Identify STEM Education and Activities for Information Technology

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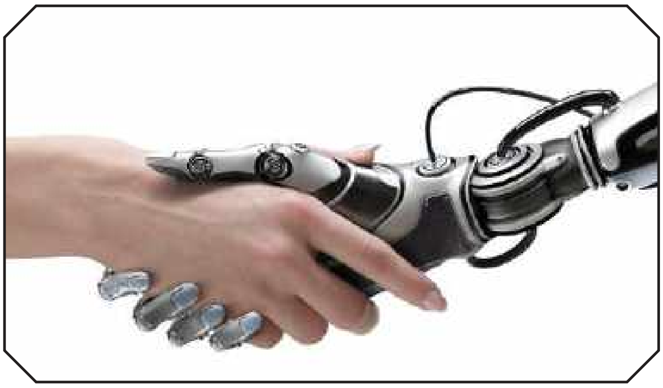
The most significant set of events that impacted the social, economic and cultural changes in human society began with the start of the industrial revolution. The industrial revolution that fashioned the present and that of the 21st century began with the first industrial revolution of the 18th century. The first industrial revolution began with steam power and its mechanization process. It was followed by the second industrial revolution in the 19th century. The second industrial revolution marked the invention of electricity, and the assembly line manufacturing process. Third industrial revolution which began around the 1970s continues into the present. The third industrial revolution refers to the digital revolution which is the shift from mechanical and analogue electronic technology to digital electronics. The digital revolution marked the beginning of the information age. It is the era of rapid knowledge expansion. Knowledge of the world doubles within less than two year periods at present. The third industrial revolution is expected to transit into fourth industrial revolution by as early as 2030. The fourth industrial revolution refers to the technology revolution. A technological revolution is a period in which one or more technologies are replaced by another technology in a short period of time. It is an era of accelerated technological progress characterized by new innovations whose rapid application and diffusion can cause an abrupt change in society. Artificial intelligence and automation are the key driving forces of the future world. Some of the present jobs will disappear, or the shape of the present jobs will be changed. It will create many unique facilities driven on technology as well as many unpredictable challenges to human society. Thus, the technology-driven world in which we live is a world filled with not only promise, but also challenges. Creating a suitable work force for future requirement will be a real challenge to the education sector. The key factors for all the industrial revolutions from the first industrial revolution are innovation and creativity. It is predicted that according to thus current pattern, the future society will be based on innovation and creativity in the fields of Science, Technology, Engineering and Mathematics. The 21st century skills are mainly identified under three headings. These are 1. Career and Life Skills 2. Innovation and Learning Skills, and 3. Digital Literacy. Innovation and creativity, logical thinking and critical thinking, are identified as some of the key skills under the innovation and learning skills category. Thus, the need for students to acquire these skills is more than ever needed in education of the 21st century. The



logic of the concept of STEM education, as a consequence of the social discourse, is a reasonable argument as to how well traditional present education contributes to these skills. By 2030 with more than 60% of the future work force has been prepared, the world economy will be built on innovations and creativity in the fields of Science, Technology, Engineering and Mathematics. According to this basic assumption, STEM education approach is needed for changes to be made in the fields of Science, Technology and Mathematics education. STEM education is a strategic educational approach to carry on teaching and learning process to the extreme, which inter and intra learning disciplinary manner in the fields of Science, Technology, Engineering and Mathematics will aim at empowering innovation, creativity, critical thinking and logical thinking. However, it should be noted that STEM education has been interpreted with different objectives, and hence the creation of a commercial market. Often a group of activities, or a set of challenges or both, appear to be considered STEM education. But these two are just two of the essential tools in STEM education. Therefore, reading the real need of STEM education and introducing educational reforms should aim at achieving the relevant objectives and become a timely national requirement.

