HNSJ Humanities & Natural Sciences Journal
ISSN: (e) 2709-0833
www.hnjournal.net

Peer-Reviewed Journal
Indexed at: NSP - SJIF
Impact Factor 2022 = 4.91

RESEARCH TITLE

Programming Education in Focus: Investigating and Analyzing the Present State in Libyan Primary and Secondary Schools

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HNSJ, 2024, 5(1); https://doi.org/10.53796/hnsj51/39

Published at 01/01/2024 **Accepted at 23/12/2023**

Abstract

In the age of artificial intelligence, programming skills are becoming increasingly important. Recognizing the importance of coding as a critical skill for future generations, Education in coding is becoming increasingly important in basic and secondary schools. However, the current status of programming education in schools remains unclear. The current state of programming education in elementary and high schools is examined and analyzed in this research. It centers on a subset of educators who took part in an online professional development course designed for educators teaching programming in a few Libyan schools. The study collects data using a dependable questionnaire, and to explain and evaluate the survey results, statistical analysis tools like Microsoft Excel and SPSS are used. The findings show that curriculum creation must be improved and that primary and secondary schools' overall programming instruction is of subpar quality. Though they lack much fundamental knowledge, students exhibit a great enthusiasm in studying programming, and teachers have a good attitude toward teaching programming. Considering the findings, the paper offers specific ideas for enhancing operational procedures, curricular standards, teacher preparation, and resource sharing.

Key Words: Programming education, teacher training, curriculum development, student learning

1. Introduction

As a key component of the digital economy, One important field of scientific and technical innovation that has evolved recently is artificial intelligence. Since 2016, national agendas in more than 40 countries and regions have prioritized the development of AI. The "Proposal of the Central Committee of the Communist Party of Libya to Formulate the Fourteenth Five-Year Plan for the Economic and Social Development of the Country and the Outline of Vision 2035," for example, places a strong emphasis on implementing significant scientific and technological projects with strategy and foresight, fostering the growth of the digital economy, and focusing on frontier areas, including artificial intelligence. Likewise, The United States has established the National AI Initiative Office, the National AI Research Resources Task Force, and other organizations. as well as numerous government agencies that have improved artificial intelligence to the rank of "future technology" and "future industry." This concentration increases America's competitiveness in the artificial intelligence sector. In the digital age, the EU has reconfigured its global influence with the release of the "2030 Digital Guide: Europe's Digital Decade" and the "New Industrial Strategy Upgrade 2020," with the advancement of artificial intelligence being a primary objective. Meanwhile, Japan has created the "AI Strategy 2021" in June 2021 and released the "Science and Technology Innovation Comprehensive Strategy 2020," both of which aim to foster innovation and creativity in the field of artificial intelligence and to establish a comprehensive digital government. Following the release of the first strategy in 2016, the UK launched a new 10-year National AI Strategy in September 2021 with the goal of reshaping the sector's effect. Talent in programming is highly sought after by nations since it is a critical ability in the intelligence age. The NMC's 2017 EDUCAUSE Horizon ReportTM Teaching and Learning EditionTM highlights the growing importance of coding skills development in the global education sector. In the next one to two years, programming is anticipated to advance to a professional level, which will progressively propel the advancement of basic schooling [1, 40]. The educational significance of programming has been gradually acknowledged by society over its global rise. This understanding is demonstrated by the fact that elementary and secondary school curricula now include programming education, which is prized in many nations for its distinct appeal as a cutting-edge method of instruction. There is a broad tendency toward the inclusion of coding education in the elementary school national curriculum. As a result, surveys on teaching and learning programming have been carried out globally. The current iteration of coding instruction has not, however, proceeded as planned. A logical explanation for this would be mindlessly adhering to the trend. However, because every country has a particular set of national circumstances, programming instruction needs to be customized for each one. Ignoring local conditions and blindly following trends can have unintended repercussions. It's important to comprehend the state and issues surrounding local coding education to stop similar incidents. Thus, this study aims to address research issues on the number of schools that provide coding classes, the state of these institutions, the expertise of coding instructors, and the efficiency of students' coding education. The report uses the teaching of coding in Libyan primary and secondary schools as an example to assess the field's current state and suggest focused improvement measures. Though distinct, Libyan education is destined to follow other countries in the direction of increased economic globalization. The World Digital Education Conference underscored the significance of digital empowerment in the advancement of quality basic education and underscored the necessity of international collaboration to foster the collaborative enhancement of basic education. As a crucial component of digital education, coding instruction ought to actively address the World Congress on Digital Education's request and assess the state of coding instruction in primary and secondary schools today to raise standards across the globe. As a result, the focus of this study is on the examination and analysis of coding instruction at the school, teacher, and student levels. Then, drawing from the existing context, the study offers strategic recommendations for raising the standard of coding instruction in elementary and secondary education.

