

Integrating Language and Arts with MIT Scratch

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Abstract—

To be successful in 21st century, one needs to think critically and creatively, embrace diversity and tolerate ambiguity, create as well as consume information. Many of these skills can be developed through the innovative use of computers in art subjects like drawing, painting, music etc. and natural language. Arts education promotes work habits that cultivate curiosity, imagination, creativity and communication skills. Students who possess these skills are better able to tolerate and tackle ambiguity, explore new realms of possibility, express their own thoughts and feelings and understand the perspective of others. Students' capacity to create and express themselves through arts is one of the central qualities that make the human, as well as a basis for success in the 21st century. But the new technologies have been largely absent in art education at school level. The current education curriculum focuses on fairly latest but, difficult to understand category of programming languages. So this paper explores how the language and arts can be integrated using MIT's Scratch environment that facilitates easy entry into programming.

Keywords— Integration of language and arts, Arts education, programming, Scratch programming

I. INTRODUCTION

Education is an anxious exploration to discover ways that will make students to perform better and broaden their perspective to live in harmony with nature. Studies related to Harvard Project Zero [1] showed that art education has significant effect upon the habits of the students. It improves observational accuracy, clarity, creative thinking and openness to exploration. If student gets focused and trained in these skills, it will result in a better score in education.

Programming is like poetry writing. It conveys a message not only to the computer but to those who modify and use your program. With a program you can build your own rules, you can create your own world according to your conception of both the problem and solution. We believe that teaching programming is important for two core reasons; firstly, it is a form of digital literacy that is of growing importance within society, and secondly, it promotes intellectual development and the development of problem solving skills in a way that is applicable to many other subjects and in many other areas of life. Programming makes people to enjoy and achieve and provides an experience of a powerful way to learn and understand.

Media arts (computer assisted arts) demand and encourage the development of skills in designing, creating, critical thinking, communicating and problem solving. It also amplifies emotions, humour, and imagination. Considering all these advantages, it was becoming more and more apparent that integration of arts and computer technologies should be brought into practice at an early stage of child's development.

Scratch is a programming language learning environment created with an idea to enable beginners to quickly create programs without having to learn how to write them syntactically correct [10]. It is a visual programming language developed by Life Long Kindergarten group at the MIT media lab, that allows children to easily create their own personally meaningful interactive media content (interactive stories, music, games and art). In addition, this helps in developing computational thinking [3]-[7] among kids that is vital for their survival in this digital world. Computers amplify human potential. Scratch provides an easy to enter immersive-environment for children to master the digital technologies.

Scratch is an effective tool to lead the students (primarily ages 8 to 16) into deeper thinking. It is a way to express the ideas with creativity. It is a social intelligence, cross cultural competency and new media literacy programming environment. The goal of scratch programming not to be creative technology but rather technologies that foster creative thinking and creative expression.

There is a Scratch website [2] where children can upload their creations and share them with everyone, encouraging a collaborative group work. It is a mix of online experience in programming, animation, game creation, multimedia, fine arts, science, social studies, language arts, mathematics and collaboration.

II. INTEGRATION: WITH SCRATCH

Scratch can be used as a platform for developing different kinds of skills for kids. The foremost skill aimed at is a kind of thinking that is required to solve a problem with the help of computers. That is, break down the problem into manageable task and logically connect those chunks to execute a task in hand. This requires thinking in multiple dimensions that is, spatial and time dimension. What we think of proposing consists of all these tasks. These skills must

be imparted at an early stage. How can this be imparted? Scratch provides an environment where skill develops in these tasks simultaneously at an early stage, since the entry is low level.



Fig1.Screenshot of bee and butterfly dance application.

For the purpose of illustrating how language, arts and programming can be integrated through Scratch, we selected a beautiful and pleasant poem (written for a Malayalam Movie) by O.N.V Kurup [8] and [9]. This poem and the associated music was an instant attraction among all people of all ages in Kerala. The song if taken out from the context of the film is about how the God is reflected in all that is beautiful in nature. Blinking stars, shining moon over the tree branches, blooming plants and trees, drunken bees and butterflies are some of the characters in this poem. These characters are dear to kids and its animation is trivial in Scratch. Depending on one's capacity for imagination and worldly experience, innumerable captivating visual animation can be given to this poem through the framework of scratch.

Consider the development of the above scenario as follows.

1. Using the concept of modularization, the entire problem can be divided First a bee appear at the center of the screen
2. It moves to top left and draw circle representing moon
3. More bees appear. Also blinking stars and bat appears
4. 3 bees draws three trees using the concept of IFS (Iterated Function system)
5. 3 bees start moving erratically, bounce once hit on the edge
6. After a period of time flowers appear on tree and then start falling
7. Falling flowers stamp itself on reaching the ground to make a natural scene of cluttered flower all over the ground
8. After a period, small bushes appear all over and then bloom.
9. Butterflies appear and move around

Using the concept of modularization, the entire problem can be divided into small chunks, for example: bee drawing a tree, star blinking, bat flying, life cycle of bushes appearance, flower blooming, movement of butterflies and bees. This requires thinking in multiple dimensions- spatial and time. The position of each object is defined using the concept of coordinate geometry and this is referred to as spatial dimension. For example, where the tree has to be drawn, the bees should move, the butterflies should fly, the bat should fly, the stars should blink, the bushes should be grown, etc.

