A Structured Mentorship Model for Computer Science University Students in Kenya

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ABSTRACT

The Kenyan university education system has been criticized for graduating students who are underprepared to meet the skills demand of the modern workplace, and who cannot formulate effective solutions to our most pressing socio-economic problems. To address the skills gap for Computer Science (CS) students, a structured 6-month mentorship program was designed to offer skills in personal and professional development, innovation, scholarship application, and community engagement. This paper presents the results of a mixed-method study comprising of 95 CS students from 12 Kenyan universities who have participated in the mentorship program since September 2016. The study examines if structured mentorship leads to successful upskilling for CS students. The findings indicate that at least 81% of the students in the mentorship program improve in skills such as innovation and professional preparedness. Results from this study demonstrate how CS education can be complemented with a structured mentorship model towards global competitiveness.

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1 INTRODUCTION

The Kenyan university education system has been criticized for graduating students who are underprepared to meet the skills demand of the modern workplace, and who struggle to formulate effective solutions to our most pressing socio-economic problems. Many authors [1-4] have linked the reduced quality of university education to factors such as a dramatic increase in the number of institutions of higher learning in Kenya over the last ten years, inadequate teaching facilities and qualified staff, overwhelming workload among faculty, declining funds to universities, and lack of mentorship. Also, a study by the Inter-University Council for East Africa [5] indicates that employees are lacking crucial skills, such as problem-solving, teamwork, and communication skills, in the university graduates that they hire. Equally, employers have expressed dissatisfaction with the quality of ICT professionals graduating from educational institutions in Kenya [6,7]. Perhaps due to this skills-gap among university graduates Kenya is seeing an increase in non-university institutions that exclusively teach computing and problem-solving skills, such as Moringa School [8] and Andela [9]. Yet, with Information and Communication Technologies (ICT) being one of the key drivers of any knowledge economy, the need to effectively train and upskill CS university students cannot be overstated. In fact, Kenya's Vision 2030 report [10] cites ICT workforce as one of the key foundations to acquiring the status of a knowledge economy by the year 2030.

While many factors, such as improved policies, qualified staff, and adequate resources, contribute to high-quality university education, we argue that structured mentorship that complements classroom learning could contribute towards preparing CS students for the job market and improve personal development. Also, as indicated in a 'Closing the Skills Gap' project by the World Economic Forum [11], if education systems are to keep up with the changing demands in skills there needs to be continual reskilling and upskilling among students. To address this need, a 6-month mentorship program was initiated for Computer Science university students in Kenya. The structured model of the program incorporates student-driven pillars and measurable goals with the aim to bridge the skills gap. Mentorship is provided in out-of-the-classroom sessions through industry linkages and peer mentorship.

This paper discusses the structured mentorship model and the impact, experiences, and lessons drawn from 95 students in 12 universities in Kenya who have participated in the program since September 2016. The contributions of this paper are: (i) to provide data-based evidence on the potential impact of a structured mentorship model; (ii) to share lessons and experiences from the mentorship program; (iii) to contribute to insights on mentoring CS students in a developing country's context; and (iv) to demonstrate how learning of CS students can be complemented with a structured mentorship program.

The following sections review related work, followed by a description of the structured mentorship program, the methods used and findings.

2 RELATED WORK

Mentoring occurs when a mentor serves as a trusted role model, counselor, or teacher for a mentee [12]. The benefits of mentorship have been realized in youth employability [13],

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choice of careers [14], interest in CS subjects [15], students' performance [16], and even the mentor's skills growth [17]. Indeed, the impact of mentorship has been evident among initiatives by non-profit organizations in Kenya such as Akili Dada [18] and AkiraChix [19] that focus on training, mentoring, and empowering girls from disadvantaged backgrounds in ICT and leadership skills. Other examples include university-initiated mentorship programs such as the Greenhorn Mentorship Program [20] based at the University of Nairobi, Kenya, that focuses on students taking Business-related courses. These examples show that mentorship has been recognized as key in the development and learning among students, beyond the classroom.

