

02 Opportunities and Challenges of the General Science and Technology Education of Macau

— An interview with Mr. Tong Chi Kin, a Science and
Technology Committee member —

Ordinance No.9/2000 of the << Law of the bases of Science and Technology >> holds clear texts of encouraging the teaching and promotion of the knowledge of science and technology. The concrete content includes encouraging the schools and the general public to offer training courses of scientific knowledge and technology for the teachers, to support the utilization of the advanced information technology in school education and to assist the schools to establish a perfect information technology educational network. This means cooperating with the educational entities, adopt necessary procedures to blend the scientific knowledge and technology into the educational programmes while making reviews at regular intervals. The purpose is to motivate the social concern and cognition of science and technology and to improve the quality of the capacity of science and technology of the population, especially the adolescents.

The editorial board of the << Teacher's Magazine >> had an interview with Mr. Tong Chi Kin, a Science and Technology Committee member and the convener of the General Science Group. The aim of the meeting was to let all the teachers have a better understanding of the situation of the General Science Education in Macau and the operation of the Science and Technology Committee.

Q.: For the recent ten years, the Macau Special Administrative Region has been showing great concern for the development of science and technology. Besides proclaiming the << Law of the bases of Science and Technology >>, she has also established a Science and Technology Committee. As one of the members of the committee, could you tell the readers of the << Teacher's Magazine >> about the actual work of the Science and Technology Committee today and the trend of its future development?

A.: The Science and Technology Committee is a consultative organization offering scientific and technological policies to the Chief Executive of Macau while presenting decisions being in tune with the administrative principles.

At present, we work in three directions. The first sector is the Science and Technology Development Fund, supporting units or organizations including tertiary institutions research and development organizations and enterprises to perform operations of scientific research, development, creation and the transfer of the scientific research outcome into commercial products. At the same time, we also offer awards to the distinguished persons who successfully manifest themselves in science and technology. Basically, the draft of the Fund plan is already made and we are now at the stage of revising the small details. It is presumed that it will be well established within this year. The second sector is how to motivate the operation of General Science and promote General Science Education. Some time ago, the Science and Technology Committee had already presented a project proposal to the Chief Executive. The Third part of the plan is playing the function of a medium for the science and technology operation.

We mean to propagate scientific and technological products, to assist the enterprises to draw in and put into practice the new concepts and to make full use of the manufactured products. The Science and Technology Committee is now making good progress in all these three sectors.

In fact, the teachers of Macau pay more interest in the mission of General Science and the popularization of General Science Education. We may compare the science and technology development to a pair of flying wings: one is for the purpose of science and technology creation and the other, for the generalization of science. We need both wings in order to manifest science and technology. It is because people used to delve into blazing new trails, creation and promoting productivity and failed to sense the importance of the generalization of science.

To tell the truth, the application of science and technology to productivity is only a wing of the science development. To actualize science and technology, we need the other wing of generalization of science which means to propagate the scientific knowledge to the public, enabling it to be acquired by all. Should this procedure be not properly arranged, the social development will be hindered and man will go without scientific thoughts, making it a serious subject for us to ponder over. Should the process be not well organized, superstitious behaviour will be widely adopted. Therefore it is necessary to handle the whole approach with the measure of idealism. The scientific and technological products of our time are all in continuous improvement. Once our understanding fails to be in

the same pace, unscientific conduct or phenomenon will appear. Consequently, with those two wings, science will then be able to soar along.

Many countries and districts, be they in the well advanced situation or in the developing stage, all give great importance to the impartation of the knowledge of general science. Quite many medium-sized cities in Europe and America have invested much resources for the establishment of science museums and scientific technology museums, making them bases for general science education. Furthermore, they also preserve a great amount of manpower and material to enhance the adolescents' acquirement of general science education. Many of the social activities concerning this development are instigated. Thus, in the educational circles, the members do carry a significant mission, specially in the obligation of imparting the general science education to the teenagers. They have to help the younger generation to be nourished with the spirit of "Study science, Love science, Utilize science" from their childhood. From these twenty to thirty years, people have begun to value the importance of initiating scientific activities and science education for the adults too.

