Experiences of Coding Skills for Young Learners & Youth in Uganda

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Abstract:-

Purpose: This paper aims at interesting introduction of coding concepts to young learners and youth by any knowledgeable stakeholder. The study shares experiences after replicating the Rangers coding game developed by Tangible Africa as a way of introducing coding skills to young learners without use of the Internet, Computers nor Electricity using *cost-effective instruments which are as simple as a game.*

Methodology: This study was based on Observations, interviews, focus group discussions with a total of 79 participants. These included 37 Children, 6 Teachers, 2 parents, 9 Librarians, 2 ICT professionals and 23 undergraduate students. The study aimed at capturing the experiences of participants prior, during and after training sessions on basic coding by nonprofessional programmers. This skilling project targeted the building of team work spirit, enhancing problem solving capabilities, critical thinking and also improvement of participant's employability, knowledge, skill and enhancement of career path.

Findings: The researcher discovered that no child (below 18 years of age) had ever heard the word "coding" or imagined its scope. Those above 18 years had basic knowledge about coding but a majority lacked the practical skills. However, their anxiety to learn showed that both young children and youth are always interested in new ideas and are anxious to learn.100% wondered how coding could be taught without electricity, internet or computers. The study also revealed that, in terms of learning abilities-both children and youth learn better in groups thus, it is always better to work as a team to be able to exchange ideas Age group-Children of all ages are attracted to colors and shapes and thus, use of colors and illustrations stimulate reasoning. Articulation skills-Children at the age of 10 and above articulate and interpret instructions better and faster for early and intermediate levels. As levels get to advanced level, the challenge is common to all ages. Interest in Coding-Children younger than 10 years of age simply enjoy the game. Between ages 10-12 years, understand concepts and talented ones can be groomed. From age of 13-18, they understand concepts and focus on the future. For the youth above 18 years, these adults relate with environment and embrace the challenges in society and wish to be part of the solution for the future. In a way, they easily acknowledge innovations and see benefits to real life. Limitations and recommendations- The coding mobile app does not auto correct. The Rangers coding puzzles being used were not multi colored and visualized. The cards are made of paper and these were vulnerable to deterioration. Improving them to metallic format would improve their durability. Lastly, the participants were confused by the mix of two concepts namely "Poaching and Coding". Separating concepts is better to enable concentration of the main Cause.

Value: Introducing learners to coding skills at tender age familiarizes children to coding concepts thus, skilling them for self-employment. It also eases accomplishment of tougher coding tasks as they progress with their academic career. A part from that, it helps them in making career choices, stimulates team work, problem solving and intellectual thinking.

Keywords:- Coding, Tangible Africa, Young Learners.

I. WHAT IS CODING AND WHY IS IT RELEVANT TO YOUNG LEANERS AND YOUTH

Coding which can also be used to mean programming is the concept of describing instructions. Coding includes a series of interactions between the coder and devices to solve problems (Fin Yi2020). Electronic devices such as cell phones, Televisions, home appliances also require and use codes to function. In order to master the art of coding, it requires, critical thinking, problem solving skills, persistence, attention to detail, technology and others. There are a number of programming languages available in the market such as C#, HTML, Python and others. Leaning coding at an adult age is sometimes challenging due to techno phobia, biased mindsets, ignorance and complexity in the scope. It is evident that most coding products use block based programming structures as in the Scratch game (Resnick et al., 2009). Approaches like this however, limit the analytical skills of a child to discover where the errors was since in such coding games, the leaner simply drags and pastes the blocks into a workspace. It is on such basis that the author shares experiences of using a much more sophisticated coding game and observed its impact on the learners.

Few students have also taken up career path in computer sciences especially girls as they think it is not meant for them. In terms of job availability, it is believed that in 2015, there were seven million jobs in the US requiring coding skills (Burning Glass Technologies, 2016). Apart from that, it was also assumed that still in the US, by 2031 the employment opportunities for computer sciences and information technology will have grown to about 16.6% compared to an average for other occupations estimated at a growth rate of 5.3 %. It is also stated that it is possible for

students with the right skills to graduate into employability (Julie, York, 2023).

➢ *Countries Where Coding Skills have been introduced to young learners*

Since its launch in 2017, Tangible Africa has trained 100,000 school learners and 20,000 teachers all from countries such as Kenya, Tanzania, Zambia, Lesotho, etc. However, Uganda was missing. The year 2023, will be a chance for Uganda to get involved and Soroti University as a pioneer institution through its *outreach initiatives (Tangible Africa, 2023)*. .

➢ *Coding Challenges in developing Countries*

To relate with, in developing countries like Uganda, the cost of mobile data and computers is expensive. As a result, a majority of learners are not exposed to technology at an early stage(Tangible Africa). Observations have shown that even fresh university students struggle with basics of Computers which would not have been the case if technology was introduced to them at an early age. Programming as a concept is also considered as a complex field due to imagination that it requires lots of skills in order to be perfect in the game.

II. METHODOLOGY

This study was based on Observations, interviews, focus group discussions with 49 Children, 7 Teachers, 1 Matron, 9 Librarians, 2 ICT professionals and 23 undergraduate students. The researcher also participated in the training sessions and in discussions thereafter. The children were also observed during the pre, during and after the coding sessions. The researcher organized five training sessions targeting different category of participants. In each training session, participants were grouped in different numbers of 3:5:10.The researcher captured data from participants' expectations, took a pre training survey to understand prior the state of prior knowledge about coding, observed learning abilities of each participants and was able to identify talents. The researcher also took note of the active age group, and attitude towards the game and concept. During the study, the researcher observed the children's articulation skills. attitude, reactions, actions, communications, feedbacks and took note of the interest exhibited towards learning and engaging more in coding and also the ability to work as a team. Literature was also reviewed during data analysis.

