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Integrating Computer Science in Basic Education Curriculum: Enhancing Innovation and Sophistication for Global Competitiveness

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Abstract. In this study, the researcher investigated the perceptions of professional teachers in the Jolo municipality toward Integrating Computer Science into the Basic Education Curriculum (ICSBEC), including the teachers' required capability on skills and experiences, pupils' constructive learning and analytical thinking and technological resources, tools, and facilities to facilitate innovation and sophistication in global competitiveness. The findings showed an agreeable response with the chi-square tabular value ($X^2 = 6.1325$ is less than $X^2{}_{0.05} = 7.815$, for 3 degree of freedom), which means all professional teachers' perceptions of ICSBEC are about the same, dependent on the following: teachers' capability on skills and experiences; pupils' constructive learning and analytical thinking; and technological resources, tools, and facilities needed to meet the need for innovation and sophistication (great skills) in global competitiveness. The findings revealed strong overall support for integrating computer science into the basic educational curriculum, with a mean score of 4.447(185 or 88.94%). They indicated perceived skills and experiences needed for teachers to instruct pupils, with a mean score of 4.341 (180 or 86.54%), agreeing strongly. The constructive learning and analytical thinking skills, with a mean score of 4.515 (187 or 89.90%), strongly agreed. The availability of appropriate technological resources, tools, and facilities to prepare students for global competitiveness, with a mean score of 4.692 (195 or 93.75%), strongly agreed. These results showed positive evidence that the ICSBEC holds potential impacts in cultivating innovation and sophistication among students' preparedness in a globalized world. The study employed a descriptive-evaluative approach. To gather quantitative data, the researcher utilized surveys distributed to 208 professional teachers and the FGD for qualitative data. The FGD was selected among the supervisors, principals and classroom advisers who possessed the information sought.

Keywords: Basic Education Curriculum; Computer Science; Computer Curriculum; Computer Programming; Innovation

1. Introduction

In the current age of digitalization, it is crucial to incorporate technology in education to adequately equip students for learning in the 21st century. How can computer science be integrated into the basic education curriculum to enhance innovation and sophistication for global competitiveness? What skills and experiences are needed by teachers? What are constructive learning and analytical thinking for pupils' needs? What technological resources are required to attain innovation and sophistication for global competitiveness? The study aims to achieve the following objectives: to determine how the integration of computer science into basic education curriculum enhances innovation and sophistication for global competitiveness; to determine skills and experiences for teachers to teach to attain global competitiveness; to determine constructive learning and analytical thinking needed for pupils and to examine the technological resources, tools, and facilities required for innovation and sophistication in attaining global competitiveness. This study benefits policymakers, school administrators, parents, and educators who advocate educational development to meet global competitiveness. Specifically, it provides a frame of reference as guidelines for policy formulation to validate decisions on curricular revision toward global competitiveness. It impacts the community's need to meet the world standard in education.

It is assumed that professional teachers perceived positively on the ICSBEC: Positive responses on the teachers' skills and experiences, positive responses on pupils' constructive learning and analytical thinking, as well as the technological resources, facilities, and tools needed to attain innovation and sophistication in global competitiveness. According to Ricketts (2018), computer science is becoming more important for students in the 21st century. He emphasizes that cultivating students' interest in computer science at elementary level is best. Exposing students to computational thinking and problem-solving in kindergarten is also important. His findings have shown that early exposure to computer science makes students more competitive. Costley (2014) emphasizes the importance of technology in the classroom practices teaching and learning to the vision for global competitiveness. In addition, child-centered methods prioritize the use of learning activities that are directly relevant to children's everyday experiences, with the aim of motivating and engaging them.

Computers have become integral to daily life, shaping how individuals design, create, and communicate more efficiently than ever imagined (Gillpatrick, 2020; Wolff, 2021). They enable the processing of vast amounts of information, facilitate global collaboration, and contribute to solving complex problems in various fields such as science, engineering, business, medicine, and education.

Tracing back to our ranking in the Global Competitiveness Index (2017-2018), the Philippines' overall rank is 56 out of 137 countries. With this rank, Senator Aquilino "Koko" Pimentel III took the initiative to introduce the Bill "Integrating Computer Science in the Curriculum of Enhanced Basic Education Program." The purpose of this proposed bill was to provide students with the necessary resources to enhance their skills and abilities in the digital era and improve their competitiveness on a global scale (Senate of the Philippines, 2019).