Outside Kenya, there have been successful mentorship programs for university students that focused on more than just academic development. For example, a mentorship program at the University of Cape Town in South Africa, by the Educational Development Unit (EDU), uses a holistic approach, rather than focusing on academic skills, to strengthen life skills, industry exposure, and giving back to the community [21]. The EDU approach is reported to generate results that out-perform most undergraduate courses, with increased graduation rates and professional achievements among its participants. The study in this paper seeks to emulate such mentorship examples in implementing out-of-the classroom skills that could potentially improve personal and professional skills.

In spite of the benefits that mentorship provides to students, mentorship efforts are yet to take root in many Kenyan universities, especially for students taking technical subjects such as Computer Science. Additionally, most existing mentorship programs in Kenya focus on only girls [18,19,22], high school students [24], and out-of-school youth [23]. Few sustainable mentorship programs are focused on university students. Further, a comprehensive study on the role of mentorship in enhancing youth employability in Kenya [13] showed that university graduates need exposure to various other interventions to scale-up their competitiveness in the local and global market. The program described in this paper aims to fill this gap.

While some mentorship programs take an informal and non-structured format, studies [25] have shown that students express a need for a formalized mentorship program in order to increase accountability. Also, mentorship programs that are organized such that participants are held accountable for the mentorship activities [12] have shown an impact in increasing the students' skills and confidence to succeed in the computing field. In the context of this study, organized mentorship, with specific goals and measurable expectations, is defined as a *structured mentorship*. Thus, this paper discusses the effect of a free structured mentorship program, which complements classroom learning, for Computer Science university students in Kenya.

3 THE STRUCTURED MENTORSHIP MODEL

The mentorship project started in September 2016 as a response to various mentorship requests from students. Over the two years, the growth of the program has influenced the development of a structure that is discussed under program pillars, cohort-based model, mentor involvement, format of mentorship sessions, mentorship curriculum development, and evaluation criteria. The author is the Program Lead and Founder of the mentorship program.

3.1 Program Pillars

The first cohort of 40 students completed an online survey, an exercise whose aim was to understand the skills' gaps that they wished addressed. Four common themes emerged from the students' responses:

3.1.1 Innovation and ICT Skills. 60% of the students indicated that they wished to learn how to use their ICT skills to solve societal issues and challenges, as well as learn relevant ICT skills not taught in the classroom.

3.1.2 Personal and Professional Development. 80% of the students indicated that they wished to develop their professional and soft skills such as writing, interview preparation, and presentation skills.

3.1.3 Scholarship application and awareness. 85% of the students indicated that they were not aware of scholarship opportunities in the field of Computer Science, nor did they possess the skills to write scholarship essays and applications.

3.1.4 Community Engagement. 80% of the students indicated that they had not participated in any tech and community events outside the university. Additionally, students expressed the desire to have an avenue that could link them to the local community where they could give back to volunteer-driven initiatives.

The above skills were analyzed alongside the objectives of successful mentorship programs [21] as well as those cited in the study by the Inter-University Council for East Africa [5], as needed by higher education graduates to succeed in the workplace. Thus, these skills were deemed as appropriate to form the pillars of the program.

3.2 Cohort-based Model

The program maintains the same group of students over a period of 6-months, as opposed to walk-ins, which could mean mentorship to different students at any given time. This choice was deemed appropriate to promote more effective evaluation of the impact of the program. Before joining the program, students apply through an online application form that includes two essays that describe the motivation of the student's application to the program. Such an application model is practiced by established mentorship programs like Techwomen [26]. The selection of students to the program is by the Program Lead, peer mentors, and industry stakeholders. The first cohort of the mentorship program took place from September 2016 to March 2017, excluding the December Holidays. The second cohort of the mentorship program took place in May 2017 to December 2017, and the third cohort of the mentorship program started in March 2018 and ended in September 2018, including a one-month break when most of the students had their university examinations.

3.3 Mentor Involvement

Mentors to the students are drawn from three pools of individuals: Program Lead, Industry Professionals, and Peer Mentors.

3.3.1 Program Lead

The Founder and Program Lead of the mentorship program conducts sessions on all the five pillars as well as one-on-one follow up sessions with each mentee over the period of the program.