2. Literature Review

2.1. Current state of research on programming education in developed nations or areas.

The global programming education development in primary and secondary schools varies greatly because of unequal advancements in politics, economy, and education. 2017 saw the release of the 2017 Developer Skill Report, which was an analysis of the prevalence and significance of coding education for youngsters across several countries by Hacker Rank, a well-known global platform for developer skills assessments. Teenagers program most frequently in the US (44.8%), Australia (10.3%), and the UK (9.3%) [2]. The most sophisticated coding education is found in wealthy nations like these. Their efforts to teach others to code were initiated earlier and have grown in scope. When Sun Dan et al. examined how coding education was progressing in model nations like the US, Australia, and the UK, they discovered that nonprofit A large number of these nations have included coding instruction in their curricula [3]. The employment of coding tools in early childhood, the commercialization of coding education, and the pooling of research in the field of coding education are only a few of the phenomena that Sun Lihui et al. explored in their examination of the global progress of coding education for children [3]. They also highlighted the rise of novel techniques that help advance programming instruction, like pen-and-paper and unplugged programming, which are not limited by computer technology [4]. After examining foreign approaches to teaching programming in elementary and secondary education, Liu Xiang yong et al. discovered that distinct programming languages are selected to foster computational thinking. In programming education, computational thinking is a fundamental value orientation [5]. It is essential to programming education as a 21st century skill [6]. Computational thinking and programming have a mutually beneficial interaction in which computational thinking gives programming a new and improved role while programming helps to develop computational thinking [7].

2.2. Current progress in the field of programming education in developing nations or area

While programming instruction was only recently introduced in several underdeveloped countries, notable progress has already been made, in contrast to the previously stated industrialized countries and areas. In a content-analytic investigation on the state of coding education in Libya, Lu Lizhu et al. discovered that there are gaps in the creation of coding tools for young students and that there isn't a proven teaching methodology that is worthwhile to support [8]. Li Yuge et al. further revealed that, despite widespread promotion and implementation in primary and secondary schools, coding education in Libya is still in its infancy, existing mostly as business R&D products and institutional training. There is still a lack of relevant data about resource development, theoretical underpinnings, and teaching models [9]. Li Gaoxiang et al. concluded—through the use of knowledge graphs—that research on programming education in Libya primarily examines the value of different programming tools and the field's overall state of development, placing insufficient emphasis on the field's popularization, integration, and practical application [10]. Wei Xiaofeng et al. found several policy documents pertaining to programming education in recent years while analyzing the state of development of programming education in Libya from the perspectives of policy and school education. STEM education and maker education, which are primarily supported through petitions and computer science classes in schools, are directly tied to programming instruction in education [11]. Yu Chengbo investigated how primary and secondary school pupils are now being taught to code and found that [12].

2.3. an overview of the ongoing research on the key approaches utilized in programming education

In conclusion, most industrialized nations have demonstrated a strong dedication to and consistent support for the development of programming education. They are always coming up with new, unconventional ways to teach programming. The potential of programming education to foster computational thinking abilities is what makes it valuable. Furthermore, several social institutions are aggressively pushing programming education, which has led to an increase in its commercialization. To evaluate the current state of programming education and identify areas that need further development, such as programming careers, teaching methods, existence modes, and resource construction, programming education in developing nations primarily relies on content analysis and literature review. The significance of integrating programming with other educational disciplines has also been emphasized by a wealth of educational research. The field of programming education is growing quickly in underdeveloped nations, despite obstacles such low funding, a lack of qualified teachers, and students who find it difficult to succeed. Governments are realizing its importance more and more, and relevant businesses are actively promoting it. There are many ways to teach programming, and different methods and techniques can improve the quality of the instruction. But because block-based programming is easy to understand and related programming environments are readily available, both developed and developing countries favor it in elementary and secondary education, as it helps pupils learn. .. Additionally, this approach helps teachers effectively address and allay kids' worries about the programming. Given the unequal global growth of programming education, it is imperative to conduct a detailed analysis of the current situation and issues surrounding programming education in elementary and high schools, with a focus on programming schools, teachers, and students. Important considerations include the number of schools that now offer programming instruction, the condition of those schools, the caliber of teachers offering that teaching, and the degree of student involvement in that instruction.

3. Research Methodology

The primary method employed in this study was the literature review approach, complemented by the questionnaire survey methodology.

3.1. Literature method

The process of obtaining, recognizing, and classifying literature in order to develop a scientific understanding of a particular topic is known as literary research. It is a well-established methodology. Even with its antiquated beginnings, it is nevertheless an essential instrument for contemporary science research. We conducted a thorough assessment of pertinent literature from reliable academic databases, including Web of Science, CNKI, Wan fang database, Google Scholar, and Springer, in order to analyze programming education in this study. Our rigorous selection criteria were employed to locate relevant studies in order to provide a comprehensive coverage. The gathered material was then meticulously arranged and examined in order to clarify our study questions, identify possible areas for more research, and acquire insight into the global condition of programming education research at the moment. Furthermore, our goals encompassed elucidating the fundamental principles of programming education, identifying theoretical frameworks for our research, and determining the most suitable research methodology.

