impact.
- may be sensitive to which languages a person knows. Differences can be seen if these are from the same language family, like English and French, or from different families such as Dutch and Tamil.
- is always context-bound. This means that the individuals being studied may come from very different socio-economic or other circumstances. They may have had different experiences in life. Being left or right-handed; being bilingual with languages which have high or low social status in the given society; or being an infant or adult, are only a few of the variables which can influence the research results and how we interpret them. Experience is a key factor in research on multilingualism and creativity, and knowledge of a second or third language can be a profound experience in itself.
- reporting may carry great significance at a given time, but then be considered flawed later on. Research is a cumulative process, in that one study invariably builds on those that have been conducted earlier. Research communities need to challenge assumptions and research outcomes, because this is an integral part of furthering scientific understanding. In addition, research into language use has to handle environmental variables and this can be difficult even in highly controlled situations. This means that different methodological approaches, and outcomes, need to be viewed as complementary, to a greater or lesser extent, and acknowledged as deductions are drawn. The multilingual individual is a microcosm of the societies in which s/he lives. Therefore, research on multilinguals involves controlling what are sometimes termed 'wild variables' and means that enquiry into very specific attributes is as important as that which handles broader knowledge or skills.
- may report that x has an impact on y. This is very common in the current understanding of multilingualism and the human condition in the neurosciences. For example, knowing a second language is increasingly viewed as involving different neurocircuitry within the brain, when compared to monolingualism.

... the monolingual and bilingual groups exhibited significant differences in the *corpus callosum* midsagittal anterior midbody regional area...
 With respect to second language education, the results of this study could suggest that bilingual learning and use can have a profound affect on brain structures in general and the *corpus callosum* in particular.
 (Coggins, P., Kennedy, T., Armstrong, T. 2004: 72-73)

The Flexible Mind

The *flexible mind* is about extending the capacity to think. We can consider this in terms of the human body. A person who exercises and is physically fit is more able to adapt to different situations, like needing to swiftly walk up a steep hill. The ability to respond to different physical demands depends, partly, on physical flexibility. In a similar way, a flexible mind is one which can adapt itself to the demands of different situations. **A FLEXIBLE MIND IS AN ADAPTABLE MIND.** Norman Doidge reiterates this point in that 'The idea that the brain is like a muscle that grows with exercise is not just a metaphor' (2008: 43).

It can be argued that speaking more languages brings cognitive benefits, which may be associated with increased use of the brain. One of possible spin-off benefits is creativity. (Tokuhama-Espinosa, 2008: 93)

It is not that monolinguals are denied a degree of flexibility reported as a characteristic of multilinguals. But the extent to which the multilingual mind is adaptable is of great interest. One of the long-standing analogies about bilinguals has centred on being able to **SEE THE WORLD THROUGH DIFFERENT LENSES**. Thus, as the multilingual engages with life, s/he has various types of binoculars which can be used as and when the need arises. The binoculars enable choice, and the choice is linked to the extent to which the mind is flexible in adapting to situations.

We note that multilinguals have a more extensive range of affordances available to them than other language users and we argue that their experience as multilinguals provides them with especially favourable conditions to develop awareness of the social and cognitive possibilities which their situations afford them.
(Singleton & Aronin 2007: 83)

As we interact with our environment, a more extensive range of affordances or interpretations can lead to increased choices.

Being able to look at the same thing – for example, a problem or some other form of challenge – from different perspectives is an important competence in the Information Age. Access to information, and the need to navigate this, has become a defining competence of the times. If the multilingual mind has the potential to support 'looking at things from different perspectives', then it may be that the multilingual mind can be regarded as **A MIND WELL-EQUIPPED FOR MODERN TIMES**.

The main arguments found in the research examined revolve around the added value which results from knowledge of more than one language. For example, it is widely suggested that a bilingual is not a monolingual with two languages, because knowledge of different languages amounts to more than the sum of its parts. The bilingual is viewed as having *multicompetence*.

...the learner's playful use of multiple linguistic codes may index resourceful, creative and pleasurable displays of multicompetence.
(Belz 2002: 59)

Multicompetence was originally used to describe the extra capacity which may emerge as a result of knowing more than one language. It is the compound state of a mind with two grammars. We can think of this in terms of the monolingual who has knowledge of his/her first language together with, say, another cognitive framework such as mathematics; being able to solve problems through both constructs can be assumed to support flexibility of the mind. However, the multilingual, whether a mathematician or not, will have these extra constructs because of knowledge of more than one language.

These subtle differences consistently suggest that people with multicompetence are not simply equivalent to two monolinguals but are a unique combination ...so the multicompetence state (L1 + L2) yields more than the sum of its parts, L1 and L2.
(Cook 1992: 557)

It is the uniqueness of this capacity which may lead to the potential for creativity. For example, there has long been an anecdotal view that 'tension' is often required to achieve creativity. *Creative tension* is a popular concept in organisational management and it relates to how people perceive the gap between what they know/where they are, and what they want to know/where they want to be. **CREATIVE TENSION IS CONSIDERED TO BE A FORM OF ENERGY**. It is often linked to iconic creative figures in history such as Michelangelo, Van Gogh or Mozart, among others.

The gap between vision and current reality is a source of energy. If there was no gap, there would be no need for any action to move toward the vision. Indeed, the gap is the source of creative energy. We call this gap creative tension.
(Senge 2006: 150)

When looking across research on the multilingual mind there is much interest in how the two or more languages interact with each other within the brain in relation to a type of tension, and what this might mean for the individual in relation to thought.

