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Neuroatelier: Learning Neuroscience in the Early Years

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Abstract

Neuroatelier is an educational programme created for the needs of global neuroscience promotion event Brain Awareness Week 2016 and developed through 2016 in many cultural centres, libraries and kindergartens in Belgrade in Serbia. As pedagogues we created this programme in consultation with students who study neuroscience related concepts in their faculties (biology, molecular biology, medicine, physical chemistry). The programme is based on STEAM (Science, Technology, Engineering, Arts, Mathematics) approach to education as well as interactive approach in planning activities with children and intended for preschool children age 4 to 6. The activities are structured so children could learn together with other children and stu dents about basic neuroscience concepts through active engagement in different self-chosen semi-structured learning spaces through interaction with artistic materials which invite children to explore, discuss about and co-construct with them. There are five semi-structured spaces offering different provocative materials: I Neuro-colouring book, II Neuro-straws, III Neuro-mold, IV Neuro-tattoo, V Neuro-constellation. Within them participants of the programme developed their theories about neuroscience concepts through artistic engagement and on that basis science relevant discussion. Therefore, this programme was an opportunity for children to learn about neuroscience and for students to experience about how children learn and how the process of creating and developing the programme looks like form the insider's perspective.

Keyword : neuroscience, preschool children, STEAM, educational programme, science students

1. Introduction – what is STEAM?

In modern times the apartness of social and natural sciences, as well science and arts has become an important notion. Inter, multy and transdiscilinarity in science are substituting unificity and convergent, one-solution and one-perspective oriented thinking. Those are seen as the way of dealing with the challenges and complexity of the changing world, so the art is seen as medium which integrates content and enables expressing the personal perspective.

In accordance with those issues some new approaches and educational philosophies had emerged. Approach and movement which is drawing great attention is STEAM (science, technology, engineering, art, and mathematics) approach to education. The new acronym STEAM derived from STEM plus Arts and refers to integration of different arts (visual arts, drama, music, dance, 3D modeling, crafts etc.) in learning STEM concepts [1].

This movement highlights the importance of arts which is not supplementary subject but integrate disciplines and extend perspectives, ways of seeing, thinking and learning [1][3].Visual and performing arts are seen as integrating element which could enhance learning within and across disciplines. The arts perspective opens up possabilities for considering science problems from different perspectives through finding multiple solutions, creating authentic algorithm and pathways [3].

Gardner (1993), Malaguzzi (1998) and Eisner (2002) mentioned the preschool child as an artist whose creativity is without limits or restrictions [2]. Therefore, the child is considered as an expert for own life, competent, creative, curious, full of potential and ambitious entity. That child speaks 100 languages through using different symbolic systems [4]. Competent child-researcher learns by asking questions, discussing, creating and making sense of the world through co-construction with others in varius cultural context. In this qualitative transformation of participation, the child, the others and the cultural practice transform [6] so the child is co-constructing and reconstructing own theories of the world [5].

2. Neuroatelier – STEAM based programme

Neuroatelier is an interactive, artistic, playful programme which was developed for the needs of neuroscience promotion event Brain Awareness Week 2016 in Belgrade in Serbia (14-20/3/2016) and realised during and after this event in more then ten kindergartens, libraries and cultural centers in Belgrade (Serbia). The programme was intended for preschool children age 4 to 6 and based on STEAM approach to education and interactive approach to working with children. In this programme

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visual and applied arts are medium through which children are expressing themselves and simultaneously learning about neuroscience. As pedagogues we created this programme in consultation with students from Students' Section of Serbian Neuroscience Society who study neuroscience related concepts at their faculties (biology, molecular biology, medicine, physical chemistry) with the aim to offer opportunities for developing creativity in children, support the development of scientific view of the world and encourage science students to create educational science programmes.

2.1. Strand 1 – learning neuroscience with children

Regarding this educational programme we created flexible space to support learning. The space we created is flexible and open-ended for different creations. Although, the entire duration of this programme is approximately 1.5-2 hours (depending on the context and children′s choice) it is time flexible and structured around 4 activities: I Interactive storytelling, II Microscoping, III Five learning spaces, IV Brain-canvas.

I Interactive storytelling

In this introductory activity two student-coordinators are talking about nervous system. Student-coordinators welcome children and other participants (other students, librarian, cultural centre officers, kindergarten teachers, parents). After that, they involve them in collaborative storytelling where the assembly of the human body parts is shown on a printed pattern of the human body. Each child extracts one element (usually organ shaped image) from the bag and fit it into the appropriate place on the human body pattern. A discussion on the role and significance of the brain in the organ systems follows. Two student-facilitators are asking questions about significance of the brain, whole nervous system and other parts of the body structure and functions. At the same time, children ask questions and talk about their experiences regarding questions and further discussion develops.

Also, children had opportunity to simulate in playful manner how impuls (information) from outside world ′travel′ though all body parts to the brain and back by using toy-car as medium. Nerves that we have in the whole body were usualy compared with neuro-highways that transmit impulses to the brain and back. In our programme, children were ′drivers′, impulses were children′s experiences from everyday life (e.g. mosquito bite, bicycle fall), ′highways′ were nerves and brain the destination. On the other hand, the team used 3D models of the the brain anatomy, various nerve cells and few prickly balls which helped in discussing the function of neurotransmiters presented as ′juice energy balls′ in intercell communication.

Depending on the place, group of children and other participants, we changed and adjusted the programme according to the context. For example, when we visited the Spanish Language Institute Cevrantes in Belgrade, in the first section children were engaged in interactive storytelling about the scientific and artistic work of famous spanish neuroscientist and Nobel prize laureate Santiago Ramón y Cajal. A student of molecular biology played a role of Ramón y Cajal and led children through Neuroatelier. The drama gave a new experience to children by the fact that the children imagined that there were really Nobel laureate in front of them, which motivated them further to discourage neuroscience. Also, when we organised this programme in the French Institute student-coordinators and French teacher spoke with children about neuroscience simultaneously in Serbian and French.