Randomness appears everywhere: location where flower appears, erratic movement of butterflies and bees etc. This randomness is a must for naturalness, and must be defined specifically for every kind of object. Scratch provides facility for creating such random and erratic motion through random-number generating function. There are three types of random movements. They are: first, random speed of object. Object that move with non-constant speed. The ant movement falls into this category. Second is random turn or changing direction of object. This can be seen in fish and other animals. Fish will move with constant speed, but they change their direction of movement in sudden. And the third category is random speed and turn. Many insect that can fly, falls into this category, like butterflies and bees. The motion of this type of object is not monotonous. This can be accomplished with the above stated concept of random number. This type of object generates some kind of jerks in their movement. During every motion there will be deflections in the coordinate values, as:

$$X = X \pm \Delta X$$
$$Y = Y \pm \Delta Y$$

When the execution begins, bees pick up a random coordinates and plots an object. Simultaneously, Bees and butterflies pick the coordinates randomly and fly according to it. For some moment this process continues repeatedly. This is called looping. At the same time when the bee touches the wall it gets flipped. This introduces the concept of conditional statement. Once the 3 trees are completely visible, the flower object, which was initially hidden, will become visible at the branches of tree at random positions. After some time, flowers shed down to the ground. After that bushes starts to grow. Initially the size of the bush being very small, it will not be visible. By repeatedly increasing its size by small amount, it grows. In order to show the gradual growth, wait or delay is introduced in each step. The waiting time is called delay. This also includes the concept of communication and synchronization. This is the process behind one single object. These processes can be duplicated by duplicating the objects: making clones of existing object using the stamp command in Scratch. Finally, the flower blooms and covers the entire area, waits for some time and then disappears. Like this, with the help of an example the Programming language and arts skills are integrated.

III. PROGRAMMING THE NATURAL EVENT SEQUENCES

In our daily life, we observe several sequences of activities of which some repeat periodically. For example consider the life cycle of a tree. It is a sequence of events that unfold in time. We can abstract the whole process and map it into chunks like growing of trees, appearance of bud and flower, flower falling etc. Some of these activities occur in parallel at different locations of the tree. Several flowers appear and after certain period start withering way. This demonstrates the concept of sequence, multiplicity of objects, communication or message passing between objects and also parallelism. In order to obtain the proper sequence of events that happen at different point in time, communication and synchronization between objects are required. Though all the objects are present on the screen, it should be visible and take part in activities only at appropriate time else it should remain hidden.

In the example, initially three trees are drawn in parallel. For a visual appealing, Iterated Function System (IFS) based fractal drawing is utilized. The process of random plotting of the trees is mapped to random movement of bees. Three bees are given the task of drawing three trees. As the time unfolds, the outline of the three trees start appearing on the screen and with the further elapse of time it becomes sharper and distinctly visible. This illustrates the concept of parallelism and is done using the concept called thread. When the tree is fully visible, the blooming of flowers begins.

For communication and co-ordination between objects, Scratch uses the concept of message broadcast and message reception concept. Availability of this mechanism is very vital for any sort of animation. In our animation, one of bee passes the message to flower objects to become visible and active. When the flower objects receive the message, they will appear on the branches of the tree. The positions of branches of the tree are selected by the concept of random number generation. After standing still for a period of time, the flowers start falling. After a certain time interval, small bushes start sprouting on the ground. It grows to certain height and the starts flowering. It is then followed by the appearance of butterfly and its movement all over the place.

IV. OUR EXPERIMENTS WITH HIGH SCHOOL STUDENTS

To test whether this approach attracted students to tinker with scratch, the animation was shown to high school students. To our surprise, most students immediately wanted to repeat the experiments and learn how different part of the animation worked. Some of the questions asked were.

1. What is the trick behind the wandering movement of the bees?
2. How is the flapping of butterfly programmed?
3. Bush growth is beautiful. How is it programmed?
4. How to draw one's own sprites (characters)? And incorporate into it.
5. Can we put our own voice?
6. How is Randomness programmed?

On request, we showed how to create programs for each of the queries except the fractal tree. We were able to explain, all other part of the programming. Instead of the fractal tree, creation of Sierpinski triangle was shown with few blocks. Students were also shown generation of music and drum sounds in scratch programming. We hope that by making several examples that expose the full capabilities and potential of Scratch programming, student community will be able to take up from there to generate their own visualizations.

V. CONCLUSION

Arts education is essential for survival in 21st century. It strengthens student thinking and foster the learning process. Arts integration refers to the effort to build a set of relationships between learning the arts and other skills and subject of the curriculum. Scratch being amazing universal software, which has their capability to change the digital world in the future. It is being a non-scripting way to reveal the ideas in digital-media, the students will find it easy to learn and implement all complex logics. Hence Scratch programming can be introduced to provide arts education at school level because of its simple, easy to use, syntax free language.

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