Q.: What have you been doing for the promotion of general science in Macau? Is there any long-term plan of development for the future?

A.: Our General Science Group had drafted a written proposal which was discussed by the Science and technology Committee. The proposal offers short-, medium- and long-term projects to be actualized. The short-term plan includes those few items of operation to be carried out within two to five years. The first is how to manifest the function of the Science Technology Museum in the field of general science education so that it is able to go in pace with the establishment of the theme construction. The second step is the process of general science teaching staff investigation. This enables us to plan the strategy for general science tutor team training. The tutors should all be experts in the field of general science and they will be the specialists to promote projects of the required knowledge, to popularize it in schools and to organize the similar activities for the public.

Therefore it is necessary to see into the manpower resources and the training programmes. The third item to be accomplished is to establish bases for general science education which we have none in Macau. At present, we have only some government departments, some private and public organizations installed with a little higher scientific technological equipment. However, this does not mean that they are the bases for general science education. Therefore it is proper to erect general science bases first and then promote the public and private institutions with higher scientific technology installment to be general science education bases. For the example of the office of Meteorological & Geophysical Bureau of Macau (the so-called Observatory), bearing many engineers and technicians of abundant knowledge of that field is a venue of rich information offering higher professional functional operations and techniques. Nevertheless, to elevate it to be a base for general science education, some educational information has to be arranged, e.g. persons being able to explain the operation of the whole unit. But, the main point is what do we want the students or visitors to know about? What should they acquire? If situation allows, by and by, such organization can gradually play the base of general science education. In this way, the general science knowledge of the adolescents and the public citizens may be improved.

Other operations including the support from other science and technology organizations and civil communities are activities, exhibitions, competitions, etc. and general science meetings of different themes.

Q.: Besides offering the adolescents knowledge can the general science education nurture the teenagers to acquire an appropriate attitude towards science and equip them with a considerate capacity of the subject?

A.: The attitude towards science and the capacity of the theme are not just some knowledge but a way of speculation. We hope that the final intention of general science education is to equip the younger generation with the quality of being acquainted with science, having the zeal for science and to put the scientific knowledge into practice. For example, the Macau Electricity Company, which is the

biggest scientific technology enterprise, has a beneficial effect for the young people for learning the information technology development. As we know, among the three main developments of the society, one of them is the communication and scientific technology development. In these few recent years, the information technology is having its greatest growth. Therefore, to transform these main stream enterprises into general science education bases, we have to allow the teenagers to come to know, to love and to utilize the information and communication technology.

Q.: Just now you have mentioned about the idea of establishing general science education bases, do you mean that there will be special persons stationing at the office of organizations such as Meteorological & Geophysical Bureau, to explain to the visitors the procedures of their operation? Will there be a section open for the visitors to have their actual field practice?

A.: At present, there are special appointed persons leading tours around while explaining the operations of their own institution. It is because they are willing to give much weight to such tasks. We greatly hope that through the visits, the message of general science education is delivered. Hence, tours based on general science education are never the same as any other tours since the aim is to offer to the visitors an atmosphere for that purpose. Should an organization like to become a base for general science education, experts of the educational field will discuss with the specialists of the institution to constitute an educational visit. I hope the organizations will take the initiation to make it themselves and, of course, they have to agree to this policy first.

Another way of supporting this scheme is to offer assistance to such general science activities in the society. At present, many communities, both in the mainland and the neighbouring regions, are holding different general science projects every year. Our Science and Technology Committee is going to sponsor local communities, including the academic circles or youth associations to hold the similar activities. We shall try our best to offer help in the strategy of planning and procedure of funding so that more various relevant science and technology programmes can be provided. Besides sending experts to the Government Departments, schools or communities to offer training to the persons who are willing to contribute their efforts to this development, our Committee also sponsors different types of general science projects to be held in China or in the international level. Till now the outcome is quite satisfactory. Except for the Robot Contest, we had won applause for the competitions of Creative Science and other scientific performance contests. Besides competing in the subjects of Mathematics, Informatics, etc., our young people had also participated in Physics, Chemistry, etc. in the Olympic Contest.

