RESEARCH ARTICLE

A Systematic Review on the Inclusion of Coding As A Subject At The Primary Stage With Respect To their mental and Social Health

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***Abstract*:**
In recent years, a significant revolution takes place in the field of Education. It is not based only on imparting knowledge to the minds, but also more focused on developing abilities and aptitudes that made us successful in our daily lives and a global workforce. Technology plays a vital role in transforming learning in the present scenario. Children of this time are the part of tech generation. There is a shift in grasping knowledge on how devices or software are working followed by creating it themselves rather than just getting into their devices and using it. Including coding or programming as a subject from the very first stage of schooling is the need of the present generation. Many countries already introduced this subject in the curriculum and many others are intended to. The prior studies exposed that learning to Code enhances learning in other subjects and develop computational thinking skills. In addition, Suggestions are also given based on various psychological needs of the children of primary schools. Teachers' Perspectives and Parents' Perspectives are also taken into consideration.

Keywords —Coding, Programming, Computational Thinking, Problem Solving.

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I. INTRODUCTION

In the past few years, Many Countries over the globe are introducing Coding as a subject in their curriculum at an earlier stage of the school. On 29th July 2020, New National Education Policy was introduced in India focusing on reducing the pressure of curriculum from the shoulder of students and activity-based curriculum for experiential learning [5]. One of the biggest transformations is to include Coding as a core subject from class 6thin schools. There have been numerous studies to investigate the significant role of coding on the psychosocial level of children. After reviewing much research, this study is suggesting adding up Coding as a subject from class 1st at Primary Schools in India. It can aid the students in growing to be critical thinkers with the development of computational thinking and problem-solving skills. The goal is not to makethem software engineers in the industry but to inculcate the habits of critical analysis, decomposition, finding creative solutions to satisfy their level of curiosity. The main goal of this review is to evaluate the acceptability

of coding subjects for learning at the primary stage from students', Parents', and Educators' points of view.

A. *MEANING OF TERMINOLOGY USED*:

The term Coding refers to writing instruction using any text editor in any language understood by both machines and humans. The person who does coding is known as Coders. Coding encourages Logic, reasoning, and critical thinking.

Wherever the term Primary Schools Students used in this paper depicts the children of age ranges 6-11 years. There are two substages categorized for this range: A group of class 1st to 2nd students of age 6-7 years termed as Lower Primary Students and another group is of class 3rd to 5th of age group 8-11 years denotes to Upper Primary students.

B. *APPROPRIATE AGE TO START LEARN CODING*

A recent study [20] investigated children of age 2-4 years can learn many of the basic concepts to code in a playful way using guided play activities which leads to the development of their computational thinking. After

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the age of 4 years, Children can learn to code using software applications like Bee-Bot under the guidance of an adult and with the adaption of pedagogical approaches. reference [21] assessed the children of 6 years old based on cognitive development, metacognitive abilities, and divergent thinking using Computer programming languages (CPL) and found it significant. Study [5] consider children of age 6-8 years for experimental research and result that they can classify things in different categories but are still egocentric.

About Cognitive Development Theory given by Swiss psychologist Jean Piaget in 1971, Children at the age of 5 are at the preoperational stage. At this stage, the Child begins to learn using mental representations with the help of words and images. Following this theory, many experts agree that a child can start learning to code at the age of 6 years. A report [1]recommended that students of 5 years in Australia can learn to code.

C. *CODING IS A SUBSET OF PROGRAMMING*

The terms Coding and Programming are often used interchangeably. But the reality is that both terms are differently used for a different purpose. [4] mentioned in his paper that Coding is just a part of the whole programming. Coding refers to the process of translating the code written from one programming language to another which must be understandable for both machines and humans. On the other hand, Programming is a superset that includes all the subsets of coding. Programming defines a set of instructions for performing a specific task by the machines or devices on the behalf of humans.

II. LITERATURE REVIEW

A. GAMIFICATION HELPS IN LEARNING CODE

Making use of game elements in the learning is known as Gamification. It is an educational approach to encourage the children for learning without getting bored and reduce the burden. Reference[16]consider that Scratchjr is a digital playground of coding for children. They don't need a keyboard to code, just the knowledge of basic action words like jump, move – up, down, left, right, and counting numbers can bring you

to the next level of creativity.[6][14]stated that over 13 million times scratchjr is downloaded till Feb 2020 across the 191 countries of the world. Lower Primary students enjoy learning coding through visual block-based coding like scratchjr- an introductory programming language. More experienced students feel bored and get frustrated from introductory block coding. So, a high-level block-based programming language like scratch, snap is the best way to enhance their skills. [22] focused on fun-based learning and stated play to learn while learning to play which ultimately leads to the development of Computational Thinking among students.

B. CODING DEVELOPS COMPUTATIONAL THINKING AND 21ST-CENTURY SKILLS.

A study [21][3] resulted in the positive effects of CPL on 6 years old Children's metacognitive abilities but showed no difference in their cognitive development using pre- to post-testing. The students can develop the skills for task orientation and systematically achieve their goals under a planned environment. Moreover, they get to know their mistakes and tried themselves to provide remedies using trial and error skills. [12] focused on the students of 8-11 years old learners. Research results revealed that Coding positively affects students' Computational Thinking. When kids learn to code, Various activities are involvedby which multiple skills are developed among them. They get to know how to solve complex problems in terms of small pieces, learn to build a connection between similar problems and prior experience, can identify the relevant information as per the requirement, and design steps by step instructions to get the solution. Each activity deals with the skills developing computational Thinking i.e., Decomposition Skills, Pattern recognition Skills, Abstraction Skills, and Algorithmic skills respectively.