At the heart of human creative endeavours lies the issue of thinking, which involves the deeper faculties of the mind.
(Bhatia & Ritchie 2008: 5)

Tension here should not be construed as negative. Creative tension has been compared to a bow and arrow. In itself the bow, the mind, is not able to project the arrow without appropriate tension suitable for the specific target. So if the target is some form of problem, the tension could be viewed as resulting from the interaction of the bow, string and the person him/herself. And it is this capacity for tension which links back to flexibility.

Divergent and convergent thinking (thinking broadly across a range of possible ideas or in a very focused way) are two frequently discussed thought processes in enquiries into the multilingual mind, creativity and problem-solving. Put simply, both are linked to how we generate ideas. There is much difference of opinion on the terms between researchers, and it is possible that creativity could result from convergent just as from divergent thinking, or variants of each.

This finding indicates that being bilingual does not necessarily imply being creative, but rather that the positive effect of bilingualism on creative abilities is likely to be limited to unconscious automatic cognitive processing, which lays the foundation of more sophisticated processing during which truly creative ideas may be generated.
(Kharkhurin 2008: 238)

One argument linking divergent thinking to multilingualism and creativity relates back to the idea of lenses. The ability to simultaneously activate and process multiple unrelated categories may be greater when more than one language is available for the process. What is of significance is if the potential flexibility being used in different ways for approaching thinking impacts on the potential for enhancing creativity.

Creativity derives from and depends upon implicit and explicit cognitive processes.
(Smith 2008: 525)

Some researchers who look into multilingualism and cognitive flexibility use tests where the subjects are asked to look at a picture which has more than one image embedded into it, and describe what they see. The tests themselves tend to use very specific images, or other types of non-verbal perceptual tasks.

In both studies bilingual children were more successful than monolinguals in seeing the other meaning in the images...
(Bialystok & Shapero 2005: 595)

What is interesting is the degree to which the multilingual can possibly have an advantage over the monolingual in searching for structure, and seeing patterns when handling such perceptual tasks.

The modern age is one of widespread information and communication. Thinking processes and cognitive flexibility have been under the spotlight in various research fields for decades, but now there is great attention being given to **DIGITAL LITERACY AND COMPETENCES**. Being able to respond to the opportunities and demands of information and communication technologies is an area of some interest. Cognitive flexibility has a role to play here, and there are now questions open with respect to the multilingual mind.

...many theorize there is a correlation between mental flexibility and the number of structures one learns to work within – whether language rules or logical, mathematical constructs – meaning that the more languages you know the more flexible your mind is.
(Tokuhama-Espinosa, 2008: 93)

If multilingualism contributes to how the flexible mind engages with different input, re-organises and restructures thought to better understand how to adapt to different situations, then it may emerge as an asset in **COMPETENCE-BUILDING FOR THE INFORMATION AGE**.

The Problem-solving Mind

Language processing in the bilingual or multilingual mind will differ from the monolingual mind because there is more than one language to use at a given time. The existence of more than one language in the brain suggests that multilinguals have enhanced cognitive control when compared to monolinguals. This leads us to *executive function* which is a key concept in understanding cognitive control.

The multilingual mind operates with more than one language, and in so doing needs to rely on mechanisms which differ from the monolingual mind. This is because the monolingual mind has only one fundamental linguistic frame of reference. The question arises whether having a multilingual 'executive function' is a form of cognitive asset, which could enhance the potential for creativity. A range of reports argue that multilinguals, specifically bilinguals, have **EXECUTIVE FUNCTION CAPACITY WHICH IS SUPERIOR** in various ways when compared to that of monolinguals.

The executive functions are basic to all cognitive life. They control attention, determine planning and categorising, and inhibit inappropriate responding....
Speculatively, these executive functions are recruited by bilinguals to control attention to the two language systems in order to maintain fluent performance in one of them.
The massive practice that is involved in that application leads to the hypothesis that these processes are bolstered for bilinguals, creating systems that are more durable, more efficient and more resilient.
(Bialystok 2007: 210)

Studies on or around executive function processing report on possible advantages of bilingualism in relation to aspects of problem-solving, including abstract thinking skills, creative hypothesis formulation, higher concept formation skills and overall higher mental flexibility. The reasons for any advantage may be linked to the management of two or more active language systems, and the experience of that management over time.

A possible reason for the enhanced cognitive control demonstrated by bilingual children is that the same control processes are used both to solve these misleading problems and to manage two active language systems. Bilingual children, therefore, have had more opportunity than monolinguals to exercise a crucial cognitive skill, and this practice may then accelerate the development of that skill.
(Bialystok et al. 2005: 40)

Being able to interpret information and solve problems involves not only deciding what to give attention to, but also what not to give attention to. This is even more significant if one considers situations in which there is a large amount of information to process at a given time. Separating what is important information and what is not constitutes a problem-solving competence. Related research frequently refers to 'inhibitory control'. Inhibitory control involves the scale at which a person is able to ignore distracting and irrelevant stimuli.

