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Mathematics Education in Cambodia from 1980 to 2012: Challenges and Perspectives 2025

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Abstract: The Kingdom of Cambodia was a world leader in technology and scientific understanding from the ninth to the fifteen century as the Khmer Empire. Unfortunately the Pol Pot regime destroyed the education system in Cambodia between 1975 and 1979. The process of rebuilding the educational system of Cambodia was started by collecting the surviving educated people and by adapting the slogan: "The one who knows more teaches the one who knows less and the latter transfer's knowledge to illiterates". Mathematics education in Cambodia currently faces many problems such as a lack of well qualified teachers, a lack of knowledge in curriculum development, text book writing, methodology of teaching and use of ICT. Currently no quality assurance mechanism is available to ensure Cambodia's mathematics curriculum is up to international standards. The relatively low salary of teachers in the Kingdom remains an impediment to our educations system as it provides little motivation for people to become teachers.

The Cambodian Mathematical Society (CMS) was established on the 4th of March 2005 and recognized by the Royal Government of Cambodia to play a part in addressing the problems and improving the capacity of mathematical education in Cambodia. CMS is committed to promoting mathematics as a key "enabling" discipline that underlies other key disciplines and is at the heart of economic, environmental and social development in Cambodia.

A successful outcome for mathematical education in Cambodia depends on the creation and implementation of developmental goals that are appropriate for Cambodia.

The CMS has identified goals that will be made priorities in addressing the needs of mathematical education in Cambodia. These goals include improving the level of qualification of Cambodian mathematical teachers, upgrading the mathematical curriculum to a modern and internationally competitive level, improving the quality of teaching materials and textbooks available in the Khmer language, improving the pedagogical methods of teaching mathematics, promoting and supporting the use of information communication and technology (ICT) in mathematical instruction and encouraging participation in international mathematical programs and competitions as well as developing such competitions further in Cambodia.

Key words: Cambodia, mathematics education, teaching skill, information technology, human resource

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1. Introduction

As previously stated, the Kingdom of Cambodia was a world leader in technology and scientific understanding during the Khmer Empire from the ninth through to the fifteenth century. The scientific understanding of our ancestors was among the most developed in the world at the time and their appreciation of science was profound. During this time our intellectuals were world leaders in their knowledge of mathematics, astronomy and other scientific pursuits and their strong understanding of the natural world enabled them to create some of the most advanced and sophisticated architecture on the planet. The complex temples and shrines in the Angkor region is recognized by international scholars as the world's largest preindustrial city.

Unfortunately, the progress did not last because of the unrest and war with neighbouring kingdoms. More recently the persecution of intellectuals under the Pol Pot regime from 1975–1979 had a profound impact on the societal and intellectual development of Cambodia. During the Khmer Rouge regime, education was dealt a severe setback and the great strides made in literacy and in education during the two decades following independence were destroyed systematically by the regime. Schools were closed and educated people and teachers were subjected to particularly harsh treatment often facing exile or execution. Soviet sources reported that 90% of all teachers were killed under the Khmer Rouge regime. Only 50 of the 725 university instructors, 207 of the 2,300 secondary school teachers, and 2,717 of the 21,311 primary school teachers survived. During the Khmer revolution, young people were rigidly indoctrinated but literacy was neglected and almost an entire generation of Cambodian children grew up illiterate. After the Khmer Rouge was driven from power the educational system had to be re-created from almost nothing. Illiteracy had climbed to more than 40%, and most young people under the age of 14 lacked any basic education. The aftermath of this regime resulted in many difficulties, which we still face today (Russell R. Ross, 1987).

Land area: 181,035 Km^2; Provinces/municipals: 24; Population: 14,521,275 (2011); Household size: 4.7;
GDP per capita: $912 (2011)
Occupation classification: - Agriculture: 72.3%, - Industry: 8.5%, - Services: 19.2%; Literacy rate: 77.6%;
Gen. edu. studts: 3,123,082; Higher edu. studts: 222,016(37.69%F); HE students per 100,000P: 1430 (2012); No. math teacher: 6082; No. PhD in mathematics: 6 (2012)

2. Current Situation of Mathematics Education:

2.1 Resources

Cambodia allocated 15.92% of its annual budget in 2012 into education. But the annual education budget is only 1.6% of Cambodia's GDP. This is very low in comparison with other countries. However 83% of the funds are allocated to servicing remunerations and operational expenses which leaves little funding for facilities maintenance and proper teaching materials such as computers and internet connections (C. Tan, 2010). Many schools in Cambodia are currently understaffed with 45,296 teachers teaching 2,562,010 primary school students, 27,067 teachers teaching 541,147 lower secondary students and only 10,160 teachers teaching 318,165 upper secondary students. Among these teachers only 6,082 are involved in mathematics education and will teach over the 38 weeks of the academic year 18 hours per week at lower secondary school, 16 hours per week at upper secondary school, 14 hours at teacher training centres, 12 hours at higher education. Mathematics is taught for 7 hours per class, per week from grades 1–3, 6 hours per class per week from grades 4–10, students studying advance mathematics in grades 11–12 receive 8 hours per class per week but students choosing to study basic mathematics only receive 4 hours per class per week (C. Y. Kim & M. Rouse, 2011).