In light of the increasing importance of the discipline that deals with computers, it is essential to impart this knowledge to upcoming generations (Simões et al., 2022). They are the ones who will play a vital role in the construction of the next generation of computers; therefore, it is imperative to foster their comprehension of computer science to cultivate their critical thinking abilities (CSU Global, 2021). The individual studying computers embarks on a journey of intellectual growth. By delving into the theoretical aspects of algorithms, data structures, and computational methodologies, they lay the groundwork for practical applications. This scholarly engagement equips them with technical proficiency and cultivates the cognitive flexibility necessary to navigate the evolving landscape of computational innovation.

Integrating computer science into the basic education curriculum is primarily designed to equip the pupils with adequate knowledge to understand and appreciate computer data processing (Kwon et al., 2021). It aims to provide sufficient computer literacy knowledge to pupils who are beginning to learn and understand the highly technical field of computer science.

Teaching those with no previous knowledge and exposure to computers and those without a computer program background is the preparation for global competitiveness (Busuttil & Formosa, 2020). According to Karlsson (2022), the pupils can understand the concept of computer processing information systems and identify and describe the essential functions of the hardware devices or components associated with computer systems. The pupils can discuss computer programming and its steps and procedures. They can visualize the social implications of computers on individuals, organizations, and society.

Integrating computer science into the curriculum enhances the capability to adopt innovation and sophistication for global competitiveness. With the rise of the digital age, pupils are exposed to technology and resources and encouraged to explore the world of computer science, where the development of problem-solving and analytical analysis is part of the curriculum (Haleem et al., 2022).

From a constructivist perspective, integrating computer science into the basic curriculum requires constructive learning and analytical thinking (Kurt, 2021). Leite et al. (2022) suggest that teachers guide their pupils by following principles such as engaging, exploring, explaining, envisaging, elaborating, and exchanging. Emerging these activities allows to build powerful ideas suitable for learning programming. Thus, programming provides meaningful technological tools and appropriate application of technology (Jamil & Isiaq, 2019). The utilization of technology is a viable option to enhance educational expertise, as it encourages learning methodologies, particularly in the delicate field of early childhood education. The objective is to create collaborative learning settings aided by innovative, demanding, multi-disciplinary, and age-appropriate technologies to develop the child's learning experience (Ramadevi et al., 2023). Integrating computer science into the basic education curriculum prepares the youth with rich and varied opportunities to develop desirable technological innovation and sophistication of products that will be beneficial in the future.

Many countries have already introduced computing to the curriculum, and Senator Pimentel III introduced a bill for the inclusion of a computing curriculum at primary level. In this connection, there is a need to determine the perceptions and desirability of education administrators and teachers on integrating computer science into the basic education curriculum, enhancing innovation and sophistication to meet global competitiveness. It is also crucial to acquire skills and experiences needed for teachers in the pupils' constructive learning and analytical thinking and to acquire the technological resources, tools, and facilities required to meet the need for innovation and sophistication in attaining global competitiveness.

The main aim of this study is to determine school administrators' and teachers' perceptions regarding the skills, experiences, and competencies needed for teachers to teach their pupils constructive learning and analytical thinking and the required technological resources, tools, and facilities to meet the need for innovation and sophistication in attaining global competitiveness. ICSBEC enhances pupils' expectations to gain sophistication, boasts pupils' learning capabilities for innovations, provides competitive learning, utilizes teachers' skills in teaching programming, and provides good opportunities to explore analytical thinking and innovative learning.

2. Review of Related Literature

2.1 The Nature of the Subject under Investigation

The variables under study are (a) teachers' skills and experiences, (b) pupils' constructive learning and analytical thinking, and (c) technological resources, facilities, and tools. These variables cause the enhancement of the basic education curriculum toward global competitiveness.

The teachers' skills and experience are composed of attributes that instill learning in the pupils. Skill is the teachers' way of acquiring knowledge toward computing programming abilities. Teachers' expertise is knowledge stored that is already put through practice related to computing programming activities (Scherer et al., 2020). Competencies have something to do with the effectiveness and efficiency of teachers in carrying out the program of activities about computing (Semenovskikh et al., 2021). Thus, teachers inspire, organize, and guide the whole teaching process, leading to learning knowledge effectively. From this point of view, according to Johnson (2017), the teacher's role is to provide opportunities for students to build their knowledge, not just to impart them.