Bilinguals... have acquired a **BETTER ABILITY TO MAINTAIN ACTION GOALS** and to use them to bias goal-related information. Under some circumstances, this ability may indirectly lead to more pronounced reactive inhibition of irrelevant information.
(Colzato et al. 2008: 302)

Attention to task is an important factor in not only problem-solving, but learning in general. It is said that **ATTENTION DRIVES MEMORY AND LEARNING**. The multilingual mind is already involved with separating the language processing frameworks resulting from knowing more than one language. This is especially the case in terms of ambiguity, and different representations created by words. However, it also separates distracting alternatives which might interfere with thought.

Inhibitory control could lead to a significant advantage for the multilingual mind, and could possibly link to creativity.

Some studies have looked at problem-solving with respect to bilingual and monolingual behaviour when using multimedia gaming. This is a particularly interesting research area because it links closely to the development of electronic literacy, to the types of competence required when using specific forms of information and communications technology. These studies reveal that **BILINGUALS TEND TO BE BETTER IN PROBLEM-SOLVING WHICH IS COGNITIVELY DEMANDING**.

Because all the participants were highly practiced and efficient at performing this task, group differences emerged only when processing demands increased, setting limits on the performance of the monolinguals but not the bilinguals.
(Bialystok 2006: 76)

This interest in processing demands has led to suggestions that **THE MULTILINGUAL MIND MAY BE BETTER AT MULTITASKING** than the monolingual mind. This is partly attributed to attention and inhibitory control. Multitasking can be considered as the simultaneous handling of more than one task and is directly linked to executive control.

Research reveals that when engaged in highly demanding problem-solving tasks bilingual students outperform monolinguals, but that this is not the case when each group handles relatively less demanding tasks. Sometimes, it is not that the bilinguals have a clear overall advantage, but that they may be better at handling the cognitive demands involved.

Some problem-solving tasks and processes include processes which could lead to creativity. Conceptual expansion is closely aligned to hypothesis formulation in problem-solving. This is sometimes discussed as 'fluid intelligence' which can be considered as a higher order problem-solving capacity. It is reported that **KNOWING MORE THAN ONE LANGUAGE MAY HELP THE BRAIN SHARPEN ITS ABILITY TO FOCUS**.

... linguistic and scientific creativity is enhanced by bilingual language proficiency.
(Kessler & Quinn 1987: 173)

Problem-solving is a constant feature of life. Whether people are answering academic questions in examinations, or considering which household appliance to purchase, problem-solving competences will be required. The indicators in this respect suggest that multilingualism may well provide a **MULTICOMPETENCE (THE ADDED VALUE RESULTING FROM KNOWING MORE THAN ONE LANGUAGE)** which could become an increasingly important competence for achieving creativity in the modern age.

The Metalinguistic Mind

Awareness of language as a tool for thinking and human communication is a valuable skill. It leads to greater understanding of how language is used to achieve specific goals in life, and how to achieve deeper understanding of how language functions. Language awareness gives **THE POTENTIAL FOR ENRICHED INFORMATION PROCESSING**. Metalinguistic awareness is essentially about linguistic processing, leading to skills in analysing how language is used, and using language to achieve desired goals.

(Linguistic processing is) the child's ability intentionally to consider the aspects of language relevant to the solution of a problem.
(Bialystok 1986: 498)

If the metalinguistic mind has more than one language, then this is viewed as giving advantage because the person is able to develop critical awareness of language and communication through more than one system. Understanding that words can have more than one meaning; identifying ambiguity in communication; translating words and interpreting concepts; and seeing the sub-text underlying how language is used are all given attention in research in this area.

Bi- and multilinguals are "cognitively more flexible" and this is facilitated by their increased metalinguistic awareness.
(Kharkhurin, 2007: 182)

The metalinguistic mind enables the person to have specific types of ability to handle 'language dynamics' in communication. Essentially, it enables the person to 'go beyond the words', and is closely linked to improved reading skills through phonemic awareness (understanding sounds and symbols) and heightened sensitivity in interpersonal communication.

When the metalinguistic mind comes about through the interaction of two or more languages in the mind it can be seen as something which enriches each of them.

More specifically, it seems that bi/plurilingual children, in favourable contexts, do not hesitate to use all language resources at their disposal, individually and collectively. They are more open to variation and they show greater flexibility in adapting to new linguistic systems. Such orientations seem to relate to greater awareness of language patterns, and a more efficient (strategic) use of the resources at hand to facilitate discovery, both at translinguistic and interlinguistic levels. These strategic skills could be constitutive of a plurilingual expertise.
(Moore 2006: 135)

Flexibility in adapting to and using different linguistic systems enables the taking of an existing concept and synthesising it with and/or differentiating it from others, using this to fuel the emergence of new ideas. This is where the metalinguistic mind is associated with **ACHIEVING CREATIVE CONCEPTUAL EXPANSION**, and the potential for creativity.

The Learning Mind

Modern cognitive theories assume that humans learn by interacting with their environment. This process which involves both the person's previous knowledge and the environmental stimuli is seen as a constructive process. During this interactive process new knowledge is constructed and learned, and then integrated into the previous knowledge. The results of such knowledge constructions are always more than the sum of the environmental percepts; they are new concepts which cannot be foreseen. So learning is not adding information to information already stored, but constructing new knowledge. In a way **EVERY LEARNING PROCESS CAN BE SEEN AS A CREATIVE PROCESS**. In psychology and philosophy this is called the emergence phenomenon.