3.3.2 Industry Professionals

Industry professionals from various computing and professional disciplines volunteer to facilitate sessions that address the various pillars. Additionally, ICT and Community-based organizations have partnered with the program to offer professional mentorship, as well as provide opportunities for the students to get involved in community projects as volunteers.

3.3.3 Peer Mentors

Peer mentors are students who have gone through a full cycle of the program and who give back by mentoring new students who join the program. Therefore, the peer mentorship model commenced in the second cohort of the program. This model has been successful in other projects, such as the near-peer mentorship model for middle school mentees [27]. At the start of the cohort, the peer mentors are trained in mentorship principles. The peer mentorship model involves the pairing of a maximum of three mentees per peer mentor, scheduled meetings that involve group and individual tasks, and a review after each peer session.

3.4 Curriculum Development

After the end of the second cohort, and after collecting sufficient student feedback to encourage proceeding with the project, a curriculum was designed and developed by the Program Lead with input from peer mentors and industry stakeholders. This curriculum was tested for the first time with the third cohort of mentees and was reviewed at the end of that phase of the mentorship program. The curriculum contains two main parts: training, and implementation. The training occurs in the first four months when the students take part in workshop sessions that address the pillars of the program. The implementation occurs in the last two months when the students take part in stakeholder-driven competitions to practice what they have learned. For all the competitions, professionals from the industry and who practice in relevant sectors volunteer to judge the competitions.

3.4.1 Innovation Training and Competitions

Training on Innovation involves impacting skills that enable the students to identify socioeconomic issues in the Kenyan society and use the ICT skills they learn in the classroom to provide solutions, through design thinking and prototyping. Further, the students are taught how to write pitch proposals and to pitch their solutions. Thereafter, the competition phase simulates a real-life innovation process of a solution, applying for a seed-grant and pitching an idea. The students are grouped into teams of up to six students and throughout the mentorship program, they work together to design an innovative solution to a socio-economic problem in Kenya. In the final two months, each team writes a seed-grant proposal and prepares and presents a pitch to a panel of industry professionals.

An example of an innovation that was designed and developed by the students is *Eternal Vote,* a project that was inspired by the 2017 Kenyan elections, which were marred with claims of rigged elections that led to repeated voting. The innovation considered the use of blockchain technology to improve accountability in voting.

3.4.2 Public Speaking Training and Competitions

Training on Public Speaking involves impacting skills in speech writing, presentation skills, and speech delivery, in order to improve students' self-confidence as well as confidence in presentations and speaking in front of a crowd. The objective of the competition phase is to simulate a real-life speech or presentation opportunity. The students compete individually in various rounds by giving speeches on various topics using various speech formats such as humorous, topical, and impromptu speeches.

3.4.3 Professional Development Training and Competitions

Training on Professional Development involves impacting skills such as CV writing, interview preparation, and professional communication. The objective of the competition phase is to simulate a real-life environment of applying for a technical role, such as that of a Software Engineer, as well as to practice professional communication and writing. The students compete individually in various rounds of mock-interviews that simulate real-life interviews. After each stage, the students receive feedback on their performance from the professional mentors who take part in the review process.

3.4.4 Scholarship Application Training and Competitions

Training on Scholarships involves creating awareness of scholarship opportunities as well as training student how to write award-winning scholarship applications and essays. The objective of the competition phase is to simulate a real-life competition of applying for highly competitive scholarships and grants, as well as to practice professional communication and writing.

3.5 Format of Mentorship Sessions

The mentorship sessions consist of non-technical workshops in a seminar room and technical workshops in a computer laboratory. Additionally, the mentees complete various tasks remotely, such as an assignment to practice their CV and scholarship writing skills. The students are also hosted in various ICT companies and tech events over the period of the program. Examples of companies that have participated in the program are Google and IBM.

The mentorship meetings are held once a week on Wednesday evenings and on two Saturdays a month. These times were deemed appropriate to enable students to attend their university classes during the week-day, as well as accommodate students who are on internship or have full-time employment. The program's timetable includes breaks from the sessions when the students have their university exams. All mentorship sessions are held within Nairobi, the capital city of Kenya.