Piaget's cognitive theory emphasizes the importance of constructive learning and analytical thinking. The interaction between the subject and object generates new knowledge from previous knowledge and experiences (Piaget, 1971). The pupils' factor is a variable that explains how pupils acquire knowledge and learn at their own pace. Understanding the individual needs of learners is crucial in Piaget's theory, as it enables educators to develop student-centered approaches that accommodate diverse learning styles and abilities. From this perspective, students are the main learning activity, and they construct knowledge initiatives based on prior knowledge and experiences. It is, therefore, related to kinesthetic learning,

where physical activity is encouraged through hands-on experience and after-depth instruction. Thus, it is learning by doing (Jonāne, 2018).

Another independent variable is the technological factor, with components such as facilities and tools as vehicles/instruments that drive the direction of computing (Qurat-ul-Ain et al., 2019). Resource allocation, like the availability of computers and internet access, is a determining factor in supporting the learning process's success (Afzal et al., 2023).

2.2 The Pertinent Model for Adopting Computer Science at an Earlier Age

The pursuit of competitiveness stems from several factors, including the skills, experience, and competencies of teachers, the constructive learning of students, and the integration of computer science through technological resources, facilities, and tools to achieve global competitiveness (Christensen & Knezek, 2018; Robertson, 2021). Based on the mentioned variables, the learning triad emerged as innovation and sophistication in increasing learners' capability for global competitiveness (UNESCO, 2015).

Several countries across Europe and the United States of America have successfully integrated computer science into the basic education curriculum. They use advanced educational technology to modernize techniques for ease in teaching and learning processes. With the appropriate methodologies, teaching and learning processes are enhanced effectively. Thus, technological innovations emerge to increase educational sophistication to various degrees (Aslam, 2018). Concerning educators' and learners' perspectives, environmental factors have influenced educational processes. The educators provide the proper course coverage, including educational software that is 'complete, clear, effective and comprehensive' (Elliot, 2023) in enhancing student service. In this context, learners need to be active participants in learning the course, and, at the same time, the educational software is user-friendly for easy interaction.

Teaching and learning tools for programming courses is challenging; however, the primary motivation for the development work is objectively improving the teaching-learning system where the students acquire fundamental knowledge and skills in building and implementing computer programs to address issues. Computer programming equips students with the skills to develop programs to solve real-world problems (Figueiredo & García-Peñalvo, 2021). It is important that modern technology be available to facilitate the teaching and learning of programming processes. Complex cognitive abilities, including procedural and conditional reasoning, planning, and analogical reasoning, are required for the acquisition of computer programs (CP) (Scherer et al., 2019); it is a beneficial skill that can be a rewarding career.

Bećirović's (2023) research on instructional technology revealed that instructors in higher education often need more expertise in effectively incorporating technology into their teaching. In this context, skill training patches the gap to improve capability. Modern technology has drastically improved and revolutionized education (Tahil et al., 2023). Learning and understanding technology in an educational environment addresses essential and other potential problems (Schwartz, 2024).

Educational software can improve student learning significantly. The government's current agenda and political will are an approach to providing significant interest in and expenses on technology for educational purposes (Wright, 2018). Utilizing technology enhances language teaching and learning. However, although instructional technology has improved, challenges are continuously addressed. Standards for teacher education, professional development, and classroom practices are all areas that require attention (Yang & Walter, 2015). The inclusion of computer science in school curricula differs in terms of its methodologies worldwide. However, Webb et al. (2017) examined the difficulties faced by the computing science education community in effectively communicating, defining requirements, and advocating for changes in the curriculum to promote computer science education both in theory and in practice. They considered computer science to be a specialized subject available exclusively to more advanced or competent students. Their reasoning implied that computers and cars were similar in that most students simply needed to know how to operate them, not how they functioned.

In today's rapidly evolving and predominantly digital society, programming and technology have become crucial components in various sectors (Nouri et al., 2020). Programming is often emphasized as an educational tool for promoting students' computational thinking. Computational thinking involves computers aiding or shaping the cognitive processes used to define problems in a manner that allows their solutions to be stated as computer procedures and algorithms. (Kim et al., 2024). Programming is considered a component of computational thinking and involves tasks that help improve computational thinking skills (Brating et al., 2022). According to Bada (2015), students are the center of learning, thus putting an emphasis on student-centered learning is the most crucial contribution to constructivism, which suggests how people acquire knowledge and learn. He further asserts that learning is an activity in which individuals make sense of all information they perceive and construct meaning. Thus, it presents big ideas in education where students become expert learners.