... competence in two languages, and specifically heightened language awareness, serve as resources to build knowledge in context.
(Moore 2006: 125)

Using the 'working memory', the processes which enable temporary retention of information so as to enable the brain to 'think' are important for learning in general. Research (for example, Kormi-Nuori et al. 2008) suggests that the multilingual mind may have superior memory functioning in relation to 'episodic memory' and 'semantic memory' when compared to monolinguals.

Episodic memory is used to describe the memory of events linked to episodes (times, places, feelings, and other phenomenon which can be explicitly stated). *Semantic memory* describes more general knowledge which, though unrelated to specific experiences or events, is used to help interpret these.

The possibility of enhanced memory function has bearing through the impact of multilingualism on the learning of other subjects in the education curriculum, and on learning in general. The ability to retain, organise, store and retrieve information is an important human competence, and the indications that multilingualism provides an advantage in comparison to monolingualism have bearing on the potential for creativity. This relates to the possible impact of cross-language interactivity, a process which would not be available for a monolingual.

In all four experiments, a positive effect of bilingualism was found on episodic and semantic memory tasks... The bilingual advantage was not affected by changing cognitive demands or by using first/second language in memory tasks. The present findings support the cross-language interactivity hypothesis of bilingual advantage.
(Kormi-Nouri et al. 2008: 93)

This relates to what is called 'cognitive load', and links have been reported between multilingualism and **SUPERIOR PERFORMANCE IN HYPOTHESIS FORMATION** in terms of depth and syntactic complexity. Such work has been done on various subjects, including maths and science.

There may be specific neuro-circuitry and multisensory brain systems (changes in brain organisation, inter-hemispheric transfer, and functional plasticity) which enable change to be found in multilingual as opposed to monolingual minds. This in turn may connect to the issue of whether knowing more than one language makes it easier to learn other languages; where language learning becomes a cumulative process.

... possible that bilingual learning can have a profound effect on brain structures.
(Coggins, Kennedy & Armstrong 2004: 73)

The issue may simply hinge on the availability of more than one linguistic processing system for problem-solving when an individual has knowledge of more than one language:

Although some bilingual students do have a harder time, others seem to be at an advantage. This study explores the use that bilingual students who are succeeding in mathematics make of their two languages. These students seem to have better metalinguistic skills that allow them to self-correct when solving problems, and are perhaps more confident in their approach to solving difficult problems.
(Clarkson 2007: 191)

It may also be linked to a possible advantage in reading skills, and handling relevant information when simultaneously reading, listening and looking.

Finally, even very limited exposure to second language learning is now under the spotlight through research within the neurosciences. **CHANGES IN THE BRAIN'S ELECTRICAL ACTIVITY MAY OCCUR MUCH EARLIER THAN PREVIOUSLY THOUGHT.** The neuronal structures are highly likely to influence change.

Neurons that fire together wire together.
(Shatz 1996)

It has been argued for some years that any impact from knowing a second language would only be realised when a certain degree of competence is attained. But it is now increasingly reported that change in the brain can be found with relatively little exposure to a second language. The consequences of this for both learning in general, or creativity, remain uncertain.

The results also support (the) suggestion that even low levels of ability in the second language are related to metalinguistic advantages.
(Eviatar & Ibrahim 2000: 462)

Preliminary results from three studies indicate that classroom-based L2 instruction can result in changes in the brain's electrical activity, in the location of this activity within the brain, and in the structure of the learners' brains. These changes can occur during the earliest stages of L2 acquisition.
(Osterhout et al. 2008: 510)

That there may be a collateral relationship between multilingualism and learning in general has been under discussion in research for decades. Executive control, memory, divergent thinking, inhibitory control and metalinguistic awareness are all factors involved here, not to mention sociological and pedagogical constraints frequently referred to in the bilingual education literature.

It is possible that the interplay between languages in the multilingual mind is a key factor. This interplay includes the role of emotions, which is increasingly viewed as an important aspect of learning. It is the interplay within the mind, and how that mind interacts with the surrounding environment, which puts the spotlight on the potential for creativity.

Over two thousand years ago Plato declared 'all learning has an emotional base', but only recently has evidence started to accumulate to show that our emotions do re-sculpt our neural tissue.
(CERI 2007: 64)

Interplay of languages can be found in educational settings where more than one medium of instruction is used (e.g. through Content and Language Integrated Learning – CLIL). Research on forms of bilingual education have reported surprisingly good results across the curriculum by bi- or multilinguals.

In Germany, Lamsfuss-Schenk (2008) and Zydatis (2009) report on research outcomes which argue that learners in bilingual classes show significantly better results not only in the target language but also in the other subjects. Similar recent reports can be found in Belgium (Braun 2007), Italy and Switzerland (Gajo & Serra 2002), and Spain (Sierra 2008). Baetens Beardsmore (2008) comments that 'cognitive skills gradually being developed increase the potential for creative thinking, whether in the humanities or the sciences. The question then arises whether such skills are equally well developed in bilingual education models or better than in monolingual education' (2008:12).

The majority of education systems have been built up on a monolingual frame of reference since the onset of compulsory schooling in the mid-nineteenth century. This led to assumptions about the negative consequences of bilingualism for individuals and societies whose education system was oriented towards mass numeracy and monolingual literacy as a means of generating creative prosperity. But globalisation and human mobility, European integration and non-linear career trajectories have thrown up new social challenges in education and in development which can no longer be addressed by the solutions originally promoted at the onset of primarily monolingual compulsory schooling for all. The role of languages in the learning mind, and the learning environment, is a key factor in nurturing creative abilities within mainstream populations.

