

Educational Neuroscience and Early Childhood Education

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Abstract

This paper attempts to explore the neuroscientific approach in education, its positive and negative impacts on children, the associated ethical and moral concerns, and its application in early childhood learning. Numerous scholars are of the viewpoint that the educational techniques applied in education are linked to recent advancements made in the field of neuroscience, like application of brain-based education in early childhood learning. They suggest that methods of instruction, compatible with the brain tend to follow constructivist approaches and involve open-ended, process-based, discovery and learner-centred activities. “Brain compatible” teaching is believed to be accomplished by catering to different learning styles of students and also to multiple intelligences. Sensory experiences in the form of different kinds of play and video games prove to be effective in enhancing cognitive and emotional abilities and also in seeking attention. Creation of a congenial environment, adoption of developmentally appropriate practices taking care of the ethical and moral concerns are crucial elements in Early Childhood Education. An amalgamated approach looking into aspects of child development, cognitive and behavioural science needs to be adapted along with the neuroscientific approach, in order to promote positive learning outcomes and all around development of the learners.

Keywords: *educational neuroscience, neuroscientific approach, neuromyth, neuroethics, early childhood, learning, cognition*

Introduction

The current era has witnessed rapid technological advancement which has brought forth many challenges before the educationists, philosophers, neuroscientists and researchers, as to how children should be taught, so as to bring about positive learning outcomes, at the same time catering to individual differences and addressing the needs of special children. These challenges are being faced by educators at all levels of education. Zambo (2013) has highlighted the usefulness of educational neuroscience in teaching young children. She argues that the schools, homes and communities can contribute in creating a congenial environment for learners, if findings from neuroscience, education, psychology and sociology are substantially utilised to understand not only the strengths and weaknesses but also the abilities and needs of each and every child. With the development of the field of cognitive neuroscience which explores the mechanisms of change at the level of cognitive and neural systems, much attention is being paid on the role of educational experiences in shaping the functional circuits in the brain, associated with complex cognitive skills such as reading or math. Such kinds of studies marked the

emergence of the field of ‘Educational Neuroscience.’ This paper attempts to explore the neuroscientific approach, its positive and negative effects, the associated ethical and moral concerns, and its application in early childhood learning.

Educational neuroscience: Boon or bane

Educational neuroscience connotes the intersection between the mind, the brain and education. It has not only percolated the textbooks but also in the curriculum of teacher training programmes. Numerous researchers have highlighted the importance of neuroscience in education. Educational Neuroscience (EN) draws upon varied theoretical perspectives from neuroscientific, pedagogical and classroom praxis and establishes a judicious interrelation of insights, drawing upon an ethos of evidence-informed scientific understanding of the behaviour of the brain and its association with development of innovative and novel teaching and learning strategies. Gaeke, 2009, states that educationists need to work in collaboration with neuroscientists in order to contribute to effective realisation of educational applications (p.8). Gaeke enumerates the benefits of neuroscience in education, by saying that application of

evidences gathered from neuroscience in education can prove to be an effective means of reclamation of eroded professional autonomy (Gaeke, 2009, p.7).

A number of researchers argue that neuroscience guides several theories and principles of learning for e.g. many theories like ‘Theory of Cognitive Development’ (Piaget), ‘Identity and Personality Development’ (Erickson) and ‘Moral Development Theory’ (Kohlberg) have stated that development is a linear progress which passes through various stages. A belief which was commonly held by these psychologists was that the development stages are largely predictable. The effect of neuroscience on Piaget’s cognitive development theory can be seen when he talks about the processes of assimilation, accommodation and equilibration. Zambo states that neuroscience goes on to a large extent, in helping teachers understand the biology of their pupils, their learning styles, behaviours etc. It not only helps in development of effective behaviour regulation strategies but also proves as an effective means of aligning the conceptual challenges by understanding the processes adopted by the human brain to decode and comprehend language (Hruby & Goswami 2011, as cited in Zambo, D. 2013, p.11). Traditionally, EN is believed to be of utmost importance for children, especially those with learning difficulties and struggling to progress in mainstream curriculum. It not only offers insights into variations in brain development and its relationship with variation in the cognitive, affective, and social development which are of utmost importance for development of not only robust but also valid learning theories, which can be applied on all kinds of learners (Gabrieli, 2016).

It is no doubt that EN has multiple benefits but several researchers have provided empirical evidences and have warned educators to be very cautious while applying the neuroscientific approach in dealing with the learners (Paradis, 2007; Wilis, 2006; Bruer, 1999, 2006, as cited in Zambo, D. 2013, p.11.). The inability of teachers to understand the functioning of the brain and the process of development is likely to influence their views on various learning disorders in their students, which in turn impacts the learning outcomes in students suffering from any kind of disorders (Jones, 2014, p. 817). OECD (UK’s Brain and Learning Project, 2002) defined Neuro

myths as “misconception generated by a misunderstanding a misreading or a misquoting of facts scientifically established (by brain research) to make a case for use of brain research in education and other contexts.” Neuromyths are not only influenced by cultural conditions but also by language barriers and biases (Jones, 2014, p. 818-819).