Q.: What is the advantage of promoting general science education in Macau? Is there any deficiency also?

A.: To tell the truth, in the present situation, general science education is not in the regular trend yet. I believe the supremacy we have is our solid basis of environmental protection. Thus among the many categories of general science education, the topic of Environmental Protection will be our focus. The science of environmental protection has gained quite a success in the school educational programme. A few of the schools have already started some supplementary learning sites for the activities. The whole community has begun to give importance to preserving the natural environment also. Hence environmental protection can really be an important sector of general science education. Another measure is to utilize both the space scientific technology and the space travelling technique to be acquainted with the universe. We are now planning some practical projects of the knowledge. As everybody knows Yang Li Wei's visit to Macau has stirred up a whirlpool of space flight enthusiasm and the general public, including the adolescents, are showing great reaction to the subject.

Nevertheless, many of the general public and the students have only superficial knowledge of the facts. Therefore we are now trying to take space scientific technology, space flight technology and the mystery of the Universe as the main items to be manifested. In the coming three years, there will be a project of space searching to motivate science education and general science activities. Even Physics, Chemistry, etc. do offer much general science information and, in fact, space scientific technology and space flight knowledge are practically the synthetic application of all the various sciences. We mean to organize an instruction team to give talks about space science in schools, youth centres or communities at their request. For the time being, our main job is to start some programmes of general science programmes at the invitation of the schools. We wish we could hold a Space Scientific Technology and Space Flight Technique Exhibition to improve the public's knowledge of the universe in the future. There had been an exhibition of this type in Hong Kong in 1996 and the response was very positive, Macau is now trying hard to strive for the privilege of hosting the Space and Space Flight Exhibition of the Zhu-jiang Delta. Should it be successful, with the Free Travelling policy, the economy of Macau will be greatly promoted, In the Exhibition, many actual objects will be shown, including the Weightless Laboratory which is sure very attractive to all.

General Science Education is meant for the whole population, including civil servants, enterprise administrators, citizens of various ages, teenagers, etc. However, the focus lies on the youthful generation. It is because they have too little edification of the subject which is also an important process in their growth. At present the resources for promoting general science education are still insufficient. The individual procedures are not well coordinated and they go without a specific direction. Therefore, the Science and Technology Committee takes up the initial move and have presented some notions to the Chief Executive to ponder over. We suggested that besides supporting the civil communities to instigate the enlightenment, some practical programmes, such as the establishment of a Science and Technology Education Base, hosting a large-scale scientific technology exhibitions, etc. have to be considered.

It needs the effort of all to stimulate general science education and, schools, as well as youth centres, do shoulder an important function. Normally all schools give concern for general science education because there is an academic course named Science. However, can the schools do a bit more than that? Can they arrange a supplementary learning site for general science activities? Physics, Chemistry, Biology, etc. are never uninteresting subjects and the teachers may well arrange second site activities to captivate their interest. The youth centres themselves are already fine bases for this category of education. But, according to our investigation, such venues are often used for recreation purpose. We hope that some general science education activities can be held there in the near future.

If the programmes are appropriately designed, a great number of participants will sure be attracted. This year, we shall be taking up the task of promoting the Science of Life. People of our modern time are having too busy lives and few of us take notice of our health situation, or, I should say, we do not know how to take care of our well-being. For example, many of us get out of bed immediately, when we wake up in the morning because we are in a hurry to start the day. In fact, we should wait for a few minutes before rising from our bed and it is good for our circulation adjustment. Life has to be scientific, and so do health and exercises. We hope to do some enhancement in the field of Science of Life and Health because such knowledge is very beneficial for our wellness. We spend a great sum of money on medical expenses but set so little an amount to promote health education. Emphasize a bit more in the impartation of the latter and we may reduce much in the expenditure of the former. Therefore health education is an important operation.