The Interpersonal Mind

Parents who opt to have their children educated wholly or partly through the medium of a foreign language sometimes voice concern about whether such an experience may have a negative impact on the child's first language. There are reports and insights included in research reporting over the ages which imply that the experience of learning through the medium of a second language actually enhances the communication awareness of the first language. This could be linked to language awareness and the types of metalinguistic competence which can be developed when a person has more than one language.

Multilingualism is reported as helping to **NURTURE INTERPERSONAL COMMUNICATION AWARENESS AND SKILLS**. For example the ability of multilinguals to see that people have differing, or even false, beliefs is said to develop earlier in multilinguals than in monolinguals.

...bilingual children show an earlier understanding that other people can have false beliefs than monolingual children.
(Goetz 2003: 1)

Interpersonal competence is a notoriously difficult concept to measure, as there are multiple variables which interfere with both research practice and the outcomes reported. But the possibility that knowing more than one language provides specific opportunities for multilinguals is commonly reported across the range of the available literature.

Bilinguals exhibited significant gains, with increased language experience, in communicative and conceptual linguistic competence, and metalinguistic competence.

Results suggest that bilingual memory is not a dormant, cognitive state but a dynamic mosaic of reciprocal relations between individual, cognitive, social, contextual, and behavioural factors.
(Haritos 2005: 77)

The impact of multilingualism on interpersonal communication is reported in terms of understanding and responding to the communicative needs of others; contextual sensitivity; interactional competence in communication; and enhanced skills in differentiating languages in contextually sensitive ways. This suggests that multilingualism tends towards multi-skills in interpersonal interaction. If so, then this can have a bearing on the potential for creativity.

An overview of the studies carried out on the effects of bilingualism clearly shows that, in contrast to monolingual children, bilingual children develop cognitive benefits such as communicative sensibility, creativity and metalinguistic awareness.
(Jessner 1999: 202)

By definition, interpersonal communication involves communicating with one or more people. There is much anecdotal opinion that cultural diversity leads to enhanced levels of creativity, but research on this question frequently deals with ethnicity or culture, and neglects to examine the impact of language.

Possible explanations for this evidence of a bilingual advantage are greater inhibitory control, greater metalinguistic understanding, and a greater sensitivity to sociolinguistic interactions with interlocutors.
(Goetz 2003: 1)

Cognitive research associates bilingualism with heightened mental flexibility and creative thinking skills, enhanced metalinguistic awareness, and greater communicative sensitivity.
(Lazaruk, 2007: 605)

There is little research done on the language dimension in relation to creativity and, for example, group performance and regional economic performance.

The idea of multilingualism resulting in innovative-generating interactions which enhance levels of creativity is an issue which is slowly being addressed from different perspectives. Multilingualism is thus viewed as one human phenomenon which can have a **POSITIVE IMPACT ON REGIONAL INNOVATION AND ECONOMIC GROWTH.**

Having access to multiple languages and cultures also seems to have a positive impact on the region's talent itself. People 'think differently', we were often told, as a result of their bilingualism or multilingualism.

A respondent from a consulting firm noted that when he is faced with difficult problems to solve, he intentionally forms strategy groups with multilingual staff. He observed that being multilingual means you understand the world from different perspectives and are more likely to devise creative and innovative solutions: it's 'good for the brain to have to learn how to work and think in [multiple languages]'.
(Stolarick & Florida, 2006: 1812)

The Ageing Mind

One possibly highly significant avenue of research which could very indirectly be linked to creativity relates to multilingualism and ageing. There is very little research reported to date, but the issue is considered significant enough to be included in this report, namely the **INTERFACE BETWEEN MULTILINGUALISM AND AGE-RELATED MENTAL DIMINISHMENT.**

The suggestion is that changes in the executive function and working memory resulting from knowledge of more than one language may slow down the rate of decline of certain cognitive processes as a person ages. Put simply, if the brain has more than one linguistic processing system, and is affected by organic or functional deterioration through normal ageing or even possibly forms of dementia, the rate of deterioration may be slowed down. Thus, rates of loss of cognitive function may be reduced by the greater capacity afforded by the different languages.

As scientists unlock more of the neurological secrets of the bilingual brain, they're learning that **SPEAKING MORE THAN ONE LANGUAGE MAY HAVE COGNITIVE BENEFITS THAT EXTEND FROM CHILDHOOD INTO OLD AGE.**
(Bilingual Brain: 2008)

The implications of any offset of age-related diminishment of cognitive function and processes could be considerable. If incoming research further reveals that multilinguals have a 'cognitive reserve' which protects against these aspects of ageing, then the consequences for multilingualism and age may be considerable for not only individuals and families, but for societies. Any link to creativity is in terms of greater potential for cognitive health amongst older age groups.

According to Brookmeyer, Gray and Kawas (1998), a 2-year delay in onset of Alzheimer's disease (AD) would reduce the prevalence in the United States by 1.94 million after 50 years, and delays as short as six months could have substantial public health implications.

Cognitive reserve is considered to provide a general protective function, possibly due to enhanced neural plasticity, compensatory use of alternative brain regions, or enriched brain vasculature.