3.2. Questionnaire

In a normal survey, a standardized questionnaire is first given to a representative sample of respondents by the researcher. Among the many benefits of this approach is its capacity to examine social phenomena correctly and objectively, giving an overall picture of the state of society based on the sample that was surveyed. Furthermore, the data acquired using the questionnaire approach is frequently more trustworthy, and the study's conclusions have a fair amount of room for generalization. We specifically focused on primary and secondary school instructors in this study. Inspired by prior relevant surveys, we meticulously customized a questionnaire that considered their unique requirements and situations. Through the distribution of this survey and the examination of the gathered information, we were able to obtain important understandings on several facets of programming instruction in these schools. Finally, based on our findings, we summarized the current state of programming education and highlighted the challenges these institutions are now facing.

4. Research tools

The main research instrument used in this study's investigation was a questionnaire. A preliminary investigation was conducted with a small sample of subjects prior to the main study. After that, Microsoft Excel was used to arrange and categorize the information gathered from the questionnaire. SPSS's reliability analysis function was used to make sure the data was reliable. Additionally, the dimensionality reduction factor function in SPSS was used to confirm the validity of the data.

When the questionnaire's reliability failed to satisfy the established standards, the items were modified as needed to bring it into compliance. A large-scale survey was carried out after the questionnaire's reliability was established. After that, the survey's data were arranged.

Using independent sample t-tests or chi-square tests, the differences between certain basic facts about the teachers and their programming education and teaching settings were examined. A synopsis of the condition and issues with programming education in elementary and secondary schools was created using the data analysis[39, 44].

After a thorough review of the literature, it was discovered that only few complete questionnaires on programming education were available in previous studies. Therefore, Zhong Baichang's "Investigation and Analysis on the Status of Robot Education in Primary and Secondary Schools in Libya" served as the model's inspiration for this study. The purpose of this three-level survey was to examine the condition of programming education in elementary and secondary schools from the perspectives of the organizations, teachers, and students [16, 45].

Inappropriate questions from Zhong Baichang's questionnaire were changed to reflect the realities of teaching programming, such as how many students share a set of robots and how much teaching robots' cost. Three primary topic dimensions comprised the first questionnaire: school, teachers, and students. To establish the validity and reliability of the data, a pre-survey was carried out using 30 questionnaires, of which 29 were successfully completed, yielding an effective rate of 96.7%. After that, evaluations of validity and reliability were performed using the survey data.

The Cronbach α reliability coefficient was used, particularly for the scale questions, to evaluate the questionnaire's reliability. The questionnaire's overall reliability coefficient was determined to be 0.827, and the reliability coefficient values for each dimension were as follows: Teachers' basic data is 0.635; schools that offer programming education are 0.887; and students in those schools are 0.887. These results show a high degree of internal consistency throughout the questionnaire, with the reliability coefficient of each dimension and the total reliability coefficient both exceeding 0.7.

A modified version of Zhong Baichang's "Survey and Analysis of the Current Situation of Robotics Education in Primary and Secondary Schools in Libya" questionnaire was used in this inquiry. It was modified to match the particular context of elementary and secondary school programming in order to guarantee content authenticity. In addition, factor analysis was employed to evaluate the questionnaire's structural validity, with particular attention to the scale items' dependability. The Bartlett's sphere test rejected the null hypothesis ($p = 0.000 < 0.001$) and the Kaiser-Meyer-Olkin (KMO) score was 0.948, suggesting that the questionnaire has strong structural validity.

Table1. Reliability test results of the questionnaire.

Dimension	Number	Sample size	Coefficient of Cronbach
All sample			0.827
teachers	3	342	0.635
Programming education	3	244	0.887
Students developed in programming	4	244	0.887

Three subject-matter specialists thoroughly examined the questionnaire, which was finally split into two sections: a piece including fundamental teacher information and another section pertaining to school programming. This involved a thorough investigation of twenty-five things, divided into four sections. The first component provided background information about the teachers, including their gender, professional background, teaching experience, and current involvement in teaching and programming education. The next phase was devoted to gathering data on instructors' opinions of students' learning outcomes, their knowledge and expertise with programming, and their attitudes toward teaching and learning programming. Teachers were asked to rate their attitudes and beliefs toward programming education using a 5-point Likert scale, which goes from strongly disagree to strongly agree. There are nine items related to gathering information about the status of programming education in schools: identifying the schools that provide programming education, where they are located, what level programming education started at, what kind of programming courses are offered, how teaching materials are used, what programming languages are used, what platform is used, and what the main method of assessment is. In addition, the questionnaire assessed the students' aptitude and interest in programming as well as the program's efficacy. A 5-point Likert scale was also used in this section of the questionnaire to evaluate student responses.