The percentage of the population in each age group attending an educational institution is shown in Table 1, indicating that only 1.53% of people in Cambodia can afford to pursue tertiary education:

Table 1 Net Enrollment Ratio (Total)

	Kindergarten	Primary	Lower Secondary	Upper Secondary	Higher Education
Age	< 6	6–11	12–14	15–17	18+
% attending	52.7%	96.4%	35.1%	19.6%	1.53%

Resource: Education Statistics & Indicators 2011–2012. EMIS Office, Department of Planning, Phnom Penh, February 2012 (Supported by UNICEF/Sida).

2.2 Policy Implementation

Provincial/Municipal Offices of Education (POE) are responsible for supporting the ministry in implementing educational policies, for preparing and submitting plans for further development of education, and for providing data and statistics of schools. However, there is currently a lack of congruence between research and policy making, linked possibly to the inadequacy of our budget and research facilities, which exemplifies the weakness in analytical research and development in our educational system. As a result, there exists a significant gap between policy formation, implementation and monitoring within the educational system that does not target the specific problems which both educators (mathematics teachers) and children face.

2.3 Gender Disparity

Although the literacy rate and number of girls graduating from primary school in Cambodia is increasing, a disparity between the genders remains which can be partly attributed to the cost of sending girls to school, as there will be one less person at home to contribute to the family's income. The trade-off between school participation and economic activity increases as the child gets older and this trend is particularly prevailing among girls whose place in Khmer culture has traditionally been at home. Among the Cambodians who do obtain an education, there is still significant gender disparity in mathematical literacy. At Phnom Penh's Khemarak University only 20% of students who achieve a Bachelor's Degree in mathematics and 5% of those who achieve a Master's Degree in

mathematics are women.

2.4 Tertiary Education

In 2009, Cambodia had a tertiary enrollment rate of 10%, which appears to be low when compared with other nations. Of the students who study at a tertiary level only 10% study science and of those students, only 1.5% study mathematics. Students who study Biology, Chemistry, and Social Sciences only spend 45 hours studying calculus or basic mathematics during their foundation year, students studying business, economy, accounting and related fields study slightly more than this. Students completing a Bachelor's Degree in mathematics will need to acquire 120 credits and each credit will take approximately 15 hours to complete. A Master's Degree will require an additional 45 credits and a successful thesis. Cambodia's higher education institutions still lack world recognition and are currently not acknowledged by Quality System World University Rankings. There is also inadequate communication between schools and corporations. This hinders curriculum development in mathematics and in other subjects that is necessary to ensure that students have the skills to meet the demands of the current labour market (Chealy C., 2009).

2.5 Poverty Hindering Education

The poverty line in the rural areas of Cambodia is set at US$1 per person per day, but minimum daily food requirements will cost at least US$2.50. Due to poverty, children in Cambodia are forced to give up the chance of receiving education and will be forced to work to supplement their family's income instead. Teachers in Cambodia (mathematics teachers) currently earn US$65 to US$150 a month. In Phnom Penh, monthly living expenses for a family of four average at around US$500 a month. This forces many teachers to find a second source of income, often charging students for after school classes. This additional workload distracts teachers from their primary vocation and hinders the educational system of Cambodia.

2.6 Mathematics Teachers

Current statistics indicate Cambodia has a fast growing and youthful population compared too many other countries (Education Statistics & Indicators 2011–2012). As teachers are required to possess a certain minimum qualification and Cambodia's capacity for teacher training in still in development, the current teacher shortage could become increasingly severe.

The obstacles to mathematics teachers in Cambodia include:

(1) A lack of opportunities and time for teachers to properly learn the curriculum, and develop their knowledge and skills.

(2) No mechanism exists to motivate teachers to update their knowledge and skills and there is no system in place to analyze which teachers should be promoted.

(3) The salary of teachers is relatively low and the status in Cambodian society of teachers is not as high as it should be, given its importance to Cambodia's development.

Many mathematics teachers in Cambodia currently face impediments to their effectiveness as instructors such as:

(1) A lack of knowledge of mathematics and pedagogy due to the destruction of educational resources and authorities under the Khmer Rouge regime.

(2) A lack of motivation for teachers to improve and update their knowledge due to a lack of systems in place to reward self-improvement.

(3) A low research capacity for higher education teachers because of a lack of time caused by many teachers working second jobs during what would otherwise be free time.

2.7 Lack of Resources

Due to a lack of resources and government funding for schools in Cambodia, there is a shortage of teaching material and school facilities. According to Official Statistics from the Ministry of Education, Youth and Sport, the national education budget for 2012 is 15.92%. This amounts to 1.6% of Cambodia's GDP (Gross Domestic Product) being spent on education. Even though the Cambodian government promises to provide $1.50–$1.75 per student per year to each primary school for teaching materials and school operating costs, this amount is often insufficient to even cover the basic operational cost of schools. And so, almost no funds are available for instructional technology. Technologies such as graphing calculators, Maple, MathCad and Mathematica are not available to Cambodian students, teachers and researchers.

