Computer Science Education in the Philippines

Context

The Philippines is a developing country in Southeast Asia with a population of approximately 109 million, 33.4 million of whom are under the age of 15 (Philippine Statistics Authority, 2022a). In 2022, the services sector made the largest contribution (64.6%) to the country’s GDP (Philippine Statistics Authority, 2022b). This sector includes activities related to information and communication technologies (ICT). The World Bank estimates that the Philippines’ digital economy doubled in size in the six years after 2012 and was responsible for about 10 percent of GDP by 2018 (The World Bank, 2020).

The ICT sector is composed of several growing subsectors. There are approximately 400 software firms operating in the Philippines, most of them with home offices in the US and Europe. The business process outsourcing subsector, a major source of employment, was estimated to be worth US$29 billion in 2022. The telecommunications sector expects to roll out US$15 billion in services from 2022 to 2025 to support an estimated 159 million mobile and 11 million broadband subscriptions (Giray, 2022). It is therefore understandable that the country has a great interest in developing ICT-related skills among its people.

Educational System

The Philippine formal educational system is composed of basic and higher education. Basic education follows the K-12 system and is composed of one year of kindergarten, elementary (grades 1-6), junior high school (grades 7 to 10), and senior high school (grades 11 to 12). During the senior high school years, students select or are assigned to tracks which can include technical/vocational education such as agriculture and fisheries, home economics, and industrial arts; sports; art and design; and academic tracks such as accountancy, business, and management, humanities and social sciences, or science, technology, engineering, and math (Philippines Department of Education, no date; Republic of the Philippines GOVPH).

Having completed senior high school, students are expected to be employable already. Those who choose to do so can pursue university-level degree programs.

Computer Science Curriculum

The Commission on Higher Education (CHED) is the government body that regulates the curriculum of these and other programs. CHED Memorandum Order No. 25, Series of 2015 (2015), is the latest policy document that prescribes the minimum curricular standards for four-year bachelor’s courses in Computer Science (CS), Information Systems (IS), or Information Technology (IT).

The CS program is a four-year bachelor’s degree intended to produce software engineers, developers, and programmers. The course prepares potential graduates by immersing them in computing concepts, theories, and algorithmic foundations. It familiarizes them with emerging technologies. It equips them to create algorithmically complex software and to develop new approaches to solve problems. CS students are expected to take courses on algorithms, computer architecture, discrete structures, human-computer interaction, networks, operating systems, programming languages, software development, software engineering, and social issues and professional practice.
Students are expected to take a total of 146 credits where one credit is equal to one contact hour per week in a 16- to 18-week semester. A three-credit subject is equivalent to three contact hours per week or approximately 48 to 54 hours per semester. The curriculum is comprised of general education subjects on language and the humanities; math, natural sciences, and technology; and social science and communications. The specialization courses include introductory courses on programming, data structures and algorithms, information management, and applications development. Students are also required to undertake an internship of no less than 162 hours. Finally, the students are required to produce a thesis that demonstrates comprehensive knowledge of computer science theories and concepts.

Faculty Qualifications

To support the degree program, universities and colleges offering computer science may employ faculty members with any of the following qualifications:

- a bachelor’s degree in CS, IS, or IT
- a bachelor’s degree in allied fields such as mathematics or a master’s degree in any science, technology, engineering or mathematics field plus completion of coursework in a master’s or doctoral degree in CS or three years of experience as an IT professional.
- A bachelor’s degree with an international IT certification to teach professional courses specific to IT.

Leading Philippine Universities

The Philippines has approximately 1000 colleges and universities that offer bachelor’s degrees in information technology and computer science and degrees (FindUniversity, 2022). In 2019-2020, these institutions produced approximately 47,000 graduates, less than half produced the prior year (Statista Research Department, 2022).

CHED affirms universities with outstanding IT-related programs by recognizing them as either Centers of Excellence (COE) or Centers of Development (COD). As of 2022, there were 18 COEs and 35 CODs for information technology (Ancheta-Diego, 2022). Of the COEs, four were ranked in the 2023 Times Higher Education World University Rankings: Ateneo de Manila University, University of the Philippines, De La Salle University, and Mapua University (Times Higher Education, 2022). Note that these rankings were for the universities in aggregate and not for the CS programs in specific.