As rightly stated by Howard Jones (2010), neuromyths have a strong bearing on moulding the perception, beliefs and views of educators. So, it is very necessary for the teacher educators to be cautious that their student do not gain any faulty ideas from them and engage in unethical treatment with children later during their professional life. A similar argument was made by Geake, 2009, p. 12, stating that neuroscience account of learning is sometimes not applied appropriately in the classroom. Teaching being a noble profession and a moral enterprise should take care of the ethical principles while dealing with the young and innocent minds.

Brain based education in early childhood

Last several decades have witnessed important developments in the field of neuroscience and in technology, that have provided insights into how the brain function of students can be monitored while they are reading, finding solutions to mathematical problems, or are engaged in performing other kinds of educational tasks. Jensen (2008) called for “a new paradigm,” what he referred to as ‘brain-based education’. This novel paradigm gave rise to numerous claims, that techniques which are “brain-based” are presumed to be more effective, without any empirical evidences of their effectiveness, so the claim seemed superficial. Research in neuroscience provided possibilities to critically evaluate these claims and engage in evidence-based-practice in education. Several educationists have tried to establish links between educational techniques to recent advancements made in the field of neuroscience, suggesting that some instructional techniques are brain based (Laster, 2008), compatible with the brain (Tate, 2003, 2004, 2005, 2009; Ronis, 2007), brain friendly (Perez, 2008), or brain targeted (Hardiman, 2003). They suggest that methods of instruction that are compatible with the brain tend to follow constructivist approaches involving open-ended, process-based, discovery and learner-centred activities. Some authors are of the viewpoint that “brain

compatible” teaching can be accomplished by catering to different learning styles of students and also to multiple intelligences (Sprenger, 1999; Ronis, 2007; Tate, 2009).

Creation of suitable environments to promote learning and cognition in children

Gaming experiences in the form of video games enhance performance of children on a variety of tasks like tracking of multiple objects (Green & Bavelier, 2006), exploration of a distracting background and identification of target objects (Green & Bavelier, 2006). However, video games have little role to play in enhancement of perceptual, visuomotor and attentional skills (Green & Bavelier, 2006). In early childhood learning, free play appears to be more useful for cognitive development than organised physical activity (Burdette & Whitaker, 2005). Free play mainly involves gross motor play but activities such as role-playing, pretend play and those involving manipulating and building or creating objects can also be included. Burdette and Whitaker have reported that these bring about improvement in attention, emotional and cognitive effects in children. According to Szalavitz & Perry, 2011, play nurtures brain development through involvement of emotions and cognition in sensorimotor activity, executive function, and language expression. Synaptic connections are stimulated through pretend play.

Principles of learning: Connecting theory with practice

Brian Cambourne (2001), an Australian educator, on the basis of his observations of writing skills of children upto 3 years, developed eight literacy learning conditions. Rushton et al., 2003, on the basis of the brain research principles aligned Cambourne’s “Conditions of Literacy Learning” in the same way as Rushton and Larkin (2001) did with the Developmentally Appropriate Practice (DAP) principles. Rushton and Larkin (2001), believed that if DAP and “Cambourne’s Conditions of Literacy Learning”, are aligned with the principles from neuroscience, a compelling theory can be created on which teaching practices can be based. They suggested the following principles of learning:

- Immersion of the child in a stimulating environment involving all the senses and characterised by emotional elements that alert the neurological networks of the child’s brain

enabling him/her to be attentive and thus learning is likely to occur.

- Providing stimulating lessons which are modelled in a non-threatening manner focus student’s attention and their creative abilities are expressed.
- A non-threatening environment is characterised by ‘freedom of choice’ i.e. the students are free to make relevant choices with regard to daily activities and the content of study.
- Children need to feel safe and hence allowing mistakes and recognising their accomplishments help them learn more effectively without any fear. The amygdala in the child’s brain is believed to have an intense impact on children’s response to stress. If the amygdala is stimulated in stressful conditions, the hormones and the neurotransmitters inhibit rational thought.
- Play method is useful if it is open-ended and caters not only to the individual differences but also the unique talents of the young learners.
- If the early educators are caring and imaginative, accept the ‘child,’ as a whole and encourage natural progression of learning, they make the children feel more confident. about their abilities, children have trust in their teacher, and hence find themselves more inclined towards learning.