3.6 Program Funding

The mentorship program has been funded using donations from friends and family, as well as event-specific grants from Google and Systers Pass-it-on Award.

3.7 Evaluation Criteria of the Program

The program is evaluated using various criteria to determine the impact that the mentorship is having on the students. The criteria used are discussed in section 4.3.

4 METHOD

The purpose of this study was to explore the impact of the structured mentorship program for CS university students in Kenya. The research questions that guided this study are: (i) Does structured mentorship lead to successful upskilling of Computer Science University students? (ii) Does structured mentorship lead to local and international exposure of CS students to the ICT industry? (iii) How do CS students perceive their experience in a structured mentorship program? A mixed-method approach was used to answer the research questions. Surveys were used to collect data before the start, during and at the end of the mentorship program.

4.1 Participants

Table 1 shows the number of mentees and peer mentors who completed the program, as well as the number of universities represented by the students. All students pursue degrees in Computing and related subjects. The number of universities represented by the students has increased since cohort one, showing that the program's popularity is rising as well as the need for mentorship by students. All the students who completed the program are from universities located within Nairobi. Table 2 shows that there has been an increase in the number of industry mentors and partners from the first cohort to the third. The program consists of both male and female students with an objective to maintain a 50-50 representation of male and female students in order to embody Dr. Anita Borg's vision of maintaining a 50-50 representation by the year 2020 [28] in computing workforce, which aims at achieving a 50% representation of women in Computer Science.

4.2 Data Collection

During the first cohort, only an end of program survey was issued. The students in the second and third cohort completed a pre-program survey, a mid-program survey, and a final impact survey. Interviews were used to validate the results of the survey and to gain further insights into how and if structured mentorship leads to increased local and international exposure of CS students, as well as how students perceive their experiences in the program.

4.3 Criteria for Measurement

4.3.1 Previous experience in mentorship

When applying to the program the students indicate what prior experience they have had with mentorship while at the university.

4.3.2 Retention rate

This criterion measures how many students start the program and how many finish the program.

Table 1: Number of mentees, peer mentors, and universities in Cohort one to three

Cohort	Number of universities	Mentees who completed the program	Peer Mentor
1	5	33	0
2	7	27	14
3	9	35	12
Total unique counts	**12**	**95**	**26**

Table 2: Number of individual industry contributors and companies

Cohort	Number of individual industry mentors	Number of company partners
1	3	1
2	23	5
3	28	6
Total Unique counts	**42**	**5**

4.3.3 Student's participation in the program

This criterion is measured by the attendance rate of the students during the program using a point-based system. When a student attends a mentorship workshop or submits an assigned task, their attendance is awarded 7 points, while if they send an apology they are awarded 1 point. If a student attends an ICT event outside the ones planned within the program, they submit a mini-report of the lessons learned to our closed Google Plus community and earn 5 bonus points. The minimum attendance rate required to be considered as having successfully completed the program is 70%. This is deemed sufficient to have covered the basic mentorship skills while allowing the students room to focus on their university studies.

4.3.4 Skills improvement

This criterion is measured using a pre and post survey, where the students indicate their level of skills in the five pillars of the program at the start of the program, during the program, and at the end of the program.

4.3.5 Students' achievements

This criterion is measured by tracking the achievements of students across the five pillars in terms of innovative solutions designed, internship and employment opportunities earned, improvement in public speaking, number of community involvement initiatives, or number of scholarships won.

4.3.6 Students' satisfaction

This criterion is measured by asking individual students of their perceived satisfaction with the mentorship program in terms of whether it is meeting their mentorship objectives.

5 RESULTS

Table 3 shows a summary of the results discussed in this section.

5.1 Previous experience with Mentorship

Majority of the students had not received any form of mentorship while at university, prior to joining the program. These results confirm the claims that most Kenyan universities do not offer consistent mentorship outside the classroom. Further, the fact that students from various universities apply to join the program could be an indication that there is a high demand for interventions that support university students to learn new skills that are not taught in the classroom.