Education and research support

To support student matriculation, two government agencies provide colleges and universities with scholarships and grants. These are the Philippines Department of Science and Technology (DOST) and CHED. DOST’s Science and Technology Undergraduate scholarships are awarded to students with high aptitudes in science and mathematics and are willing to pursue tertiary-level education in these fields (Philippines Department of Science and Technology, n.d). CHED offers full and half scholarships to high-performing students (Philippines Commission on Higher Education CARAGA Region, n.d) interested in pursuing degrees in national priority areas, which include Computer Science (Philippines Commission on Higher Education, 2021).
DOST and CHED also provide colleges and universities with support for research and institutional capacity building through annual grant programs. For example, CHED has an innovation grants program that supports the development and implementation of research and development projects, enhancement or upgrade of facilities and services, innovation policy research, and capacity building through trade exhibits, expositions, and missions (Philippines Commission on Higher Education, 2022). Grants have a maximum of Php30 million (approximately USD500,000). DOST, on the other hand, issues calls for proposals for projects that are aligned with government economic policy directions ( Philippine Council for Industry, Energy, and Emerging Technology Research and Development, 2022). Grants that contribute to innovations in information and communication technologies and artificial intelligence are mentioned specifically. Depending on the specific sub-area of the grant, maximum funding support is Php7 million to Php10 million (approximately USD125,000 to 180,000).

Professional Associations

Within the Philippines, there are two professional organizations that cater specifically to computer science education: The Computing Society of the Philippines (CSP) and the Philippine Society of IT Educators (PSITE). The CSP is a professional organization composed mainly of computing researchers and educators. Its goal is to encourage and promote the advancement of computer science (Computing Society of the Philippines, n.d.). It hosts one conference per year, the Philippine Computing Society Congress, and has two journals, the Philippine Computing Journal and the Philippine IT Journal.

PSITE is a professional organization of educators specializing in computer science, information technology, information systems, and multimedia systems. Its goals include community building, responsiveness to academic needs, extension and immersion programs, and the development of institutional research and mentoring capacities. It hosts several conferences per year including the International Conference on Information Technology Education (Philippine Society for Information Technology Educators, 2022).

Industry Insights

Interviews with five (5) senior industry executives (see Table 1) were conducted to locate gaps between the intended and achieved curricula. The executives were asked two basic questions: What knowledge or skills do graduates still lack? For what emerging technology trends or innovations should educational institutions prepare their graduates? The interviews were conducted over Zoom and took 15 to 30 minutes.

<table>
<thead>
<tr>
<th>Official Designation</th>
<th>Company Core Business</th>
<th>Number of Employees</th>
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</thead>
<tbody>
<tr>
<td>Senior Vice-President for Technology</td>
<td>Information technology and systems integration</td>
<td>1000</td>
</tr>
<tr>
<td>Assistant Vice President for Information Technology</td>
<td>Retail stores for local and international brands</td>
<td>1600</td>
</tr>
<tr>
<td>Chief Executive Officer</td>
<td>Information technology outsourcing</td>
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<tr>
<td>Head of Internal Analytics</td>
<td>Financial technology company</td>
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</tr>
<tr>
<td>Chief Executive Officer</td>
<td>Information technology consulting and training</td>
<td>50</td>
</tr>
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Table 1. Profile of interviewees
The feedback from the senior executives was that the achieved curricula was still lacking. Interviewees noted a large difference in the quality of faculty and graduates among universities. Certain universities produce world-class graduates, while others are almost unrecognizable as CS, IS, or IT professionals.

Many interviewees felt strongly that core computer science competencies should continue to be taught, and that we should not make the mistake of teaching technology-specific skills. However, the interviewees also cited gaps in the ways in which core competencies are taught as well as current and emerging technologies that educational institutions should introduce to their students. The themes that emerged were as follows:

- **Programming** should advance to include more current development tools and methods. The continuous integration / continuous development (CI/CD) pipeline was given as an example.
- Students should understand the importance of **networking and distributed computing**. All real-world applications are built on top of networks. Nothing today is stand-alone anymore.
- **Algorithms** should be taught, but using current tools and languages.
- Because of the growing importance of AI and machine learning and the proliferation of big data, students need **data engineering** skills. These include skills in using non-relational databases, NoSQL databases, data streaming technologies, and others.
- **Virtualization** is gaining prominence in industry but is typically not taught in the formal curriculum. Kubernetes and Docker were given as examples of platforms that enable better utilization of resources and scalability.
- **Software engineering** practices and methods need to be updated to reflect what industry actually uses.
- **Cloud technologies** including AWS and similar platforms have to be integrated into the curriculum.
- Industry interviewees cited the need for the development of **better basic skills**. They noted that many graduates do not actually have operational knowledge of SQL, they do not know how to use the command line, and they do not understand or appreciate the rationale for approaches like agile program development. Because of these poor foundational skills, they do not know how to work efficiently and effectively with stakeholders and with technology.
- **Soft skills** that students need to develop include presentation skills, the ability to work with others, the ability to document, and to develop code that can be maintained. Students also need to be able to learn new technologies on their own.

**References**


Philippines Department of Education. (no date). K to 12 Basic Education Curriculum. Accessed from the Philippines Department of Education website: https://www.deped.gov.ph/k-to-12/about/k-to-12-basic-education-curriculum/


Republic of the Philippines GOVPH. (no date). What is K to 12 Program? Accessed from the GOVPH website: https://www.officialgazette.gov.ph/k-12/#section-3