In reality, many communities, schools, teachers and enthusiastic persons have a lot of ideas to motivate the science of education. To actualize all these proposals, we need the mutual contribution of the people of all walks of life. As long as the proposed projects are feasible, the Science and Technology Committee will try all the best to offer support. This is to encourage more schools and educational communities to take the initiative to start the operation. Once the Ordinance of Scientific Technology Fund is announced, we will put all our effort to support the enhancement of general science education. When the scientific capacity of the population is promoted, a series of scientific speculation will then be established. Anything done through the brain and investigated scientifically will sure bear the fruit of success. If we do things through superstitious practice, by luck or by lot casting, the result will never be sensible. It is because the attitude of science is based on facts and conscientious efforts. Verdicts will be given only after analysis and certification. Even if the objective situation keeps changing, we are still able to analyse it scientifically. For the example of the plague of sars of the last year, what the Science and Technology Committee thought of was how to help the citizens to understand the matter with a scientific sense. The truth is that without scientific reasoning the whole matter will be thrown into a panic, the preventive procedures will never be properly done and the collaboration of the society will never be manifested. Due to all these, the Science and Technology Committee had collected all the reports and researches of the specialists and made a compact disc of << Scientific Approaches to Preventing Atypical Pneumonia >>. This propagation did rouse a very positive effect.

Q.: You have mentioned that many of the Macau citizens are not well edified in the knowledge of science. To what level of the fundamental education stage they have to arrive at?

A.: The students' science capacity is insufficient does not mean that they know too little of science. Our students are quite knowledgeable about Mathematics, Physics, Chemistry, etc. The problem is that in so far, the supplementary learning sites for such fundamental science programmes are too scarce. In this way, the students will believe that just well learn the first law of Isaac Newton or any certain law and they are sure to obtain the full score. In fact, all these precious scientific fruits can be put into practice in our daily life. Furthermore, if the students fail to make practical application of what is learned, it doesn't mean that the teacher does not teach well. It is only the teacher is unable to demonstrate more examples of the theory. Therefore, it is necessary to develop a second learning site to allow more space for activities of practice in order to help the students to be more acquainted with the imparted knowledge. In this way, the students will never find science a boring subject but to get in touch with many articles or objects in life. The ones that are interesting or scientific products, are all fruits of wisdom or intellectual productions. To nurture a science ambiance, we have first to establish an enthusiasm for science, a fondness to learn science and a spirit to utilize science.



This is also a nourishment of cognition and capacity for the subject.

Q.: How to prepare a better supplementary learning site?

A.: For the time being, it is not too easy for a school to set a supplementary learning site because of the limited space in the premises and the restricted financial situation. Quite many schools do not have much to spare. For the example of the current Robot contest among the schools, though it seems quite successful, a few of the principals said that they had already spent a big sum for the installment of equipment and consumption (electricity).

Furthermore, the teaching workload of the teachers is very heavy and so it is very difficult to spend extra time for the arrangement of activities. The greatest problem, in the final analysis, is the want of fund. If a teacher could take no more than twenty periods every week and with a schedule of a few periods less in the week, he/she may well instigate more extracurricular activities.

At present, the subsidy for the schools of the government net is inadequate to cover the cost of education. Thus, it is impossible for them to have enough money to start supplementary learning sites which need a great deal of extra money and the amount of which cannot be collected from the students.

The Youth Centre of mainland China is very beneficial to the promotion of general science. There are many laboratories and tutors in the Youth Palace to nurture persons of talents. Any student who is interested may participate in the various activities in the Youth Centre. As some schools in Macau are not even installed with any fundamental laboratory, therefore, the future science museum of Macau which will be equipped with a few fundamental laboratories providing interactive apparatus and activity rooms, may allow the teachers to take the chance to motivate the students to make their active scientific researches. The modern trend is that many parents would send their children to private tuition as soon as they fetched them from their schools after their daily lessons. Thus, the children find no time to practise other relevant activities. I do wish the future adolescents could have their general science knowledge be elevated.

Q.: How to nurture persons of talent during their fundamental education stage so as to cope with the requirement of the future social development of Macau?