The speculative conclusion (following Fratiglioni et al., 2004; Scarmeas & Stern, 2003; Staff et al., 2004; Valenzuela & Sachdev, 2006a, 2006b) is that bilingualism does not affect the accumulation of pathological factors associated with dementia, but rather enables the brain to better tolerate the accumulated pathologies.
(Bialystok, Craik & Freedman 2007: 459, 460 & 463)

Postscript

Like Antarctica, the fields of multilingualism and creativity are explored and claimed by many.

It is only in the last 200 years that the 'southern land' was established as a continent, and not just a collection of islands; and now, as we approach 2010, there is still lack of comprehensive understanding of how this continent influences the well-being of the planet, and what riches lie beneath its surface.

The same applies to languages, the brain, and human competencies. We are moving from multi-disciplinary modes of analysis towards convergence and integration. This is a time of consolidation and fusion, where societies take stock of their existing resources and ways of functioning in order to better align themselves for the challenges and opportunities of the new age, the Knowledge Society.

We are at a period of history where innovation through creativity is viewed as a major driver for social and economic success. Innovation is an essential component of a healthy society. One potential source for fueling innovation is multilingualism.

A key word that is found throughout this commentary is 'potential'.

Knowledge of more than one language points to the expansion of certain types of human potential, including the potential for creativity. In addition, thinking, learning, problem-solving and communicating – all of which are transversal, knowledge-steeped skills used in our daily lives – show signs of being enhanced through multilingualism.

Thus, knowledge of more than one language could well open up forms of added value which go beyond the languages themselves and lead to 'multicompetence'. The implications are wide-ranging. If there are cognitive and behavioural benefits resulting from knowledge of more than one language, then there is a need to examine how this potential can be realised so as to maximise advantage.

Recognition of European multilingualism as a lever for economic growth and social cohesion, and not as an 'expensive inconvenient reality', is one issue. Communicating the value of languages and supporting their development through policy and education is another. Valuing the knowledge and use of different languages, regardless of contemporary status, is yet another. Understanding the multilingual dimension can lead to pragmatic actions which can be taken to nurture the potential that the knowledge of languages can bring to individuals and the societies in which they live and work.

The world is leading to a new age in which science can examine the impact of languages on the brain. Over the next decade even greater insight is likely to be found. This understanding will be driven by the neurosciences, enabling us to clarify our knowledge of multilingualism and its relation to creativity and other factors.

This is happening at a time when competence-building through lifelong learning is of acute significance because of the speed of change in our societies.

The major future challenges in the educational field are how to reform our learning systems to prepare our young people for 'jobs that do not exist yet, using technologies that have not been invented yet, in order to solve problems that haven't been identified yet.

(Jan Figel 2009)

The evidence clusters described here suggest that multilingualism is a resource which has the potential to play a key role in responding to the challenges of the present and future. It is one existing resource which is likely to nourish emergent processes of creativity that will help expand individual and societal opportunities.

Review Group Statements

Plurilingualism and Creativity

Plurilingualism: The ability to communicate effectively in more than two languages, independently of the age at which those languages were acquired, and to respond to the demands of a given context.

Creativity: The ability to generate new processes by extending acquired data and knowledge.

Neuropsychological advantages of plurilingualism in acquiring creativity:

- Higher exposure to language input
- Higher development of selective attention
- Higher flexibility (task-switching)
- Semantic enrichment
- Higher control of interference between aural inputs
- Higher working memory
- Increased cognitive processing speed
- Priming (conceptual or perceptual)
- Neuronal connections and webs increased

It is our opinion that multilingualism generates a higher number of neuronal connections and stimulates multiple neuronal webs, both intra- and inter-hemispheric, which would lead to a higher capacity for generating new (creative and innovative) processes.

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REFERENCES: Multilingualism and Creativity: Towards an Evidence-base

- Abutalebi, J. Costa, A.: 2008, Editorial, Acquisition, Processing and Loss of L2: Functional, cognitive and neural perspectives. *Journal of Neurolinguistics* 21, 473–476
- Ansaldò, A., Marcotte, K., Fonseca, R., Scherer, L.: 2008, Neuroimaging of the bilingual brain: evidence and research methodology. *PSICO, Porto Alegre, PUCRS.* 39, 2 131-138.
- Baetens Beardsmore, H. 2008. Multilingualism, Cognition and Creativity. *International CLIL Research Journal*, 1: 1, 4-19.
- Bamford, K. and Mizokawa, D.: 1991, Additive-bilingual (immersion) education: Cognitive and language development. *Language Learning* 41, 3, 413-429
- Beacco J-C, 2005, Languages and Language Repertoires: Plurilingualism as a Way of Life in Europe. Council of Europe: Strasbourg
- Bekhtereva, N., Dan'ko, S., Starchenko, M., Pakhomov, S. & S. Medvedev 2001, Study of the brain organization of creativity: III. Brain activation assessed by the local cerebral blood flow and EEG. *Human physiology*, 27, 4 390-397. (Cites Guilford, J. & Hoepfher, R. *The Analysis of Intelligence*. New York: McGraw Hill 1971)
- Belz, J.: 2002, The myth of the deficient communicator. *Language Teaching Research* 6, 59–82
- Bialystok, E.: 1986, Factors in the growth of linguistic awareness, *Child Development* 57, 498-510
- Bialystok, E.: 2006, Effect of bilingualism and computer video game experience on the Simon task. *Canadian Journal of Experimental Psychology*, 60, 68–79
- Bialystok, E.: 2007. *The International Journal of Bilingual Education and Bilingualism*, Vol. 10, No. 3, p 210
- Bialystok, E., Craik, F., Grady, C., Chau, W., Ishii, R., Gunji, A. & Pantev, C.: 2005, Effect of bilingualism on cognitive control in the Simon task: Evidence from MEG. *NeuroImage*, 24, 1, 40–49
- Bialystok, E., Craik, F., Freedman, M.: 2007, Bilingualism as a protection against the onset of symptoms of dementia. *Neuropsychologia*, 45, 459-464
- Bialystok, E. and Hakuta, K.:1994, *In Other Words: The Science and Psychology of Second-Language Acquisition*. New York, Basic Books
- Bialystok, E. and Shapero, D.: 2005, Ambiguous benefits: the effect of bilingualism on reversing ambiguous figures. *Developmental Science*, 8, 6, 595-604
- Bialystok, E., Shenfield, T. and Codd, J.: 2000, Language, scripts, and the environment: factors in developing concepts of print. *Developmental Psychology* 36, 66-76
- Bilingual Brain: 2008. *Brain Briefings*, (September) Society for Neuroscience, Washington DC
http://web.sfn.org/index.cfm?pagename=brainBriefings_thebilingualbrain
- Billiez, J., Bourguignon, C., Wharton, S.: 1997, Évaluation des compétences bilingues des élèves de troisième année de l'école moyenne du Val d'Aoste. Grenoble/Aoste, LIDILEM/Région Autonome Vallée d'Aoste
- Braun, A. 2007 *Immersion et compréhension en lecture*, in Puren, L. & Babault, S. (eds) *L'Éducation au-delà des frontières*. Paris, L'Harmattan. 215-257