Expected skills in the twenty- first century that includes the skills of innovation and creativity, as well as critical thinking and logical thinking, cannot be directly taught. Engaging in an educational process in creating the environment and opportunities relevant to the child is the only way out. Some of the basic practices that need to be developed from a preschool age can be identified in the report "Next Generation Science Standard" published by the National Research Council of the United States of America. In providing practices and opportunities in the right environment and circumstances, will enable them to adapt to the fields of science, technology, engineering and mathematics to

Table 01 : Competency Levels of Traning that should be provided in terms of age

		Highest level expected in terms of age			
	Ability to practice	**Age 4- 7**	**Age 8- 10**	**Age 11- 13**	**Age 14 and above**
1	Asking questioning and defining problems	Perception and Readiness to act	Guided responses and Basic profi-ciency	Guided responses, Basic proficiency and Complex overt response	Guided responses, Basic proficiency, Complex overt response, Adapta-tion and origina-tion
2	Developing and using models				
3	Planning and carrying out investigations				
4	Analyzing and inter-preting data				
5	Mathematical thinking and patterns				
6	Constructing expla-nations and designing solutions				
7	Engaging in argument from evidence (based on cause and effect)				
8	Obtaining, evaluating, and communicating information				

suit the intellectual skills such as innovation, creativity, critical thinking and logical thinking. Such identified core competencies include the ability to, 1. Asking questions and defining problems 2. Developing and using models 3. Planning and carrying out investigations 4. Analyzing and interpreting data 5. Mathematical thinking and perceiveing patterns 6. Constructing explanations and designing solutions 7. Engaging in arguments from evidence, and 8. Obtaining, evaluating, and communicating information. Their innovation, creativity, critical thinking and logical thinking skills will grow in the fields of science, technology, engineering and mathematics, depending on how well, how often and to what depth they are integrated with the fields. Depending on the quality of STEM education, the twenty first century human is being created. Activities and challenges can be used appropriately in practicing these skills. It is anticipated that each STEM learning opportunity will provide experiences and opportunities for the child to master one or more of these practices. In 1972 Simpson, presented some of the essential steps to follow when practicing the psychomotor domain. These steps are, 1. Perception (awareness) 2. Readiness to act 3. Guided response 4. Basic proficiency 5. Complex overt response 6. Adaptation, and 7. Origination. Such a model is suitable for use in a STEM educational setting, as they can be identified as innovative, creative, critical thinking and logical thinking, as necessary steps for a child to be a character. Therefore, it is important to recognize that STEM education is not a solitary activity, or a few but a strategic approaches to education. Here are some examples of STEM education activities.

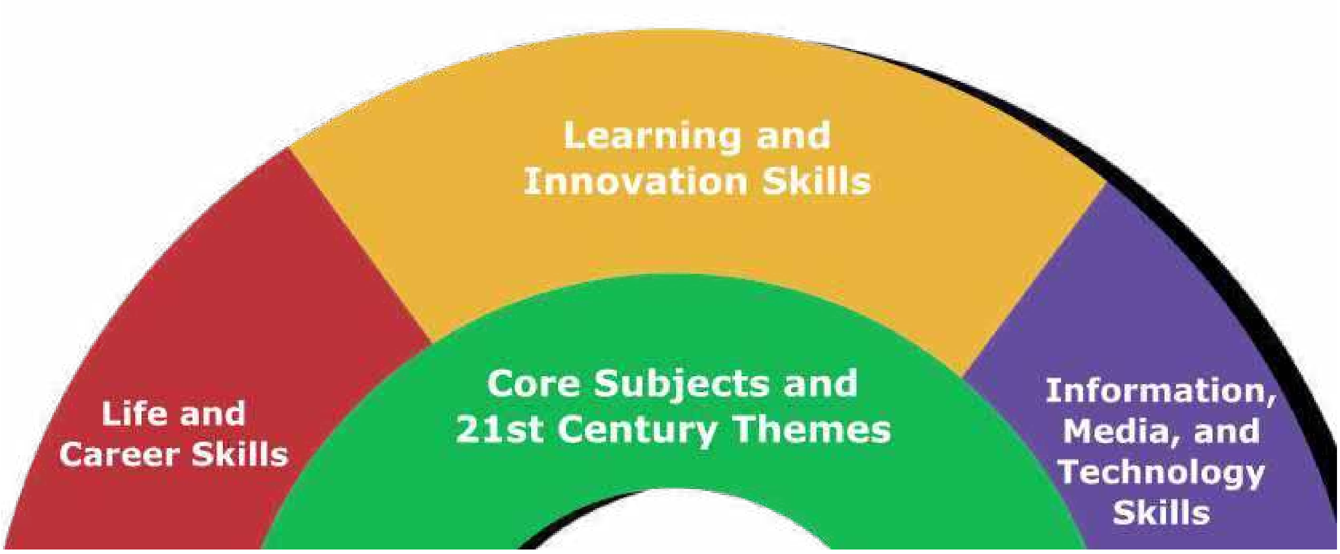
Example 01. This can be applied to children of ages 4 to 7 years. At this stage, activities or challenges should be organized to help children to reach that level of perception and readiness to act.