According to Dewey (1938), education is connected to action. He emphasizes that concepts and knowledge are developed through significant and essential experiences for learners. Through this approach, understanding, along with the collective effort of individuals engaged in learning, are cultivated. Bruner (1960) states that a fundamental understanding is built upon learners' prior experience and background knowledge. He argues that individuals develop their understanding or knowledge by engaging with their existing beliefs and the concepts, experiences, and activities they encounter. The teacher is a mentor, facilitator, and collaborator, motivating students to inquire, contest, and develop their ideas, viewpoints, and judgments (Kudryashova et al., 2016). People's knowledge is built from complex life and technical and social change. Lifelong learning continues in the light of experience, which necessitates a considerable change to general education practices.

Technology is illustrated as an independent advancement that leads society toward advancement in both economy and society. It is the dominant force that shapes the socioeconomic and technological enterprises (Islam & Ali Khan, 2023;

Tahil & Tahil, 2021). In this context, technology is considered social and conceived as a construction of technology. The transformation has occurred as a result of remarkable technological advancements that have occurred in the past decade, which have contributed to making a medium for advancement that proves challenges to the elementary educational institution.

According to Karaferye (2022), numerous teachers have utilized excellent digital learning materials to assist in providing primary education, to enhance the strategic reasoning and analytical thinking skills of children in primary school. The internet is an essential tool that enhances students' ability to learn on their own and increases their knowledge of their own thinking processes. The level of technology integration in class is directly related to teachers' willingness to use technology, experiences, knowledge, facilities, etc., in their lessons (Camilleri & Camelleri, 2017); this can impact children's enthusiasm, involvement, and academic achievements. The use of technology requires an expanded and more profound comprehension of the software by the educating personnel (Zheng, 2020). Thus, the teaching staff should possess knowledge of different potential computer applications in elementary education that consistently enhance the schools' curricula.

According to Zyad (2016), integrating computer technology in the classroom can help teachers support and improve learning, foster connections with students, and encourage students to engage with information innovatively. Students are provided with clear objectives, supportive guidance, and thorough instruction on using technology effectively and responsibly to develop new skills as digital learners (D'Mello, 2021). It leads to enhanced academic performance and greater personal and career achievements.

2.3 The Primary Empirical Studies on Computer Curriculum.

Computing curriculum has been widely introduced in many countries in Europe and the United States of America. American and European educators can explore the difficulties and approaches involved in teaching the topic at both the primary and secondary levels. In the UK in 2014, computers evoked the viewpoints of individuals regarding issues and strategies. Research indicates that both teachers and students face external and internal difficulties (Brown et al., 2014). Enhancing student resilience in the field of computing is considered a difficult endeavor. However, there are several activities that can be employed to assist this goal, such as collaborative learning, fostering computational thinking, providing assignments with real-world context, and offering support in programming tasks through scaffolding (Sentence & Csizmadia, 2017).

Teaching computer science to younger students has been limited and Wohl et al. (2015) recommend introducing computer science to elementary students to spark their interest, as research shows that early exposure increases the likelihood of students pursuing it in middle and high school (Holo et al., 2023). According to their expert thinking, students should start learning computer science as soon as they begin school.

Franklin et al. (2020) revealed that the teaching approaches in computer curricula in elementary and middle high schools ranged from highly structured lessons to

open-ended ones. They emphasized requiring students to create a project on a blank page; then, students first would be given an example project that used prompts to work them through the steps of programming on the screen and that required them to complete the lessons by recording their observations and evaluate the outcome of each step. Computing plays a vital role in driving innovation and productivity in our modern society, which is heavily influenced by technology. Individuals who have the good fortune of being exposed to computing concepts during their early and later years of schooling, can lead them to contemplate the possibility of pursuing further education in subjects linked to computing (Gretter et al., 2019).