Brookmeyer R., Gray S., Kawas C., 1998. Projections of Alzheimer's disease in the United States and public health impact of delaying disease onset. *American Journal of Public Health* 88:1337-1342

Carlson, S. and Meltzoff, A.: 2008, Bilingual experience and executive functioning in young children. *Developmental Science*, 11, 2, 282-298

CERI: 2007. *Understanding the Brain: The Birth of a Learning Science*. OECD: Paris

Colzato, L., Bajo, M., van den Wildenberg, W., Paolieri, D., Nieuwenhuis, S., La Heij, W., and Hommel, B.: 2008, How does bilingualism improve executive control? A comparison of active and reactive inhibition mechanisms. *Journal of Experimental Psychology: Learning, Memory and Cognition* 34, 2, 302-312

Clarkson, P.: 2007, Australian Vietnamese students learning mathematics: High ability bilinguals and their use of their languages. *Educational Studies in Mathematics*, 64, 195-215

Common European Framework of Reference: 2001. Council of Europe: Strasbourg

Coggins, P., Kennedy, T., Armstrong, T.: 2004, Bilingual corpus callosum variability. *Brain and Language* 89, 69-75

Cook, V.: 1992, Evidence for multi-competence. *Language Learning* 42, 4, 557-91

Council of Europe: 2007a. *From Linguistic Diversity to Plurilingual Education: Guide for the Development of Language Education Policies in Europe*.
http://www.coe.int/t/dg4/linguistic/Guide_niveau2_EN.asp

Council of Europe: 2007b, *The Common European Framework in its political and educational context*.
http://www.coe.int/t/dg4/linguistic/Source/Framework_EN.pdf.)

Cummins, J.: 1977, Cognitive factors associated with the attainment of intermediate levels of bilingual skills. *Modern Language Journal*, 61, 3-12

de Brabandere, L.: 2005, *The Forgotten Half of Change: Achieving Greater Creativity through Changes in Perception*. Dearborn: Chicago

Dietrich, A.: 2007. Who's afraid of a cognitive neuroscience of creativity? *Methods* 42, Elsevier

Doidge, N. 2007. *The Brain that Changes Itself*. Penguin: London

EC : 2007. Commission of the European Communities, Final Report, High Level group on Multilingualism: Luxembourg

EC : 2009. http://ec.europa.eu/education/languages/language-teaching/doc34_en.htm

Eviatar, Z and Ibrahim, R.: 2000, Bilingual is as bilingual does: Metalinguistic abilities of Arabic-speaking children. *Applied Psycholinguistics* 21, 451-471

Flynn, S., Foley, C. and Vinnitskaya I.: 2004, The Cumulative-Enhancement model for language acquisition: comparing adults' and childrens' patterns of development in first, second and third language acquisition of relative clauses. *The International Journal of Multilingualism* 1, 1, 13-16.

Figel, J.: 2009. Quoted in *Le Magazine* 31 / 2009.