Interface between Neuroscience and Education: Ethical and moral concerns

With the increased percolation of neuroscience in the lives of young children, it is very important to look into the ethical and moral issues too. Neuroscience being a boon as well as a bane can have social, ethical and legal implications. The concept of ‘neuroethics’ has emerged to help educators to pay attention to these concerns. According to Racine and Illes (2006) (as cited in Zambo, D., 2013, p.12). Neuroethics focuses on the inappropriate manipulation of the human brain. Zambo, on the basis of her experiences as a teacher educator while dealing with pre-service and in-service teachers has talked about the neuromyths which her students had, and that too with little scientific truth. They seemed to pay attention to only those ideas which were in consonance with their own beliefs and seemed to ignore the valid information which was being provided to them

through the lectures during their teacher training programmes. Gazzinga states that neuroscience and ethics do not amalgamate easily and this is clearly evident from the fact that we tend to focus only on those ideas which are in consonance with our beliefs and emotions, which may unfairly cloud the judgement of the educators. Not only teachers but parents and the caregivers unconsciously propagate ideas which may hamper a child's development for e.g. providing medicines to children suffering from attention deficit and having trouble in self-regulation. We need to question ourselves whether it is just to put our children on medication just because we want them to be successful not only academically but also in other spheres of life. Zambo, on the basis of her research observations has categorised teachers into: believers (those who consider neuroscientists as experts and rely on new technologies to ascertain what and how to teach and on dealing with students with special needs), believers with reservations (those who believe that apart from neuroscience, information from the fields of child development, educational psychology and psychiatry should also be used) and non-believers (who believed that interactions between students and teachers are more important than a brain image captured on a screen).

Teachers nowadays seem to find it very difficult to care for the free will, identity and feeling of self-worth of every child and every teacher has her/his unique way of responding to these issues. The values which the teachers hold influence their behaviour and the ways in which they respond to their students' needs. Brunkhorst, 2005, as cited in Zambo, 2013, p.15, on the other hand goes to the extent of saying that the values that the teachers have influence their actions and the teachers who have genuine interest in their students' moral development adopt such teaching strategies which help in development of creativity, enhance interest of their students and also bring out their inherent potential. These teachers do not fail to accept the moral challenges which appear before them, are passionate about their profession and are very cautious of retaining their genuine interest in deep learning. As rightly stated, the best way to inculcate values in our learners is to model sensitivity, care and genuine respect towards each individual, their family as well as the

community which they are a part of, overcoming racial, gender, religious and other biases. Zambo, 2013, pp 17, states that philosophers have outlined five approaches to moral decisions:

A utilitarian approach: which believes in prevention as well as cure. In other words, it aims in preventing acts which are harmful, which penalise offenders and prevent rehabilitation of those who can be saved from the bad consequences of immoral and unethical acts.

A rights approach: which believes in an individual's right to know the truth, safety, freedom of choice, take decisions and the right to have their choices honoured. These rights are considered more important than effects of scientific advances.

A fairness or justice approach: which is strongly against favouritism and discrimination as proposed by Noddings (1999, 2005a, 2005b) (as cited in Zambo, D. 2013, p.17.) who highlights the importance of finding out the answer to the question that "who would be the beneficiaries of such an approach, and who will be the losers?"

A common good approach: believes in developing communities based on common goals and values. A similar approach was suggested by Law, 2005, as cited in Zambo, D. 2013, p.18., who proposed the idea of moral schools which ensure development of each and every individual.

A virtue approach: proponents of this approach like Bulloch and Brunkhorst believe in nurturance of values with a spirit of compassion, reflection, honesty and integrity, to enable everyone to live up to certain ideals.

Each approach has its benefits and the responsibility lies on the teachers, parents as well as the caregivers to derive the best out of them, to benefit the children.

Conclusion

Educational Neuroscience (EN) is a field which draws upon a number of theoretical perspectives from neuroscientific, pedagogical and classroom praxis and establishes a judicious interrelation of insights drawing upon an ethos of evidence-informed scientific understanding of the behaviour of the brain and its association with development of new teaching and learning

strategies. The ethical and moral issues associated with application of neuroscience in education are still a matter of debate. The teachers, parents and caregivers of young children need to be very cautious while dealing with them. Teachers need to have a thorough understanding of the needs of the learners, aim at their overall development and be cautious not to promote neuromyths, as their own beliefs and decisions can have a negative impact on the young children. We need to realise that the information derived from neuroscience can be extended, modified according to our own beliefs

and myths. An amalgamated approach looking into aspects of child development, cognitive and behavioural science needs to be adapted along with the neuroscientific approach, in order to promote positive learning outcomes and all around development of the learners. No doubt, there are a variety of evidences to support the contribution of neuroscience in suggesting good pedagogical practices, their contribution in resolution of dilemmas and in suggesting alternatives in pedagogy and curriculum design and its potential in improved practice needs further exploration.

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