Adopting new curricula is crucial (Howson et al., 2023). The success of computer learning is attributed to teachers' factors. Howson et al. (2023) _revealed that academics recommend creating teacher certification programs and incentives for educators to seek these qualifications to increase attention to training in computer science. A computer science curriculum that concentrates on the science of computing gives students a solid foundation regarding the way computers work in today's largely digital world. The skills within computing are helpful, for they revolve around applying problem-solving skills to numerous other contexts (McGill et al., 2023). The primary schools' computing curriculum is set to provide an opportunity to explore, observe, and learn about technology. According to Century et al. (2023), computer science is increasingly recognized as foundational learning in all disciplines regarding how activities function in the digital age. They emphasize that the interest is growing among educators about how best to integrate computer science learning in other fields.; integrating it into other disciplines can expand access to students who often need access to computational thinking.

2.4 Synthesis

Philippines's Global Competitiveness Rank provides a lesson on integrating computer science into the basic education curriculum. Adopting computer science in the basic education curriculum is focused on improving learning outcomes. The focus is on incorporating strategies to enhance learning, honing the learners to compete with current and future global competitiveness. Various studies show that, at an early age, pupils are appropriately equipped with the knowledge of computer science fundamentals as the proper tools to make them capable of meeting the digital age and preparing them for global competitiveness. Some European countries, including the United States of America, have already adopted computer science in their curricula. They found that the earlier the introduction of computer science subjects, the better they respond to technological advancement. Adopting computer science at an earlier age proved to have a tremendous advantage on the part of growing up to meet the challenge of sophistication and innovation, which put the pupils/students at the edge of competitiveness for educational advancement (Figueredo et al., 2021; Kurt, 2021; Leites et al., 2022; Ramadive et al., 2022).

3. Methodology

3.1 Research Design

The descriptive-evaluative study is useful in discovering professional teachers' perceptions about integrating computer science into the basic education curriculum. The researcher needs to evaluate the stakeholders' responses when policymakers pursue implementing the curriculum at the elementary level.

3.2 Participants and the Locale of the Study

The participants were selected through convenient and judgmental sampling, which is according to the purpose of the study, so that the chosen individual is good evidence of being representative of the total population. The locale of the study is from Jolo I District to Jolo IV District of Jolo municipality. The study respondents were Supervisory Officials, Principals, and Elementary Teachers (from grades 4 to 6), including the School Division Superintendent of the Ministry of Basic, Higher, and Technical Education (MBHTE) under study. This study's total number of participants was 208 including four district supervisors, 29 school principals/teacher-in-charge, and 174 classroom advisers.

3.3 Research Instrument

A focus group discussion FGD was conducted with 40 experienced teachers, representing administrators, supervisors, head teachers, and regular teachers across four Jolo districts (10 participants from each group, Jolo I to IV District). A moderator led the specific topic with guided questions which were open and flexible, enabling in-depth investigation of opinions, emotions, beliefs, and actions regarding the Integration of Computer Science (ICS) into Basic Education Curriculum (BEC) to enhance innovation and sophistication for global competitiveness for both pupils and teachers.

The questions were composed of the participants' demographic profiles and perceptions of integrating computer science into the basic education curriculum, including the skills and experiences needed for teachers to teach pupils constructive learning and analytical thinking, as well as the technological resources and facilities required in meeting the need for innovation and sophistication in attaining global competitiveness.

3.4 Data Gathering Procedure

The researcher sought authorization from the Schools Division Superintendent to carry out the study. After being granted permission, questionnaire distribution was pursued by the superintendent, district supervisors, principal/teacher-in-charge, and classroom advisers of grades IV to VI of selected elementary schools. The collection and retrieval were conducted. Personal observations supplement the gathered data. The FGD participants were selected among the supervisors, principals, and classroom advisers who possessed the information sought.

3.5 Data Analysis

In the interpretation of data and test for assumed hypotheses, the statistical tools that would be adopted in this study were frequency count ($\frac{f}{n}$ x 100), mean ($\frac{\sum x_i}{n}$), and chi-square (test of significance). The mean category is 1.00–1.80 – Strongly

Disagree; 1.81–2.60 – Disagree; 2.61–3.40 – Moderate; 3.41–4.20 – Agree; 4.21–5.00- Strongly Agree. In the mean category, it is divided by five times 208.