C. CODING AND BLOOMS' TAXONOMY

Another study [9] also gave similar views about block programming by making use of other platforms such as Scottie Go! and micro: bit for learning to code at the upper primary level which enhances the problem-solving skills among them. In this paper, a very interesting review is uncovered about the level of bloom's taxonomy. The authors stated that students learned how to apply the gained knowledge in the new situation that understanding the concept of coding. In the line, [19] also disagrees with the 6 levels (Remember, Understand, Apply, Analyze, Evaluate, Create) of bloom's taxonomy for computational thinking tasks where understanding leads to the application. Another systematic review is done by [15] and they also exposed that many other researchers also find it difficult to assess the computer science education students using bloom's taxonomy. There should be a different taxonomy to be used for Computer Science subjects.

D. CODING ENHANCES THE LEARNING OF OTHER SUBJECTS

Coding is an inseparable subject. [17] found in their discoveries that Students who learn to code have more positive results in other subjects. They find the solutions smartly by using their logical thinking and problem-solving abilities which excelling their mathematical abilities. Creative skills developed using coding helps in language development. They are more focused on finding the reasons behind what happened rather than only grabbing the content passively which ultimately helps in clarity of science concepts.

E. CODING HELPS IN DEVELOPING SOCIAL SKILLS

[11] worked on the interaction between parent and child while learning coding at an initial stage, which categorized their interaction in 3 talks. Evaluation of the results showed that small instructions given by parents to children help them to complete the task efficiently (Spatial Talk), asking questions by adults to children is the best way to scaffold while learning (Question-Asking Talk). Sometimes, the irrelevant utterance by parents can distract the children (Task relevant talk). The interaction between parent and child creates one to one connection while learning coding at the initial stage. A systematic study navigated by [10] discovered that students improved diverse skills like logical thinking, reasoning ability, decision-making, problem-solving skills, and social skills through peer grouping, and team spirit, while programming and learning with fun and enjoying themselves without any boredom.

F. PARENT'S PERCEPTION ON THE INCLUSION OF CODING AS A SUBJECT

A study was done by [13] for measuring the parents' point of view regarding coding. The authors said that their opinion about coding can be changed if they get to know about its significance. So many sessions or workshops were organized for parents to let them understand and they again collected responses from parents. The results were remarkable. In another study given by Yu et al. (2020), it is also found that the children whose parents supported them to code learned better than those who are learning under pressure. This study focused on ZPD (Zone of Proximal Development) discovered by Lev Vygotsky about the theory of learning and Development fitted properly in this context. [7][23]strongly agree that Parent Support is a must to encourage their child to learn to code and include features to scaffold their children's learning experience.

G. EDUCATORS' PERCEPTION ON CODING

Reference [9][2] revealed the results that show teachers, acting as a facilitator in the lower primary level, did not find their lack of coding skills as an obstacle for achievement of learning outcomes in the classrooms. But, At the Upper Primary level, Teachers must be trained and act as a mentor and need to have suitable qualifications for teaching coding. [8] concluded that an appropriate training program,

clarification of financing and suitable technical infrastructure are the most important factors to consider while inculcating technology to curriculum. Proper In-service training and Pre-Service training should be given to the educators to meet the requirements of the coders and to be programmers of the future. [18][2] explored that teacher can improve their teaching strategies to improve learning management systems using open-source technologies that emphasize the programming applicative part.

H. CODING PREPARES FOR HIGHER STUDIES AND CAREER OPPORTUNITIES IN THE FUTURE

In this tech era, Students are not to be brought up as a consumer, but to be a producer in society. Computer programming is the need and demand of the future world. [4] concluded in a study that Coding is the first step to learning programming and computing skills. Children who learned Coding can choose software engineering, Website development, Data Science as their fields of knowledge in their higher studies. [17] strongly suggest that various abilities and attitudes improved by Learning to code also help them in multidiscipline. The students having knowledge of coding followed by programming have a lot of career opportunities in the field of computer science and applications.

III. FURTHEREXPLORATIONS

Coding as a subject has been included in the curriculum in developed countries. So, in this context, a maximum of the studies is done on the population of age of 6-11 years of developed countries. The study has not consider the students of underdeveloped countries like India. It is important to address every student to achieve the goal of universalization of Education globally. In the 21st century, Further research is needed to know the impact of the coding subject on the mental ability and social wellness of students at primary schools in India. A study is required to promote Governmental, other voluntary organisation social workers and the society to act together to contribute to better mental health and wellness of students.Though a new education policy has been announced by the Government of India in 2020, where coding has been included as a subject from 6th standard. But private schools already spread awareness about coding among kids from 1st standard. The effectiveness of the programs should be assessed through this study and recommendations should be made for the Government to make change in policies or change of programmes according to the needs of the primary students.

CONCLUSION

The findings of the review are that introducing coding at the primary level is an appreciable step in the field of Education. To fulfil the needs and to grab the opportunities in the 21st century, Including Coding at the primary stage of schools is desired. Coding fosters 21st-century skills and computational thinking among students. Students having the ability to learn to code have more opportunities for employment in the future. There may be some obstructions in the implementation of coding at primary schools like lack of physical resources such as deficient infrastructure, lack of time resources, the disinterest of parents and teachers, deficiency in financial resources, improper teacher training, etc. There is no doubt in the statement that every child has their own ability to learn. Thus, it is also proposed to not be any time bound for the completion of the courses so that each learner can learn at their own pace.

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