III. FINDINGS

Demographically, the participants included;

Table 1 showing the gender of participants.

	Female	Male
Children	20	17
Librarians	5	4
ICT professionals		2
Parents	2	
Teachers	2	4
Undergraduate	9	14

Students		
Total	38	41

The table above shows that there were more male than female participants. However the difference in gender of 3 participants is not a big gap. Thus, coding talents can be tapped from both gender.

Table 2 showing the age group of the participants;

	0-5	5-12	13-17	18 and above
Children	4	15	18	
Librarians				9
ICT professionals				2
Parent(Teacher)				6
Undergraduate Students				23
Total	4	15	18	40

The table above indicates that there were more children between the ages of 13-18 years. The involvement of youth and adults participants was to compare their experiences with that of children so as to understand where the gap was. As indicated later in the discussion, adults also struggled with advanced coding levels and took time to interpret instructions and understand how programs are actually built. It is also justified in this study that, such challenges by adults would not have been the case if coding concepts were introduced to them at an early age.

IV. DISCUSSION OF CONTEXTUAL FINDINGS

Below are highlights of experiences of the participants in basic coding.

➢ *Pre concept understanding*

When the participants were asked if they had ever heard of the word coding and what their own interpretation of the word was. All the children 37/37 representing 100% and parents 2/2 said they had never heard of the word. They however confessed that what they knew was what a computer is but still 50% had never used it. For the rest of the participants all, undergraduate students said they were familiar with the word but lacked practical skills to do it. From the 23 students only 2 representing 9% had practical knowledge of coding because they were already enrolled in a computer related course. 67% of the Librarians on the other hand, had only used one programming language "HTML" in designing websites during undergraduate training while 3/9 representing 33% had no idea of coding.

➢ *Learning abilities*

The researcher noted the following; all participants regardless of age were interested in innovations and were anxious to learn. One of the participants said "Am curious to learn how coding can be learnt without internet, electricity or computers because I know coding needs technology to operate." All participants 79/79 representing 100% scrambled for the puzzles and each wanted to touch them and use the mobile app.

> *Number of trainees per group*

The researcher grouped the participants in odd numbers of one, three, and five and set them to start learning. Observations indicated that engaging participants in practical sessions needs group work and each group should have a maximum of five participants. However, a group of three was considered most effective so as to enable participation of all.

> *Age group to target*

Because learning coding using a game puzzle was a new concept, all sampled participants were willing to learn. However, for the case of Children, in order to build and meet the target, more emphasis should be given to children between the ages of 12-18. It was noted that in all the coding sessions for children, an average age of 14 were the best performers.

> *Lessons learnt from the sessions*

When the participants were asked what they had learnt from the coding sessions, below were some of the responses;

Table 3 Lessons learnt from the sessions

Some participants could not explain what they had learnt.
Some said it helped them learn how and why to protect wild animals
Others said it helped them learn to follow instructions
Others appreciated the value of team work in order to progress to next levels
Other participants acknowledged the need for critical thinking to solve a problem
Some participants were motivated to become engineers
Others said it was going to help learners in career choices
While others said it creates familiarity with the concept thus, easing advanced coding

V. WHAT WAS LIKE MOST ABOUT LEARNING BASIC CODING

Some participants mentioned that it was fun and entertaining way of learning a new concept. One of the participants said that "Infact children learn better when new things are introduced to them in a fun away". Another said that, learning coding using a game made the concept look easy thus, it was encouraging to learn more.

VI. LIMITATIONS AND RECOMMENDATIONS OF THE RANGERS CODING GAME AS A CASE STUDY-

Below are some of the responses given that limited learning coding using the Rangers Game puzzles and mobile application;

- The coding mobile app does not auto correct, 50% of the participants indicated that it would be easy to check where one went one and be able to give a chance to repeat the commands.
- 100% of the children commented indicated that coding puzzles are not multi colored and visualized. They suggested that if each card had a unique color, they would be so attractive to the children.

- In terms of durability of the puzzles, some respondents (80%) commented that the cards are made of paper and these are vulnerable to deterioration. Improving them to metallic format would improve their durability.
- Others said the game was addictive. Apart from that it requires utmost concentration and keeps one wanting to be able to continue and keep redoing the failed levels until success is achieved.

VII. CONCLUSION

It is evident from the experience of coding as shared above, that introducing coding to young learners builds, teamwork, ignites reasoning and critical thinking, enhances analytical skills, builds passion in the field, and familiarizes them with mobile technologies and applications. All of which are necessary for advanced skilling and provision of solutions in a changing world. Apart from that, the world today is technology driven and thus any stakeholder such as parents should take part in introducing valuable concepts so as to be able to identify and build skills in children, The need and use of mobile applications for example is over whelming thus, everyone should be equipped with the technological knowledge and skills. All of which are more possible if coding skills are introduced to children at a young age.

VIII. AREA FOR FURTHER RESEARCH

Strategies for rolling out Coding for beginners in developing Countries.

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