The FGD sessions were recorded and transcribed for analysis. The data were organized, categorized, and summarized using dummy tables in Microsoft Excel

4. Results and Discussions

The results and discussion were based on each group of Jolo I District to Jolo IV District, Division of Sulu, Ministry of Basic, Higher and Technical Education (MBHTE), through questionnaires and Focus Group Discussions.

4.1 The Perceptions of Superintendent, District Supervisors, Principals, and Classroom Advisers Concerning the Integration of Computer Science in the Basic Education Curriculum

The majority of FGD participants believed that ICBEC enhances innovation and sophistication for global competitiveness for pupils and teachers. In their beliefs, "they emphasized the demand of the 21st Century for teachers to be digitally competent, including the learners. The children were more exposed to computers and gadgets than their teachers and parents. They also said that modern technology comes to the world as learning to carry out skills in programming enhances critical thinking for innovation and sophistication for teachers and learners. They emphasized that the teachers used computers, laptops, tablets, smart boards, and smart TVs to support learning. During a pandemic, teachers adopted blended learning to continue educating the pupils to be globally aware of the current trends and issues."

The perceptions of professional teachers are shown in Table 4.1.

Table 4.1 The observed and expected frequencies of professional teachers' perceptions.

	Perception				
Preferences category	**The perception of the superintendent, supervisors, principals, teacher-in-charge, and classroom teachers concerning the ICSBEC**	**The skills and experiences needed for teachers to teach pupils to attain global competitiveness**	**The pupil's constructive learning and analytical thinking are needed to meet global competitiveness**	**The technological resources, tools, and facilities meet the need for innovation and sophistication in attaining global competitiveness**	**Total**
Agree(O)	185 (186.8)	180 (186.8)	187 (186.8)	195 (186.8)	**747 (89.79%)**
Disagree (O)	23 (21.2)	28 (21.2)	21 (21.2)	13(21.2)	**85 (10.21%)**
Total	**208**	**208**	**208**	**208**	**832 (100.00%)**

Based on the chi-square test of independence at a level of significance of 0.05, the calculated result is less than the tabular value ($X^2 = 6.1325$ is less than $X^2_{0.05} = 7.815$, for 3 degrees of freedom). This concludes that the proportion of agreeable responses is about the same for all perceptions of professional teachers on the Integration of Computer Science into Basic Education Curriculum (ICSBEC).

Table 4.1 shows that professional teachers agree with ICSBEC, scoring 185 or 88.94%. They agree that skills and experiences, scoring (180 or 86.54%), constructive learning, analytical thinking (180 or 86.54%), and technological resources (195 or 93.75%) meet the goal of global competitiveness. Thus, the respondents strongly agreed (89.79%) that ICSBEC strengthened their interest and desire to enhance innovation and sophistication in global competitiveness for pupils and teachers with constructionism; the curriculum exposes classrooms to computer programming concepts and explores the learning outcome. Century et al. (2023) emphasized that kindergarteners were interested in and could learn many aspects of robotics, programming, and computational thinking.

Table 4.2. emphasizes respondents' responses in every district.

Table 4. 2. Perceptions of Supervisors by District

District Supervisors	Jolo I District	Jolo II District	Jolo III District	Jolo IV District	FINAL RESULT
The perceptions of the Superintendent, Supervisors, Principals, Teacher-In-Charge, and Classroom Teachers regarding the Integration of Computer Science in the Basic Educational Curriculum.	4.375	4.625	4.500	4.750	**4.563**
The skills and experiences needed for teachers to teach pupils to attain global competitiveness.	4.500	4.333	4.667	4.833	**4.583**
The pupils' constructive learning and analytical thinking are needed to meet global competitiveness.	4.444	4.556	4.667	4.778	**4.611**
The technological resources, tools, and facilities meet the need for innovation and sophistication in attaining global competitiveness.	4.714	4.833	4.143	4.857	**4.637**

As shown in Table 4.2, the perceptions of Supervisors (including the school division superintendent) in all Jolo Districts with respect to ICSBEC strongly agree (4.568). Likewise, the skills and experiences teachers need to teach pupils, the pupils' constructive learning and analytical thinking, and the technological resources, tools, and facilities meet the need for innovation and sophistication in attaining global competitiveness. The supervisors' perceptions were related to Robertson's work (2021) that teachers' skills, experience, and competencies, the constructive learning of students, and the integration of computer science through technological resources, facilities, and tools are needed to achieve global competitiveness. In this context, their strongest belief was in dire need for technical resources, tools, and facilities to meet innovation and sophistication in global competitiveness.