5.2 Retention Rate

83%, 77%, and 88% of the students who started the program in the first, second, and third cohorts, respectively, completed the program successfully. The students who do not complete the program usually drop out within the first two months, and the main reason given for dropping out is new school and work commitments that demand more of their time.

5.3 Students' Participation Rate

The participation rate is measured by calculating the total number of points earned by a student and then dividing by the gross total that would be earned from participating in all the workshops and completing all the tasks. The overall average attendance rate by all the mentees at the end of the second cohort was 84%, and 95% at the third cohort. The point-based system had not been designed during the first cohort and hence was not used to measure attendance rates. The high attendance rates in the second and third cohorts indicate that students are finding value in the program. Further, the increase in attendance rate from the second to the third cohort indicates that the program is improving in meeting the objectives of the mentees.

5.4 Students' Achievements

Table 3 shows the number of students who won various scholarships or were accepted into internships in cohort one to three. There has been an increase in the number of students who won scholarships, across the three cohorts, after receiving mentorship training on writing award-winning scholarship applications. All the scholarships that the students won are in the CS field. For example, in cohort three, 22 of the students were awarded the Google Africa Udacity scholarship that sponsors students to take certified online courses in Web and Android Development. At the same time, two of the female students won full scholarships to attend the Grace Hopper Celebration of Women in Computing in the US for the first time.

5.5 Skills Improvement

Across all the skills students in the second and third cohorts demonstrated more improvement than those in the first cohort, showing that the program has improved in meeting the students' objectives. Further, at least three-quarters of the students who signed up for the mentorship program perceived to have significantly improved in most of the skills offered in the program. Table 4 and Table 5 show a comparison that was made between the number of students who indicated to be skilled to 'a great extent' at select skills, at the start and at the end of cohort two and cohort three. The findings in Table 4 and Table 5 show that at least 81% of the students who join the mentorship program improve in most of the skills by the time they complete the program.

5.6 Student Satisfaction

Table 3 shows the percentage of students who indicated that the program is either meeting their mentorship expectations or if it is exceeding their expectations, in cohort two and three. At the end of cohort two, 80% of the students indicated that the program has met their mentorship expectations, and 20% indicated that the program has exceeded their mentorship expectations. At the end of cohort three 41% of the students indicated that the mentorship program so far has met their expectations and 59% indicated that the mentorship program so far has exceeded their expectations. Additionally, in all cohorts, 100% of the students indicated that they would recommend a friend to apply to the mentorship program.

Further, some of the sample feedback from students are cited verbatim as below:

"I have become more confident in my skills, and have learnt to conduct myself in a highly professional manner as I exit college."

"I was really scared before the pitching sessions but after pitching several times my confidence was really boosted."

"I gained the opportunity to learn skills not taught in school."

"I was able to overcome my impostor syndrome"

"I have improved in my innovation skills."

"I am inspired to grow as an ICT developer and to do more in my career."

6 DISCUSSION, LESSONS, AND LIMITATIONS

The results show that a structured mentorship program, where students have measurable goals in terms of attendance and objectives, provides an organized and guided platform where students can learn new skills for their personal and professional development, especially for skills that are not typically offered in the university curricula. The findings also indicate that CS students benefit from guidance and support to identify and prepare for local and international opportunities, which are usually highly competitive.

6.1 Lessons Learned

Since September 2016 the program has restructured to respond to students needs as well as to the growing interest from potential participants and contributors. Thus, it is imperative to embrace flexibility throughout the program so as to adapt to what works and improve or change what does not work. While some mentorship programs work with students from just one institution, incorporating students from various institutions

Table 3: Summary of results from cohort one, two and three

Cohort	Number of students who started the program	% of students who had *no* previous mentorship experience	Number of students who completed the program	Average overall participation rate	Students who won scholarships and internships	expectations met vs those whose expectations were exceeded
1	40	85%	33	-	1	-
2	35	60%	27	84%	4	80%: 20%
3	40	80%	35	95%	26	41%: 59%

Table 4: Comparison of % of students who are skilled to a 'great extent' at the start and end of cohort two

Skill	Start of program	End of program
Innovation	13%	81%
Communication	22%	82%
CV-writing	19%	84%
Scholarship application	8%	54%
Community involvement	35%	85%

Table 5: Comparison of % of students who are skilled to a 'great extent' at the start and end of cohort three

Skill	Start of program	End of program
Innovation	13%	87%
Communication	25%	81%
CV-writing	10%	88%
Scholarship application	5%	83%
Community involvement	10%	82%

creates an environment for vast idea-sharing, thus leading to a more conducive environment for teamwork and collaboration.