- Fratiglioni, L., Paillard-Borg, S., & Winblad, B. (2004). An active and socially integrated lifestyle in late life might protect against dementia. *Lancet Neurology*, 3, 343-353
- Gajo, L. & Serra, C. 2002 Bilingual teaching: Connecting language and concepts in mathematics. In: So, D. & Jones, G. (eds) *Education and Society in Plurilingual Contexts*. VUB Brussels University Press, Brussels, 75-95
- Giussani, C., Roux, F. E., Lubrano, V., Gaini, S. M. & Bello, L.: 2007, Review of language organisation in bilingual patients: what can we learn from direct brain mapping? *Acta Neurochirurgica*, 149, 1109-1116
- Goetz, P. 2003, The effects of bilingualism on theory of mind development. *Bilingualism: Language and Cognition*, 6, 1 – (1-15)
- Hakuta, K.: 1990, Language and cognition in bilingual children, in A. Padilla, C. Valdez & H. Fairchild (eds.). *Bilingual Education: Issues and Strategies (47-59)*. Newbury Park, California: Sage Publications
- Haritos,: 2005, The language ecology of bilingual memory. *Academic Exchange Quarterly* 9, 3, 77-82
- Hernandez, A. E., Dapretto, M., Mazziotta, J., & Bookheimer, S.: 2001, Language switching and language representation in Spanish-English bilinguals: An MRI study. *NeuroImage*, 14, 510-520
- Jessner, U.: 1999, Metalinguistic awareness in multilingual speakers: Cognitive aspects of third language learning. *Language Awareness* 8, 3 & 4, 201-209.
- Jessner, U. A.: 2008. DST Model of Multilingualism and the Role of Metalinguistic Awareness. *The Modern Language Journal* 92, ii.
- Kessler, C. & Quinn, M.: 1987, Language minority children's linguistic and cognitive creativity, in G. MacEoin, A. Ahiqvist, and D. Haodha (eds.) *Third International Conference on Minority Languages: General Papers*, 173-187. *Multilingual Matters*, Clevedon
- Kharkhurin, A. V.: 2007, The role of cross-linguistic and cross-cultural experiences in bilinguals' divergent thinking, in I. Kecskes and L. Albertazzi (eds). *Cognitive Aspects of Bilingualism*, 175-210, Springer, Dordrecht
- Kharkhurin, A.: 2008, The effect of linguistic proficiency, age of second language acquisition, and length of exposure to a new cultural environment on bilinguals' divergent thinking. *Bilingualism: Language and Cognition* 11,2,225-243, Cambridge University Press
- Kormi-Nouri, R., Shojaei, R.-S., Moniri, S., Gholami, A.-R., Moradi, A.-R., Akbari-Zardkhaneh, S. & Nilsson, L.-G.: 2008, The effect of childhood bilingualism on episodic and semantic memory tasks. *Scandinavian Journal of Psychology*, 49, 93–109
- Lamsfuss-Schenk, S. 2008: *Fremdverstehen im bilingualen Geschichtsunterricht*. Frankfurt/Main: Peter Lang
- Lazaruk, W.: 2007, Linguistic, Academic and Cognitive Benefits of French Immersion. *Canadian Modern Language Review* 63 (5) 605-628. Toronto: University of Toronto
- Moore, D.: 2006, Plurilingualism and strategic competence in context. *International Journal of Multilingualism*, 3, 2, 125-138
- NACCCE: 1999. *All our Futures: Creativity, Culture and Education*. National Advisory Committee on Creative and Cultural Education, 1999. NACCCE, UK <http://www.cypni.org.uk/downloads/alloutfutures.pdf>

- Osterhout, L., Poliakova, A., Inoue, K., McLaughlin, J., Valentine, G., Pitkanen, I., Frenck-Mestre, C., and Hirschensohn, J.: 2008, Second-language learning and changes in the brain. *Journal of Neurolinguistics* 21, 509–521
- Ozolins, U.: 2003, Language and economics: Mutual Incompatibilities, or a Necessary Partnership? *Current Issues in Language Planning*, 4, 1 67-84
- Peal, E and Lambert, W.: 1962, The relation of bilingualism to intelligence. *Psychological Monographs* 76, 27, 1-23
- Senge, P. 2006. *The Fifth Discipline: the art and practice of the learning organisation*. Doubleday / Currency
- Scarmeas, N., & Stern, Y. (2003). Cognitive reserve and lifestyle. *Journal of Clinical and Experimental Neuropsychology*, 25, 625-633
- Schatz, C.: 1996. Quoted in media article, Your Child's Brain. *Newsweek*: 19 February
- Sierra, J. 2008 Assessment of Bilingual Education in the Basque Country, in Cenoz, J. (ed.) *Teaching Through Basque: Achievements and Challenges*. Clevedon, Multilingual Matters, 39-47
- Singleton, D. & Aronin, L. 2007, Multiple language learning in the light of the theory of affordances. *Innovation in Language Learning and Teaching*, 1, 1
- Smith, S. M.: 2008, Invisible Assumptions and the Unintentional Use of Knowledge and Experiences in Creative Cognition. *Lewis & Clarke Law Review*, Lewis & Clarke law School, Portland, Oregon
- Staff, R. T., Murray, A. D., Deary, I. J., & Whalley, L. J. (2004). What provides cerebral reserve? *Brain*, 27, 1191-1199
- Stolarick, K., Florida, R.: 2006, Creativity, connections and innovation: a study of linkages in the Montréal region. *Environment and Planning A*, 2006, 38, 1799-1817
- Tokuhama-Espinosa, T.: 2008, *Living Languages – Multilingualism across the Lifespan*. Praeger: London
- Valenzuela, M. J., & Sachdev, P. (2006a). Brain reserve and dementia: A systematic review. *Psychological Medicine*, 36, 441-454
- Valenzuela, M. J., & Sachdev, P. (2006b). Brain reserve and cognitive decline: A non-parametric systematic review. *Psychological Medicine*, 36, 1065-1073
- Zydatiß, Wolfgang: *Deutsch-Englische Züge in Berlin (DEZIBEL): Eine Evaluation des bilingualen Sachfachunterrichts an Gymnasien*. Frankfurt: Peter Lang 2009