A.: The stage of fundamental education is a phase which everyone has to undergo. During this period, the development of thoughts, morals or knowledge, views and technology, undoubtedly, all have to be holistically initiated. Furthermore, what is expected from the students today is much more than before, specially in this era of speedy continuous improvement of high technology. Hence, schools should establish more general science activities of team work, programmes, creativity competition, etc. Let us take the example of Escola Secundaria Lou Kung Chi Tai. The school organizes that type of activities and programmes every year and the students are free to enroll themselves to participate and present their own creation. To encourage the manifestation of their creativeness, it is proper to blend general science education into the normal school curriculum.

Q.: What is your perspective on general science education in Macau, Mr. Tong?

A.: Anyone does have the obligation to understand the newest scientific development in his/her own community. Try to collect the updated information or we will be ignorant of their trend if we just keep working at the desk. Many national leaders would invite scientists to introduce to them the latest direction of the scientific development every year to understand how the consequences of such trends would affect the ongoing human life. As we know the Blue Tooth Technique is soon influencing the whole communication domain. Even if one is not working in the information technology sphere, he/she still has to have a basic knowledge of these important progressive techniques. During the Information and Technology Week, Mr. Gao Kun, the Father of Fibre Optics was invited to come over to Macau and the Chief Executive, though busy as he was, still took time to listen to his speech while quite many civil servants show no interest in it at all. I perceive that in the future, there would be an annual science and technology information seminar for certain categories of civil servants to enable them to get acquainted with science, to establish scientific attitudes and to acquire scientific speculations.

As for my perspective, first of all, I hope the persons of the educational circles and the communities will give importance to general science education. Then, I expect more people will take the initiative to participate. Thirdly, I would like to see everyone loves science, learns and utilizes science. When all these points are accomplished, the quality and capacity of the Macau people will be promoted.

The success of a district is under the influence of many factors and one of them is the people of ability. People of ability means people with talents and possessing scientific attitudes. Only when we all work in one accord that the general science education can be well motivated and the holistic capacity of the people of Macau will then be promoted.

Excerpted from "Teacher's Magazine"
8th Issue, May 2004.

03 让学生体验生活中处处有数学

引言

传统的数学教学忽视与学生生活实际的联系，致使许多学生对学习数学失去兴趣和动力；亦有些学生学会了数学知识，却不会解决与之有关的实际问题，造成了知识学习和知识应用的脱节，感受不到数学的趣味和作用。

心理学研究说明：兴趣来源于需要，人对客观外界事物需要与否和需要的强烈程度，决定于兴趣的有无和浓厚程度，而数学教学紧密联系生活是提升学生学习的兴趣，激发学习情绪最有效的途径。故此我们必须摒弃过去，在教学时，教师要多关注生活与数学相互结合，力求做到数学源于生活，寓于生活，用于生活，让学生感悟到数学的应用价值和数学的魅力，并感受、体验数学就在自己的身边，生活中处处要用到数学。

一、教学内容生活化

(一) 教材内容进行合理组合，贴近生活。

教学中，要注重教学内容的应用性和现实性，有些教学内容脱离学生实际生活，有些甚至是编造的，学生学不懂，又怎会感有趣？

瑞士心理学家皮亚杰认为：呈现给儿童的学习材料，既要和已有的经验有一定的联系，同时要有足够的新颖材料，才能引起儿童的兴趣，促进儿童的发展。因此教材内容要懂得灵活调整，选取及补充最新的生活材料、有说服力的数据资料和统计资料等，满足学生实际需求及符合社会时代发展。

生活是千姿百态，趣味盎然，生活就像数学的宝库，取之不尽，用之不竭。教师要善于挖掘生活的资源，用学生熟悉、感兴趣、贴近他们实际的生活素材，使学生易于理解及掌握。

以学生经验为出发点，了解学生的次级文化，数学问题中融入学生的生活语言。本校学生大多来自低下阶层，生活文化背景亦相近，本校老师根据学生的生活文化水平和本校的特色，把一些教材内容增减，设计了一些贴近学生生活的教学内容，唤起了学生的学习兴趣，提高学习效果。

(二) 配合学生的生活经验及周围的环境

用学生身边的事情，呈现在教学内容里，除增加了数学教学的趣味性，亦令学生体验到数学知识与日常生活的密切联系。