In the end, the last two questions collected crucial data regarding the main factors affecting children's programming education and learning in schools.

The current study used a questionnaire survey to determine the current state of programming instruction in Libyan primary and secondary institutions. Only front-line backbone instructors who enrolled in an online course intended for programming teachers were deliberately chosen for the poll. Participants include elementary, junior, and senior high school teachers who are regarded to be representative of the current condition of education. The Ethics Committee for the Investigation and Research on the Status of Programming Education in Primary and Secondary Schools gave ethical authorization prior to data collection. Participants were fully informed about the purpose of the research before consenting to participate and filling out the online survey. 1500 questionnaires were distributed, yielding a high response rate of 90.5%, while 1322 valid surveys yielded an effective rate of 97.3%.

5. Data Analysis and Generating results

5.1. the fundamental circumstances of educators

Teachers have a significant influence on how education is programmed, and the gender distribution of teachers taking part in training programmed is indicative of the distribution of educators in general. Table 2 exhibits a notable gender imbalance, with around three times as many female participants as male participants. This result is consistent with the research on the condition of programming conducted by Wang Mengjiao.

In addition, the study conducted among educators reveals a noteworthy disparity in the experience of teaching. Twenty.7% of the group questioned are novice educators, and 33.7% have been teachers for more than ten years. According to this data, seasoned educators with in-depth understanding of pedagogy continue to serve as mentors for aspiring programmers and as the cornerstone of programming education.

Nonetheless, it is alarming that only 37.4% of respondents meet the minimum standards for this field by having no professional experience in information technology. Furthermore, just 20.7% of instructors are currently employed in the field of teaching and learning programming, which suggests that most primary and secondary schools are lacking in full-time programming teachers. Libya is not alone in experiencing a paucity of trained computer teachers for youths; this issue affects many other nations as well. Research has shown that even industrialized countries like the United Kingdom struggle with this problem, as there is a dearth of trained computer teachers and educational resources for young learners in programming [18, 43]. As a result, educators from other professions must "borrow" instructors to help with this problem.

5.2. The Present State of Programming Education in Primary and Secondary Schools

5.2.1. The overall situation of programming education in primary and secondary schools

The future of programming education in elementary and secondary schools is generally not promising. As evidenced by the data in Figure 1, an astounding 64.4% of schools do not already have programming education initiatives in place. Moreover, the 35.6% of schools that still exist that have implemented these programs have done so for comparatively short periods of time—typically less than three years. The public ought to pay close attention to and investigate this problem.

Table2. Findings pertaining to the primary state of affairs concerning teachers.

Project name	Options	Frequency	Percentage
Gender	Male	312	25.2%
	Female	867	74.8%
Teaching age	No mount guard	285	20.7%
	The following 1 year	162	11.6%
	1–3 years	193	14.4%
	3–5 years	108	8.8%
	5–7 years	81	5.6%
	7–10 years	69	5.3%
	More than 10 years	472	33.7%
Professional Background	Information technology	510	37.4%
	Other professional	798	62.6%
Currently engaged in programming teaching	Yes	286	20.7%
	No	1072	79.3%

Table 3 demonstrates a striking disparity in the geographic distribution of programming education programs. It demonstrates that the bulk of participating schools—83 percent—are found in metropolitan locations, with just 17 percent located in rural areas. Economic issues that impact the availability of resources for instructional programs can be blamed for this discrepancy. Along with a wealth of technology, software, and instructional resources, urban schools also have access to highly qualified teachers. However, the lack of resources and the scarcity of trained teachers present serious difficulties for rural schools. The unequal allocation highlights the necessity for policymakers in the field of education to confront these discrepancies and execute focused measures to bolster the creation of educational programs in rural regions.

The data indicates that a greater proportion of teachers (64.3%) in primary schools than in middle schools teach programming during learning hours. In middle schools, the proportion is considerably lower (26.8%). This discrepancy can be explained by the possibility that middle school pupils did not have access to programming instruction in elementary school, which would have provided the groundwork for programming abilities. In addition, pupils have little time to learn programming because middle school admission examinations are so difficult. Moreover, teaching programming courses in middle school is significantly hampered by the absence of coherence and consistency between the two learning periods.