A key lesson that emerged right from the beginning is that student-driven goals for a mentorship program offers significant potential to meet students' objectives. Further, a stakeholder-driven mentorship curriculum is likely to have more impact than one without stakeholder input. In addition, such a mentorship program gives industry contributors a platform to give back to academia through fostering industry-academia linkages and offering mentorship.

6.2 Limitations

While the mentorship program described in this study has demonstrated a positive growth and early impact on the 95 students who have taken part in it so far, several limitations have been observed that need improvement.

The 6-month duration could be short considering that the program serves students who have to juggle a full-time university workload with an additional mentorship workload.

The impact of the program was not sufficiently tracked right from the first cohort, thus important lessons could have been missed. However, as the program grows the required criteria that would demonstrate improvement of skills and impact would be measured for each cohort.

The program still lacks a follow-up model that would determine if the mentees are using the skills they learn after the program has ended. In future, such a model would be designed in order to gain a broader understanding of the impact of a structured mentorship program.

7 CONCLUSION

The Kenyan university education system has been criticised for producing CS graduates who are not ready for the job market. However, the findings in this study suggest that for institutions in developing countries that face limited human and technical resources in their higher education systems, a consistent, measurable and structured mentorship program that combines industry expertise, peer mentorship, and relevant skills for out-of-the-classroom learning, could potentially contribute towards filling any skills gap. Such a mentorship program can offer training on how students can apply their ICT skills to innovative projects. Further, in order to adequately communicate their ICT expertise and efficiently disseminate their information, tech students are expected to develop their professional skills. In addition, tech students should be able to tap into the numerous opportunities which would expose them to the vibrant tech community. However, structured mentorship programs should be adaptable to the needs of the mentees and of the environment.

REFERENCES

[1] Wycliffe Wanzala. 2013. Quest for quality and relevant higher education, training and learning in Kenya: an overview. *Education Journal* 2, 2 (March 2013), 36–49. DOI: 10.11648/j.edu.20130202.13

[2] Ishmael Munene. 2016. Kenya's universities are in the grip of a quality crisis. (February 2016). Retrieved from https://qz.com/618436/kenyas-universities-are-in-the-grip-of-a-quality-crisis/

[3] Josephat M. Mukhanji. 2017. Stakeholders' Perception on Instructional Effectiveness in Maseno University, Kenya. *The International Journal of Social Sciences and Humanities Invention* 4, 43. (March 2017). DOI: 10.18535/ijsshi/v4i3.05

[4] Kumwenda Save, Niang E. Hadji, Orondo Pauline, William Pote, Oyinlola Lateefah, Bongo Gedeon, and Chiwona Bernadette. 2017. Challenges facing young African scientists in their research careers: A qualitative exploratory study. *Malawi Medical Journal* 29, 1, (March 2017), 1–4.

[5] IUCEA. 2014. Status of Higher Education Qualifications Systems and their Contributions to Human Resources Development in East Africa. (June 2014). Retrieved from https://iucea.org/index.php?option=com_phocadownload&view=category&download=127:iucea-study-report-on-status-of-higher-education-status-in-eac-2014&id=14:qa-policy-documents&Itemid=613

[6] Audrey Cheng. 2016. Bringing World-Class Tertiary Education to Sub Saharan Africa. (December 2016). Retrieved from https://challenges.openideo.com/challenge/youth-empowerment-challenge/beneficiary-feedback/bringing-world-class-tertiary-education-matched-to-emerging-markets/comments

[7] IDC. 2011. Kenya ICT Market Survey 2011. (November 2011) Retrieved from https://www.scribd.com/presentation/73453205/Julisha-Kenya-ICT-Market-Survey-2011