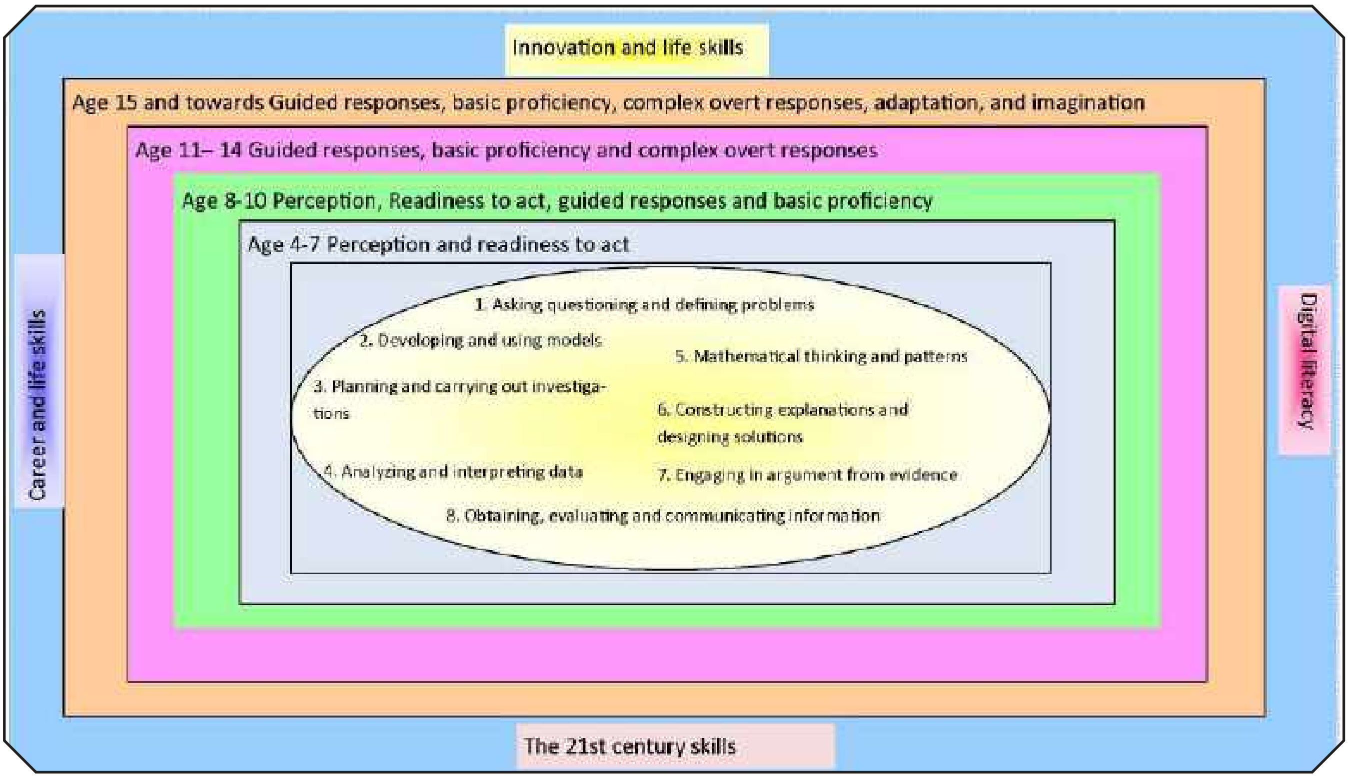
Asking questions and defining problems

Request children to watch a soccer game at the playground or on television. Accordingly, children should be motivated to ask questions, and observe the different movements as well as to stop the ball. Questioning should be done between child and teacher, between teacher and child, and between child and child too.

Further, make it an opportunity to play a soccer game. The children then push the ball back and forth, and the movement of the ball changes as it moves. The speed of the ball moves slowly, and the movement of the ball slowly changes with the direction of the ball, as well as with the position of the ball, so that the child has the ability to question it, and develop the ability to question.

This will enable the child to ask questions, perceive, and be ready to act. Accordingly, it should guide the child to understand how the movement is triggered and to prepare the child to define the problem. It is necessary to understand how the development of the internal mental thought process is carried out.