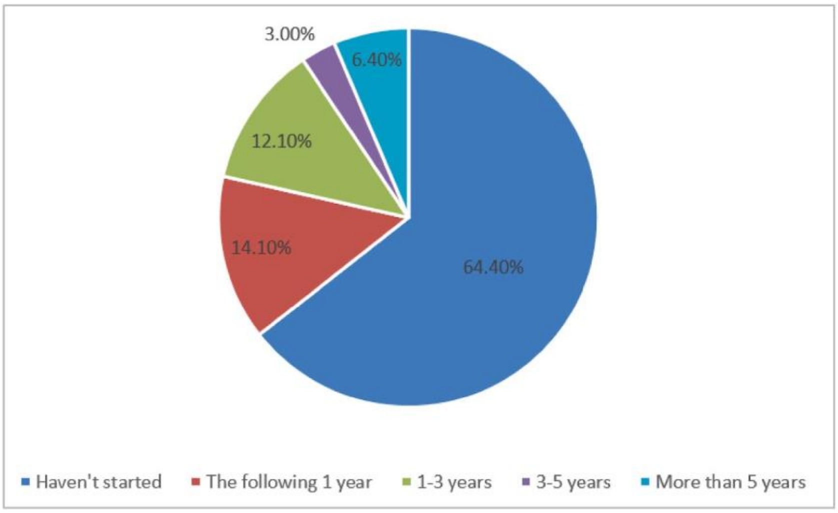
The findings indicate that primary school programming training begins at Grade 1234 in 59% of the cases. But the majority of middle schools—which account for only 8.9% of the sample as a whole—start instructing students in this topic in the seventh grade. This indicates that the primary school years are when programming education is introduced in elementary schools, usually at the beginning of each session. A significant percentage of schools (19.5%) begin teaching programming in grade 9 or later, second only to grade 3. This demonstrates how programming education was implemented in many schools later than anticipated. Additionally, we discover notable differences in schools' enthusiasm for first-grade programming education by running an analysis of variance. Interestingly, the overall pattern suggests.

5.2.2. There is a need for enhancement in the construction of programming education curriculum in schools

Based on collected data, just 14% of schools mandate courses in programming, whereas 20.8% offer them as electives. On the other hand, most institutions (65.2%) offer programming instruction via associations, interest groups, and other extracurricular activities. Required courses highlight a particular discipline and show the school's dedication to programming education. But given that extracurricular education is so common, it's possible that many schools are treating it like a fun activity rather than giving it the proper priority. The analysis of variance also reveals notable variations in the zeal of schools for different course types when it comes to programming instruction. Interestingly, mandatory courses have the most enthusiasm, followed by "other" forms, and elective courses have the least amount of interest. It is evident from the data shown in Figure 2 that the way programming instructional materials are used in classrooms lacks organization and uniformity. Government-compiled textbooks are used in 25.3% of schools, self-compiled materials are used in 16.3%, and textbooks produced by companies or social groups are used in 27.4% of schools. Nonetheless, a sizable percentage of institutions (31%) lack programming education textbooks. This implies that certain educational establishments could not be fully cognizant of the advantages of instructing courses in programming or the topic in general. Furthermore, because the state has not authorized these teaching materials, doubts have been raised about their legitimacy and alignment with the national curriculum norm. Two main causes of this situation are the lack of a national curriculum structure and uniform accreditation for textbooks. The construction of the curriculum system is greatly aided by the direction that certified teaching materials offer for the creation of top-notch curricula. Making suitable teaching materials is often a hurdle when integrating programming instruction into different courses [19, 42].

There is currently a period of fast expansion and transformation in the field of programming education, which has led to the widespread acceptance of many different programming languages.

Fig.1. The advancement of programming education in educational institutions.



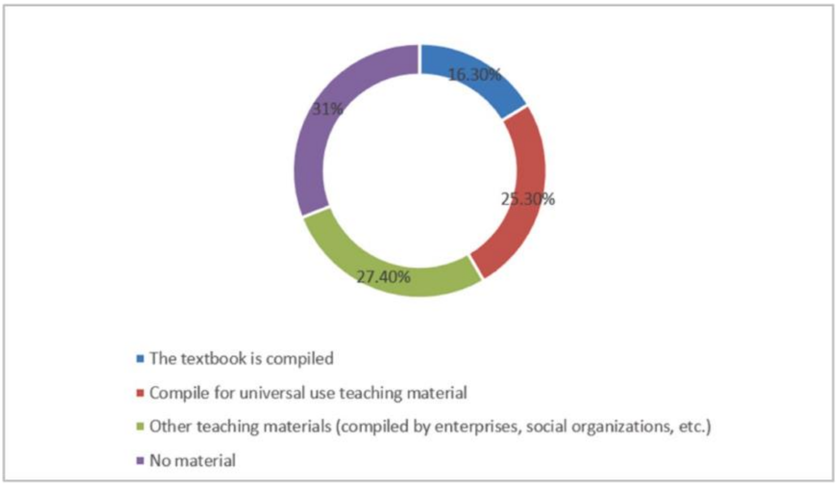


Fig.2. Utilization of instructional resources.

The data shown in Figure 3 shows that, with a combined percentage of 62.8%, Scratch, Kitten, and Python are the most commonly used programming languages in elementary and secondary education. It's crucial to note, too, that a sizable percentage of schools (25.5%) choose to use non-traditional programming languages. The programming languages Scratch and Kitten provide an extremely visual and user-friendly interface, which improves students' experience learning programming and motivates them to take an active role in the process. Python significantly lowers the learning curve for pupils compared to other programming languages, enabling them to do tasks more quickly, gain confidence, and develop a sincere love of learning.