Table 4.3 indicates the principals' perceptions (Jolo I-IV Districts) regarding Integrating Computer Science into the Basic Educational Curriculum.

Table 4.3. The Perceptions of Principals by Jolo I-IV District

Principals/Teacher-In-Charge	Jolo I District	Jolo II District	Jolo III District	Jolo IV District	FINAL RESULT
The perceptions of the Superintendent, Supervisors, Principals, Teacher-In-Charge, and Classroom Teachers regarding the Integration of Computer Science in the Basic Educational Curriculum.	4.089	4.594	4.321	4.304	**4.327**
The skills and experiences needed for teachers to teach pupils to attain global competitiveness.	3.810	4.333	4.190	4.357	**4.173**
The pupils' constructive learning and analytical thinking are needed to meet global competitiveness.	4.317	4.569	4.698	4.381	**4.492**
The technological resources, tools, and facilities meet the need for innovation and sophistication in attaining global competitiveness.	4.633	4.696	4.857	4.796	**4.746**

As shown in Table 4.3, the principals strongly agreed (4.327 or 86.54%) concerning the ICBEC, and agreed (4.173 or 83.46%) on the skills and experiences needed for teachers to teach pupils to attain global competitiveness. The pupils' constructive learning and analytical thinking and the technological resources, tools, and facilities were perceived strongly (4.492 or 89.84% and 4.746 or 94.92%, respectively) to meet innovation and sophistication in attaining global competitiveness. In this context, Gretter et al. (2019) pointed out that constructive learning and analytical thinking skills are needed to meet global competitiveness. Technical resources, tools, and facilities must be acquired as requirements to reach the goal of global competitiveness since computers play a vital role in driving creativity and productivity in our technology-driven world. It is important to allow children to explore computer concepts at the elementary and secondary levels.

4.2 Perception of Teachers on Constructive Learning and Analytical Thinking Needed to Meet Global Competitiveness

Table 4.4 emphasizes the perceptions of respondents among the classroom advisers.

Table 4.4 Perceptions of Classroom Advisers by Jolo I-IV District

Classroom Advisers	Jolo I District	Jolo II District	Jolo III District	Jolo IV District	FINAL RESULT
The perceptions of the Superintendent, Supervisors, Principals, Teacher-In-Charge, and Classroom Teachers regarding the Integration of Computer Science in the Basic Educational Curriculum.	4.249	4.077	4.426	4.316	**4.267**
The skills and experiences teachers need to teach pupils to attain global competitiveness.	3.959	4.133	4.141	4.224	**4.114**
The pupils' constructive learning and analytical thinking are needed to meet global competitiveness.	4.381	4.250	4.495	4.425	**4.388**

The technological resources, tools, and facilities meet the need for innovation and sophistication in attaining global competitiveness.	4.226	4.347	4.476	4.413	**4.365**

As shown in Table 4.4, the classroom advisors strongly agreed (4.287) on ICBEC and agreed on the skills and experiences, strongly agreed (4.88) on the pupils' constructive learning and analytical thinking, and strongly agreed (4.365) on the technological resources, tools, and facilities that meet the need for innovation and sophistication in attaining global competitiveness. Franklin et al. (2020) revealed that the teaching approaches in computer curricula in elementary and middle high schools ranged from highly structured lessons to open-ended ones requiring students to record their observations and evaluate the outcome.

Acquiring proficiency in computer programming requires advanced cognitive abilities, including procedural and conditional thinking, planning, and analogical reasoning (Scherer et al., 2019). Computer programming equips students with the skills to develop programs to solve real-world problems (Figueiredo & García-Peñalvo, 2021).

Technologies are ever-present and evolving, providing many opportunities to explore teachers' and pupils' analytical thinking and innovative learning. Students will learn to navigate and use technology efficiently, helping them share and develop ideas. According to Tahil and Tahil (2021) and Islam and Ali Khan (2023), technology is a dominant force that shapes socioeconomic and technological enterprises.

Ninety-five percent of FGD participants highlighted that computer science inclusion in education could enhance individual learners' knowledge, skills, and attitudes, emphasizing student-centered learning. According to Moreno (2015), students who integrated computer science into their studies showed good academic performance, and teachers suggested several relevant websites that are easy to download. Students nowadays are already familiar with digital devices, which serve as gateways to the world.