[8] Moringa School. 2018. Retrieved from http://www.moringaschool.com/

[9] Andela. 2018. Retrieved from https://andela.com/

[10] Government of Kenya. 2013. Kenya Vision 2030: Towards a Globally Competitive and Prosperous Kenya. Retrieved from https://www.researchictafrica.net/countries/kenya/Kenya_Vision_2030_-_2007.pdf

[11] World Economic Forum. 2016. The Future of Jobs: Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution. Retrieved from http://www3.weforum.org/docs/WEF_System_Initiative_Future_Education_Gender_Work_Closing_Skills_Gap_pagers....pdf

[12] Kristy E. Boyer, Thomas, E. Nathan, Audrey S. Rorrer, and Mladen Vouk. 2010. Increasing Technical Excellence, Leadership and Commitment of Computing Students through Identity-Based Mentoring. *SIGCSE' 10.* (March 2010). DOI:10.1145/1734263.1734320

[13] Esther W. Muchiri. 2013. *The Role of Mentorship in Enhancing Youth Employability in Kenya.* Master's thesis. United States International University (USIU), Nairobi, Kenya.

[14] Kipkoech Rotich, and Koech Julius. 2014. Factors Influencing the Choice of College Among Undergraduate Students in Public Universities in Kenya: A Case Study of the University of Eldoret. *Australian Journal of Commerce Study* 4, (January 2014), 1-11. ISSN: 2308-1365

[15] Daryl D'souza, Margaret Hamilton, James Harland, Peter, Muir, P, Charles Thevathayan, Cecily Walker. Transforming Learning of Programming: A Mentoring Project. *Tenth Australasian Computing Education Conference (ACE2008).* (January 2008).

[16] Betty, Karanja, and John Gikungu. 2014. Effect of Mentorship Programmes on the Performance of Students in Secondary Schools in Mbooni East District, Makueni County - Kenya. *Mediterranean Journal of Social Sciences 5*, 5, (April 2014), 345–349.

[17] Jody Clarke-Midura, Vicki Allan, and Kevin Close. 2016. Investigating the Role of Being a Mentor as a Way of Increasing Interest in CS. In *Proceedings of the 47th ACM Technical Symposium on Computing Science Education - SIGCSE '16*, (March 2016), 297–302.

[18] Akili Dada. 2018. Retrieved from http://www.akilidada.org/

[19] AkiraChix. 2018. Retrieved from http://akirachix.com/

[20] Greenhorn Mentorship. 2018. Retrieved from http://www.greenhornmentorship.com/interface/index.php

[21] British Council. 2015. Universities, Employability and Inclusive Development: Reposition Higher Education in Ghana, Kenya, Nigeria and South Africa. Retrieved from https://ereadiness.kenet.or.ke/sites/default/files/ctools/Graduate employability final report.pdf

[22] Joyce Kinyanjui. Mentoring for Kenya's Marginalized Girls: Benefits, Challenges, and Policies. 2016. *The 2016 ECHIDNA Global Scholars Policy Brief.* (December 2016).

[23] Undugu Mentorship 2016. Retrieved from http://www.undugumentorship.org/

[24] e-mentoring Africa. 2017. Retrieved from http://ementoringafrica.or.ke/transition-programs/

[25] Andrew S. Ssemata, Sophia Gladding, Chandy C. John and Sarah Kiguli. Developing mentorship in a resource-limited context: a qualitative research study of the experiences and perceptions of the Makerere university student and faculty mentorship programme. *BMC Medical Education 17,* 1. 123. (July 2017).

[26] Techwomen. 2018. Retrieved from https://www.techwomen.org/program/overview

[27] Jody Clarke-Midura, Fredrick Poole, Katarina Pantic, Megan Hamilton, Chongning Sun, and Vicki Allan. 2018. How Near Peer Mentoring Affects Middle School Mentees. *SIGCSE'18,* 664-669. (February 2018). DOI: 10.1145/3159450.3159525

[28] Anita Borg's 2020. 2018. Retrieved from https://medium.com/@meena24dhanani/pbc-2018-50-50-by-2020-why-do-i-care-429f0ac8dfca