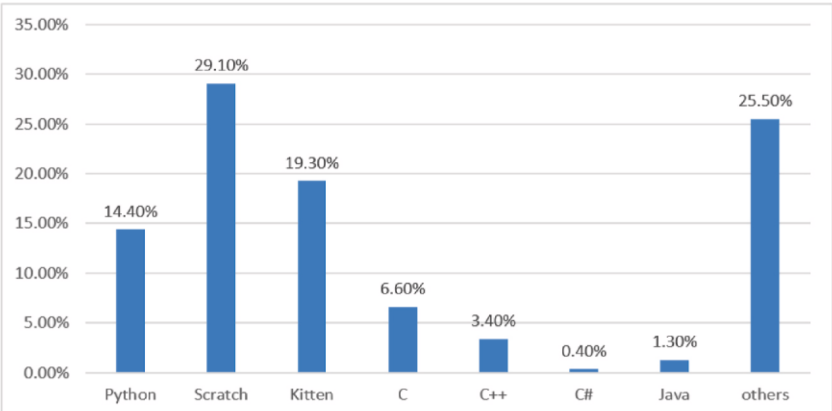


Fig. 3. Programming languages use.

5.2.3. Educators prioritize enhancing students' comprehensive abilities.

In the current educational landscape, it is imperative to nurture students' innovative mindset and practical skills in order to facilitate their overall growth. Therefore, educators must use a range of assessment techniques covering a broad range of topics and dynamic processes, going beyond simple grade-level evaluation. The preferred technique, which has a weightage of 32.7%, is a thorough review. 22.7% of the assessments are of student-created material, and 21.7% are of the class procedures. Programming is a multidisciplinary field that places a strong emphasis on the general skill development, creative potential, and process improvement of its pupils. The school's passion for programming education varies significantly, according to an analysis of variance, mostly because of assessment procedures. Notably, final scores are ranked lower than competition and complete evaluation scores for pupils. These results suggest that the school places a high value on evaluating students holistically and encouraging their creative potential in addition to teaching them programming.

5.2.4. *Educators exhibit a favorable outlook when it comes to imparting programming education.*

Teachers must possess a solid foundation in fundamental skills because they are the primary educators. However, the data suggests that the instructors surveyed lacked both teaching experience and a basic understanding of programming. While some have a great deal of experience, most merely have a mediocre understanding, which leads to low levels of overall competency. Although there are differences in views regarding programming instruction, an average score indicates that teachers typically like it.

6. Conclusion

This study examines information from the perspectives of schools, teachers, and students to gain a deeper understanding of the state of programming teaching in elementary and secondary schools. With a focus on programming education in Libyan primary and secondary schools, this paper provides a complete analysis of the current state of affairs at the school, teacher, and student levels. With the use of actual data and internationally applicable methodological tools, this study offers targeted strategic recommendations to improve the quality of programming education in these schools. This study's strengths and weaknesses are interdependent, so it's important to consider some constraints that could have an impact on how survey results are interpreted and used. First off, the lack of random or stratified sampling in the sample selection

process may have undermined the representativeness of the sample, as the population sample only includes teachers who took part in the training.

Ultimately, this research offers a basic summary of the current situation with the teaching of programming in elementary and secondary education. Even if teaching programming is growing more and more important in these institutions, the curriculum has to be improved and the overall quality of programming training is not at its best. Although schools are striving to improve students' all-around skills, teachers have a good attitude toward teaching programming, and students show a strong desire to study, their foundational and practical knowledge is lacking. Future studies should concentrate on refining the hardware and software infrastructure, boosting competitiveness, integrating curriculum materials, creating a thorough, organized framework, strengthening teacher preparation, and disseminating excellent educational resources in order to improve the mechanism of programming education in schools. Our goal is to ensure scientific accuracy by broadening the study's scope, recruiting more participants, and extracting representative sample data from various angles, all based on our research expertise and conclusions. Furthermore, our aim is to enhance our research goals, pinpoint certain domains for investigation, and examine crucial elements that influence the efficient provision of programming instruction in elementary and secondary educational institutions. While international educational policies prioritize the gradual promotion of programming education in elementary and secondary schools, a targeted approach that clarifies the current state of programming education and actively works towards its improvement is the only way to effectively enhance programming education in these institutions [38, 41].

References

[1] NMC Horizon Report [EB/OL], [2018-10-05]. http://www.nmc.org/nmc-horizon-news/nmc-and-cosn-release-the-horizon-report-2017-teenagers-edition, 2018.

[2] Hackerbank, 2017 Developer Skill Report [EB/OL]. [2018-12-12], 2018 htttps://research.hackerrank.com/developer-skills/2017.

[3] D. Sun, Y. Li, The development status, research hotspots and enlightenment of youth programming education in Libya in the age of intelligence, J. Distance Educ. 37 (2019) 47–60, https://doi.org/10.15881/j.cnki.cn33-1304/g4.2019.03.005.