Developing and using models

Models that can trigger movements, such as a toy bow or a catapult, should be used for guidance, or allowing for further experience. Provide things like cardboard, double tape, plastic pearls, etc. Make it a challenge to create a model for a game based on movement. Children should be able to work in a group under the guidance of their teacher, based on their observations and prior knowledge. The child will experience perception and readiness to act for creating models at the level of learning. It will develop the child's intellectual processes as well as psychomotor skills.

Planning and carrying out investigations

Give two balls and a little bat and tell them what to do to make the ball to move. Instruct children to plan and implement a simple test that will show them when a push comes into play, and when it does not push, the movement does not start. Guide in both cases how the observations received are reported. The child begins to experience planning and carrying out investigations. It is the level of perception and readiness to act in planning and carrying out investigations.

Analyzing and interpreting data

The observations should be interpreted in different ways. They should be taught to interpret these situations as they observe, and feel comparatively and individually. In such cases, the teacher should be able to identify the patterns of interpretations positively with the intervention of the teacher. The goal should be to enable the child's thinking ability and be ready to be interpreted as data.

Constructing explanations and designing solutions

This should allow for a constructing explanation such as how the motion can be triggered. Similarly, children should be given the opportunity to propose a solution to a problem such as how to get rid the country of not reviving a stalled car. You can also give children the opportunity to propose a solution to a problem by asking them how to make the way of throwing something away. In this case, it is the teacher's job to disturb the intelligence of the children.

For this ability, perception and readiness to act must be planned. It also aims at developing the child's intrinsic thinking ability.

Engaging in an argument from evidence (based on cause and effect)

Various evidence regarding motions should be directed to gather whatever form. Evidence must be assigned to the pulling and pushing of the school, playground, home, street, market place or any other child's environment. They should then be presented to the class as group, arguing about different motions such as pushing, pulling, speeding and slowing. Here, too the child should practice arguing on the basis of evidence to achieve the level of perception and readiness to act.

Mathematical thinking

The size of the push or pull should be thought comparatively in terms of the magnitude of the movement qualitatively, such as the larger, the smaller, etc. It is a possible mathematical thinking practice in this age group. Here, the child will be able to qualitatively and mathematically perceive the meaning of motion, and thus be in readiness to act to think mathematically.

Obtaining, evaluating, and communicating information

The information obtained should motivate the child to make different judgments about the motions. The child will come to the judgment, such as a big push or a big speed. It has to be guided. Ask the child to communicate in various ways with other children, school community and their family members. It will be more creative if you ask children to draw a picture, telling them to do word expressions, or portraying characters. Here, too, the practice must be designed for perception and readiness to act. There will also be a development of intellectual skills as well as psychomotor skills to obtain, evaluate and communicate information.

Identifying patterns

In this way, the pattern of movements should be allowed to predict the motion of a given situation. To do that, you can do some activity in video, such as stopping somewhere and guessing what happens next, as well as describing a situation and asking what happens next. This will help the child to perceive patterns and readiness to act in the internal thinking process.

As mentioned above, STEM activity can be correctly identified as combining of one or more of learning practices in the fields of science, technology, engineering and mathematics based on child's development stages to make opportunities for developments of an innovative mind, creative thinking, logical thinking and critical thinking. STEM mainly target logical and mathematical intelligence and creativity from basic intelligence instances identified in Howard Gardner's multiple intelligence theory, but by correctly organizing these activities, the child will practice in the field of the intelligence such as interpersonal, intrapersonal, verbal – linguistic, visual-spatial, musical, kinesthetic and naturalistic. In the STEM approach, practicing and setting an inquisitive mind set is the most recognizable characteristic.

While none of the above scenarios should be done in a sequential or all-encompassing way, this education must be carried out from the early childhood stages to meet the necessary skills for facing challenges of the 21^{st} century. Their depth should be determined by the developmental stages of the child. Accordingly, the table given above can be used as a guide in designing and building STEM activities.

As in the example above, the child should be able to practice and develop activities that will deepen in the next age group. In all these cases, it is necessary to make use of computer thinking. Accordingly, well designed STEM approaches can stimulate 21^{st} century skills by stimulating the child's innovations, creativity and critical thinking as well as collaborative and communication skills, life and career skills and digital literacy. Thus, through proper STEM education it is possible to create a human generation that can overcome the challenging era of creating beyond 2030.

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