4.3 The Teaching Skills and Constructive Learning and Analytical Thinking Needs for Teachers to Meet Global Competitiveness

Eighty-five percent of FGD participants emphasized that many teaching skills and strategies can help develop pupils' constructive learning and analytical thinking, such as explicit instruction, 5Es, 7Es, and 4As. The terms were commonly used in educational contexts to describe frameworks or models for teaching and learning. The 5E model is a widely used instructional framework for science education. It stands for Engage, Explore, Explain, Elaborate, and Evaluate. The 7E model is another instructional framework focusing on student engagement and understanding. The 7Es typically include Explore, Engage, Explain, Elaborate, Evaluate, Extend, and Enhance. The 7Es model aims to foster deeper learning, higher-order thinking skills, and knowledge transfer to practical contexts. The 4As model is often associated with the teaching of 21st-century skills. It stands for

Activate, Acquire, Apply, and Assess. The 4A model emphasizes active learning, skill development, and the practical application of knowledge.

Eighty-four percent of the FGD participants emphasized that collaborative learning is vital for awakening mental capacity. It includes collaborative workshops, group experiments, and relevant questions on applying analytical thinking skills to life situations. Constructive knowledge for constructive learning builds understanding through the creation of collaborative learning, which is facilitated by interactive experiences. Cooperative learning approaches develop and enhance high-order thinking skills in imparting the knowledge for the pupils.

To develop constructive learning and analytical thinking, five stages of hierarchical learning must be applied, including analysis and synthesis. Teachers must have both the imaginative and critical thinking skills which produce competent students. Training workshops on basic computer operations update the know-how, teaching skills, and experiences needed to communicate information to pupils in analytical thinking. Thus, the training and seminars provide them with expertise in modern technology. According to Seeletso (2022), computer science is increasingly recognized as foundational learning in all disciplines, and educators are growing interested in how best to integrate computer science learning in other fields. Integrating into other disciplines can expand access to students who often need access to computational thinking.

4.4 Appropriateness of Technological Resources Needed to Attain Global Competitiveness

Data in all tables indicated strong agreement on the appropriate technological resources needed to attain global competitiveness. The majority of qualitative data has something to do with modern tools and equipment such as modern gadgets, high-tech computer facilities, multimedia resources, and updated internet connectivity, including hiring ICT teachers/upgrading old teachers on teaching strategies through the integration of computer science. Adequate power supply and standby generators are necessary to avoid power interruption. Karaferye (2022) states that superior digital learning tools facilitate the provision of primary education. He further suggested that educators should be encouraged to use certain technologies to cultivate strategic reasoning and reflective thinking skills among primary school students. He added that the internet is an essential tool that improves students' self-directed learning and understanding of their own thinking processes. Camilleri and Camilleri (2017) emphasized that technology requires teachers to have a deeper and more comprehensive understanding of the software; they also need to be aware of the different ways that computers may be used in primary education to improve the curricula offered in the classroom continuously.

5. Conclusion

In conclusion, the results revealed that the agreeable professional teachers' perceptions are the same on technical capability on skills and experiences, the pupils' constructive learning and analytical thinking, and the technological resources, tools, and facilities needed to meet innovation and sophistication (great skills) in the global competitiveness. It signifies that Integrating Computer Science

into the Basic Education Curriculum (ICSBEC) holds immense potential for enhancing innovation, sophistication, and global competitiveness.

ICSBEC provides opportunities to explore, observe, and know about the technology that learning carries out skills in programming to enhance critical thinking for innovation and sophistication for teachers and pupils. ICSBEC enhances teachers' and pupils' skills in computer technology, which helps teachers and pupils in a generation of technology. It also enhances pupils' learning, helping them become sophisticated with multiple skills that boost their learning capabilities for innovation and global competitiveness.

The curriculum needs appropriate technological resources, tools, and facilities to meet the needs of innovation and sophistication in attaining global competitiveness. These include modern tools and equipment such as modern gadgets, high-tech computer facilities, multimedia resources, updated internet connectivity, hiring ICT teachers, and updating old teachers on teaching strategies through the integration of computer science. Thus, adequate power supply and standby generators are necessary to avoid power interruption in the pursuit of ICSBEC.

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