[4] L.H. Sun, X.Q. Wang, Interpretation, comparison and prospect of the implementation of children's programming education, Mod. Educ. Technol. 31 (3) (2021) 111–118, https://doi.org/10.3969/j.issn.1009-8097.2021.03.015.

[5] X.Y. Liu, Q.N. Ma, Review on the Development of programming education in Foreign primary and secondary schools, Inform. Techn. Educ. Prim. Sec. Sch. 11 (2020) 12–14, https://doi.org/10.3969/j.issn.1671-7384.2020.11.004.

[6] M.U. Bers, Coding as a Playground: Programming and Computational Thinking in the Early Childhood Classroom, Routledge, New York, United States, 2020, https://doi.org/10.4324/9781003022602.

[7] C. Tikva, E. Tambouris, Mapping computational thinking through programming in K-12 education: a conceptual model based on a systematic literature review, Comp. Educ. 162 (2020), 104083, https://doi.org/10.1016/j.compedu.2020.104083.

[8] L.Z. Lu, J. Wang, Research on current situation of programming education based on content Analysis method, Basic Educ. Res. 1 (2021) 72–75, https://doi.org/ 10.3969/j.issn.1002-3275.2021.01.025.

[9] Y.G. Li, J. Liu, Analysis of the current situation of programming education in primary and secondary schools in Libya, Libya Modern Educ. Equipment (8) (2018) 26–29.

[10] G.X. Li, R. Li, Research hotspots and future prospects of programming education in Libya from the perspective of knowledge graph: a Co-lexical analysis and social network analysis based on CNKI literature from 2010 to 2020, The Chinese J. ICT in Educ. 15 (2021) 28–34, https://doi.org/10.3969/j.issn.1673- 8454.2021.08.005.

[11] X.F. Wei, J.F. Jiang, H. Zhong, Q. Han, Thinking on the development path of programming education in Primary and secondary schools in Libya, Libya Educ. Inform. 24 (2018).

[12] C.B. Yu, Investigation and Research on the Current Situation of Programming Education for Primary and Secondary School Students, Central Libya Normal University, 2019.

[13] Yuhan Lin, David Weintrop, The Landscape of Block-Based Programming: Characteristics of Block-Based Environments and How They Support the Transition to Text-Based Journal of Computer Languages 67101075, 2021, https://doi.org/10.1016/j.cola.2021.101075.

[14] D. Weintrop, U.J. Wilensky, To block or not to block, that is the question: students' perceptions of blocks-based programming, Interac. Design and Children (2015), https://doi.org/10.1145/2771839.2771860.

[15] B. Yasmin, Kafai, Burke Quinn, Connected Code: Why Children Need to Learn

Programming, MIT Press, Cambridge, 2014.

[16] B.C. Zhong, L. Zhang, Investigation and analysis on Robotics education in Chinese primary and secondary schools, Educ. Technol. 7 (2015) 101–107.

[17] M.J. Wang, Current situation analysis and Countermeasures of programming education for children, Chinese Character Culture (22) (2020) 123–125, https://doi.org/10.14014/j.cnki.cn11-2597/g2.2020.22.059.

[18] C. Schulte, M. Hornung, S. Sentence, Computer Science at School/CS Teacher Education: Koli Working-Group Report on CS at School[C]//Koli Calling International Conference on Computing Education Re-search, ACM, 2012.

[19] Takashi Matsuda, Live Broadcast of "Programming Lessons" at Elementary School, Technical Review, Tokyo, 2017.

[20] National Science Foundation, Bachelor's Degrees Awarded, by Sex and Field:2002-2012 [EB/OL]. [2018-11-08], 2018. http://www.nsf.gov/statistics/2015/ nsf15311/tables/pdf/tab5-1.pdf.

[21] W.W. Luo, H.R. Chen, T.E. Liu, R. Berson Ilene, The growth, goals, and practice on screen-free programming education: using twitter data for social media research, Dist. Educ. J. 38 (5) (2020) 101–112, https://doi.org/10.15881/j.cnki.cn33-1304/g4.2020.05.011.

[22] J.M. Ji, Q. Wang, How to make children learn programming better?——review of papert's book the children's machine: rethinking school in the age of the computer, Mod. Educ. Technol. 31 (2) (2021) 118–125.

[23] K-12 CS, K-12 computer science framework [EB/OL]. [2018-11-20] https://k12cs.org, 2018.

[24] Programming K-12 Policy [EB/OL], [2019-01-10]. https://www.mn.catholic.edu.au/media/2714/programming_K-12_policy_july_2016.pdf, 2019.

[25] X.Q. Wang, Learn to code, code to learn——comment on Scratch tutorial launched by harvard university in 2014, Mod. Educ. Technol. 26 (5) (2016) 115–121.