II Microscoping

When the children and student-coordinators finished the discussion in the manner of interactive storytelling, the children were invited to see the brain and spinal cord slides through a light miscroscopes and then to make a personal record. All the children on themselves drew in white, round circle marked ′this is what I see?′ of seen slides.

III Five learning spaces

In the artistic section children had personal miscroscope record as ′invitation entrance card′. Afterwards, they made unique neuroscientific piece of art by using different materials in different learning spaces. Above all in five learning spaces these artistic products were motive for a dialogue about basic neuroscience concepts and neurosystem functions with student-coordinators and other participants (children, librarian, kindergarten teachers...).

In Neuroatelier children could choose one or more learning spaces, materials and engage in activities with other participants for the time they decided. In all learning spaces there were various artistic materials such as homemade playdough, watercolours, expanded coloured rice, aluminium foil, chalks, straws, toothpick, colours for children's tattoos etc. The activities were structured so children could learn together with other children and students-coordinators about basic neuroscience concepts through active engagement in different self-chosen semi-structured learning spaces through interaction with provocative artistic materials which invite children to explore, discuss about and co-

construct with them. They discussed about neuroscience concepts in different learning spaces where the artictic activities were provocation for the discussion and the manner in which children expressed their view of those concepts. There were five semi-structured spaces offering different provocative materials:

1) learning space: Neuro-colouring book – In this learning space children were offered some artistic materials like neuro-hat template, colouring material, various neuron, synapse, brain and spinal cord coluring book samples.
2) learning space: Neuro-straws – In this learning space children had opportunity to model a 3D structures of different types of neurons and other neuroscience related concepts. They used varius materials – coloured straws, toothpicks, expanded rice and homemade playdough.
3) learning space: Neuro-mold – Neuro-mold learning environment invited children to explore and create brain models with natural, homemade playdough in brain-shaped molds and paint them additionaly with colours.

Fig. 1. Children and biology student playing together with materials in the Neuro-mold learning space

4) learning space: Neuro-tattoo – Neuro-tattoo offered children artistic materials for creating and discussing about neuroscience related tattoos they have chosen from the ′tattoo catalogue′. Student-coordinator and the children themselves draw on hand and forearm using various facepainting colours. They were the tattoo artists and scientists at the same time.

5) learning space: Neuro-constellation – In this learning space children were offered some artistic materials for creating neuro-constellation which represented neurons conneted via synapses like the stars look connected in constellation. For creating this learning environment there were blue paper canvas, aluminum foil, glue and white chalk.

IV Brain-canvas
Ten minutes before the end of the programme, children could describe how and why they liked or not in the experience of participating the programme. They could choose the colour and leave their various colored handprints on brain shaped paper canvas. The student-coordinator explained the children that the handprints represent the bodies of the brain nerve cells so they are ′talking′ to each other on canvas. Since every child had the choice, left personal handprinted ′neuron body′, discussed about it with children and other participants and finally connected the neuron bodies so together they create the whole brain.

2.2. Strand 2 – creating programme with neuroscience students

As members of multidisciplinary team of 15 science students who study neuroscience related concepts at their faculties (biology, molecular biology, medicine, physical chemistry) and two pedagogy students have seen how the process of creating and developing educational science programme looks like form the insiders′ perspective.

Since the pegagogy and science students are mastering in different science content, their knowledge about educational programme development and neuroscience content are complementary, the experience of participating in this programme gave us some practical insights about creating science educational programme for preschool children. Hereby, students had opportunity to co-create an open-ended learning environment. This process had more interconnected and interdependant steps. Firstly, pedagogy students initiated the meeting and proposed semi-structured idea of creating educational programme Neuroatelier for preschool children age 4 to 6. Science students and pedagogues discussed advantages, disadvantages and possabilities of creating the programme. Then, the team had several meetings and continual online discussion with relevant emerging ideas. All the team members took part in some aspect of creating, organising and realising the programme. Many issues appeared throughout the process – choosing appropriate neuroscience concepts (neuron, synapse, action potential, brain anatomy, relation between neurosystem and other human body organ systems etc.) out of disposable content and learning resources (textbooks, encyclopedias, Internet sources, students' wider knowledge), negotiating the science perspectives since team members had different prefferences in neuroscience regarding their studies curriculum content orientation (e.g. molecular biology – microprocesses in the neuron, medicine – prevention and illness), deciding about which and how many artistic materials are adequate to give the children opportunity to explore the neuroscience concepts through active engagement and discussion with other participants, modifying a programme to a group size, structure, age, time and architecture of the room where it took place, how to organise dosposable materials for all learning spaces in the kindergarten, library or cultural center where we have realised the programme; creating the programme semi-structured scenario; deciding about the roles in the scenario, using artistic materials, arranging learning spaces, being student-coordinator etc.

3. Conclusion

In this paper we tried to present STEAM based educational programme oriented towards learning neuroscience. Although there is public opinion that it is very complicated even for school aged children to understand these concepts, we have shown that in Neuroatelier children learn in interactive and creative manner. On one hand, the value of this programme is seen as creating learning environment in which preschool children could learn about neuroscience concepts through active engagement with different materials in various social relations and manners of artistic expression. On the other hand, this programme opens opportunities for science students to learn about the process of creating educatonal programme from insiders' perspective through continual discussion, practical organisation and coordination with pedagogues and science students from other science disciplines.

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