2.8 Curriculum and Mathematics Textbook

The curriculum of mathematics is currently upgraded every five years, compared to every ten years in the past. Cambodia’s mathematics curriculum is written by experienced local teachers with international assistance as Cambodia currently lacks specialists in mathematics curriculum development.

The text-books used in Cambodian schools are written by experienced local teachers. As previously mentioned these teachers do not have the same qualifications for this job as their international counterparts often have.

Cambodian mathematical textbooks often suffer from the following problems:

(1) Text books often contain mathematical errors and less experienced teachers do not recognize these mistakes and may teach incorrect mathematics to students.

(2) Text books may not reflect modern educational psychology and pedagogy.

(3) Teachers’ guides are not widely available and there is a lack of reference books for teachers in Khmer as most teachers can only speak, read and write in Khmer.

(4) Text is printed only in black and white. There are no high quality colour graphics typically found in international text books.

(5) There is little correlation between the mathematical content taught and its application to real life situations.

2.9 School Administration and Mathematics Management

School administration and mathematics management suffer from the following problems:

(1) A lack of vision, educational leadership and management that is caused by a lack of specialist knowledge in these fields.

(2) Low contributions to education from communities and the private sector in Cambodia.

(3) A lack of school networking development, experience sharing and best practices.

3. Future Perspectives to 2025

The Cambodian Mathematics Society was established on the 4th of March 2005 and recognized by the Royal Government of Cambodia to play a part in addressing the developmental needs of mathematical education in Cambodia. The goals of the CMS include:

(1) To gather mathematicians, lecturers and teachers of mathematics to discuss current mathematical issues and discuss how to combat these problems.

(2) To advance the quality of mathematical knowledge in both applied and educational capacities, to update curricula and text books and to promote innovative teaching methodology.

(3) To communicate with the international scientific and mathematical community society in order to support mathematics in Cambodia and the Cambodian Mathematical Society.

Goals for the Development of Mathematics in Cambodia from 2013 to 2025 include:

(1) Developing and improving the quality of Mathematics Teachers at all levels by:

- Building the capacity of mathematics teachers in Cambodia through the creation and implementation of training programs.
- Increasing the number of people holding PhD's in Mathematics from 4 to 50 in 10 years to provide the necessary intellectual leadership and management.
- Increasing the number M.Sc. in Mathematics, both pure and applied, from 60 to 500 in 10 years to provide technical assistance, curriculum development, text book creation, supplementary reading material and a variety of other important roles within the educational system.
- Increasing the number B.Sc. in Mathematics, both pure and applied, from 2000 to 5000 in 10 years to provide an adequate number of qualified teachers for the growing number of mathematics students in Cambodia.
- Increasing and improving the quality of mathematics education at all levels.

(2) Preparing and publishing educational materials for students and teachers of mathematics in Cambodia. This process will involve identifying and engaging authors, writers and publishers and assembling experienced mathematics teachers who have the skills required to record high-quality instructional VCD-DVD materials.

(3) Improving the methodology of teaching mathematics at all levels to move to a more modern pedagogy by using technology and ICT.

(4) Improving the mathematics curriculum at all levels, especially Masters and PhD. programs, through the development of curriculum materials suitable for all grades by holding workshops to promote the exchange of ideas. This activity is will be concentrated at the six Regional Teacher Training Centres and the 18 Provincial Teacher Training Centres through one-week training courses and longer training programs of up to three months to build mathematical knowledge and teaching capacity.

(5) Promoting and supporting the use of ICT in mathematics education.

(6) Forming a committee to establish a national mathematics competition. The national committee will be composed of members from both provincial and urban locations and the relevant institutions, and will prepare entry requirements for capable students. This committee will also identify and support the most outstanding students and teachers and will encourage, motivate and award promising students and teachers annually.

4. Conclusion

The Cambodian Mathematical Society is committed to the enhancement of mathematics as a key "enabling" discipline that underlies many other disciplines and is at the heart of economic, environmental and social development in any country.

Although progress has been made through the support of societal, national and international agencies, there still remain significant challenges in ensuring quality mathematics education for all Cambodian students.

Consequently the committee will continue to be a passionate advocate for international support and partnerships in this important mission. Desired outcomes of the goals of the CMS include:

- Enhanced knowledge and expertise in mathematics education for Mathematics teachers at all levels within the system.
- Access to relevant learning materials, including texts in Khmer for all students, teachers and researchers.
- The mathematics curriculum will be relevant to the needs of students and communities, will be aligned with the most modern and internationally accepted science and technology, and will enjoy similar attention to other curriculum areas.
- There will be an enhanced interest in, and commitment to, mathematics education by students, researchers and potential mathematics teachers.

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