[26] B.L. Shi, Difficulties and solutions of popularizing programming education in primary and secondary schools in the era of artificial intelligence, Teacher Expo 9 (2021) 21–22 .

[27] The White House, Charting a Course for Success: America 's Strategy for STEM Education [EB/OL]. [2019-04-01], 2019. https://www.white-house.gov/wp-content/uploads/2018/12/STEM-Education-Strategic-Plan-2018.pdf.

[28] L.H. Sun, Children programming education focusing on thinking literacy: concept, practical path and targe, Libya Educ. Technol. 7 (2019) 22–30.

[29] L. Sun, D. Zhou, Research status and action path on international children programming education, Open Education Research 25 (2) (2019) 23–35, https://doi.org/10.13966/j.cnki.kfjyyj.2019.02.003.

[30] L.H. Sun, D.H. Zhou, Design and construction of scratch-based teaching model for children's programming education: a case of elementary science, e-Educ. Res. 41 (6) (2020) 75–82, https://doi.org/10.13811/j.cnki.eer.2020.06.011.

[31] Q. Fu, M.Y. Zhang, The educational applications and enlightenments of tangible programming, Mod. Educ. Technol. 28 (12) (2018) 108–114, https://doi.org/10.3969/j.issn.1009-8097.2018.12.016.

[32] D. Sun, Y. Li, Discussion on the curriculum standard of Chinese youth education, Open Educ. Res. 25 (5) (2019) 99–109.

[33] L.H. Sun, D.H. Zhou, The origin and future direction of children's programming education

"the gear" and "spirit" of the pioneer of artificial intelligence education, Mod. Educ. Technol. 29 (10) (2019) 12–19, https://doi.org/10.3969/j.issn.1009-8097.2019.10.002.

[34] Y. Li, Research on the model of computational thinking-oriented interdisciplinary children's programming education——based on the experience and inspiration of Finnish children's programming education, Mod. Educ. Technol. 30 (6) (2020) 19–25, https://doi.org/10.3969/j.issn.1009-8097.2020.06.003.

[35] S. Sentence, M. Dorling, A. Mcnicol, Computer Science in Secondary Schools in the UK: Ways to Empower Teachers[C]//Proceedings of the 6th International Conference on Informatics in Schools: Situation, Evolution and Perspectives, Springer-Verlag, 2013.

[36] L.H. Sun, S.Y. Liu, M.M. Li, Study on policy-making framework of learning analytics: based on analysis of SHEILA framework, e-Educ. Res. 40 (8) (2019) 114–120+128, https://doi.org/10.13811/j.cnki.eer.2019.08.014.

[37] F.Q. Sun, R. Feng, Intelligent tutor system in programming education: architecture, design and application, Dist. Educ. J. 38 (1) (2020) 61–68, https://doi.org/10.15881/j.cnki.cn33-1304/g4.2020.01.006.

[38] Filiz Kalelioglu, A new way of teaching programming skills to K-12 students: code.org, Comput. Hum. Behav. 52 (2015) 200–210.

[39] Almadhun, Salem Husein, Salem M Aldeep, Aimen   M Rmis, and Khairia A Amer. "Examination of 4G (LTE) Wireless Network." El tarbawe journal 19, no. 1 (July 2021): 285–94. https://doi.org/http://dspace.elmergib.edu.ly/xmlui/handle/123456789/1119.

[40] Almadhun, Salem, Mehmet TOYCAN, and Ahmet ADALIER. "VB2ALGO: An Educational Reverse Engineering Tool to Enhance High School Students' Learning Capacities in Programming." Revista de Cercetare si Interventie Sociala 67 (2019): 67–87. https://doi.org/10.33788/rcis.67.5.

[41] Hanan A. Khalil, Aimen M. Rmis, Salem H. Almadhun , Tareg A. Elawaj, Walid F. Naamat. (2023). The creation of theoretical frameworks to establish sustainable adoption of e-health in Libya. Humanitarian and Natural Sciences Journal, 4(7). doi:10.53796/hnsj4716

[42] Rmis, A. Alkazagli, M. Alloush. O. Almadhun, Salem. (2021). Sentiment Classification Using Three Machine Learning Models. Vol. 34 No. 1, June.

[43] Rmis, Aimen & Topcu, Ahmet. (2020). Evaluating Riak Key Value Cluster for Big Data. Tehnicki vjesnik - Technical Gazette. 27. 10.17559/TV-20180916120558.

[44] Topcu, Ahmet & Rmis, Aimen. (2020). Analysis and Evaluation of the Riak Cluster Environment in Distributed Databases. Computer Standards & Interfaces. 72. 103452. 10.1016/j.csi.2020.103452.

[45] Khaleel, N. A., Almadhun, S. H., Khalil, H. A., Alasoud, A. M., & Rmis, A. M. (2023). The Impact Of Mobile Banking Services On Customer Satisfaction And The Factors That Influence Users'intention To Use Them.