

**Institute for Christian Teaching
Education Department of Seventh-day Adventists**

**MAXIMIZING THE GOD-GIVEN POTENTIAL IN STUDENTS:
TEACHING BIOLOGY AS A CASE STUDY**

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BACKGROUND

Biology is the study of life and it is often taught as a body of scientific facts obtained by infallible individuals using infallible methods. It includes generalizations and theories which are subject to error and liable to change. To be generally literate a student should be able to differentiate between facts, which are truths and therefore indisputable, and speculation. A science student should also be conscious of the ever changing nature of science. A Christian university, like ours, aims to prepare students to achieve all they can and to live satisfying lives. In our teaching of biology, we recognize that all truth is God's truth, no matter where it is found (Holmes, 1987). This approach has enabled us to integrate secular learning, science and God's truth in providing a Christian education.

Potter (1971) poses two related questions which will help to shed light on the subject of a student's life; "How can we in the University system help to develop a society in which individuals are able to live happy and productive lives? " and, "What can an individual member of society do to insure for himself a happy and productive life?" He attempts to answer these fundamental questions using the DNA (Deoxyribonucleic Acid) molecule. Studies carried out on this molecule have shown that it is the molecular basis of heredity and that a typical human cell expresses only 3-5% of its genes at any given time (Campbell, 1993). This is one way in which the complexities of the study of life can be utilized to address the challenges we face everyday in our duties. According to Schwarz (1970), science reflected in technological advances, serves some needs of man. He, however warns that we should not take science and its child, technology, as our savior. Science, indeed, has no moral content in itself and amoral approach to life cannot build an enduring society.

It is in view of this fact that I refer to the biblical account of creation in which God is the creator. The moral content of Genesis 1:11,12 points out that in everything God created he placed the gift of potential. Three times these verses note that within us there is a seed. A seed as we know it, is a form of miniature plant that is capable of producing more seeds and so more plants and eventually a forest. It means that every living thing has everything it was designed to be.

Teaching biology offers many examples, such as the preceding one, which affirm God's creative power of living organisms. According to Marsden (1997) this claim of Christianity has momentous scholarly implications due to its rejection by modern western thought. Palmer (1993) warns that a self-centered education is the slave of an economic system that wants to master and manipulate nature, society, and even the human heart in order to gain profit and power. The challenge to the teacher is to stimulate open-mindedness and independence of thought and develop worthwhile scientific attitudes and values in the students (Science Curriculum Framework, 1996).

This paper is written with the purpose of sharing my rewarding experiences in developing potential in students. I will first define the term potential. Then I will outline the beliefs, values and skills expected of teachers and the conditions that favor development of potential in students. I will dwell on my experience as a teacher and finally make some suggestions and recommendations to students and teachers.

DEFINITION OF POTENTIAL

Potential, in this respect, can be defined as an untapped power, a dormant ability, an unused strength . It is all you can be, but have not yet become. It is who you really are, but nobody

knows it yet. It is how far you can really go but have not yet reached. That means that God put in everything its destiny, and designed each part of nature to have a specific role. It is no wonder that God pronounced everything he had made as very good (Genesis 1:3). According to the Bible, man and woman were created specially in the image of God and then placed in the Garden of Eden. In describing this purposeful event, White (1952) adds that the "Garden of Eden was the schoolroom, nature was the lesson-book, the Creator Himself was the instructor, and the parents of the human race were the students." The first instruction to the students of Eden was to be fruitful (Genesis 1 :28). Note that God never told Adam and Eve to be seedful. This is because God provides the seed. To be fruitful means to bring out of the seed what is in the inside, to develop yourself or to maximize your potential. It is this internal motivation designed by the Creator that presents the greatest challenge for the student today.

THE TEACHER'S ROLE IN DEVELOPING POTENTIAL

In every society there are traditions, norms and social expectations. There are also pressures, customs and value systems that affect our attitudes toward developing our natural gifts. In the case of students, these factors are bound to suppress their talents and limit their God-given potential. So, most students live in a minimum performance mode due to certain limitations imposed on them and obligations required of them by society. They are never rewarded and motivated enough to maximize their potential. The teacher may follow the model of education instituted in the Garden of Eden in shaping the future life of the students. In my view, the teacher should be equipped with a background that provides an enabling environment for the seed in the student to germinate into a fruitful tree.

White (1943), distinguishes two classes of teachers. One class, She says, contemplates the character of God and the other class is in the league with the prince of darkness. She concludes that the teacher of truth is the only safe educator. Such a teacher, in Palmer's view (1993), should be equipped with disciplines of spiritual formation that cultivate the capacity to practice obedience to the truth. This calls upon every educational institution to sharpen its recruitment practices by clearly defining its expectations, before hiring the relevant teacher.

THE BIOLOGY TEACHER'S EXPERIENCE

Teaching biology, in my experience, includes classroom activities, laboratory sessions, field trips, industrial attachments, Science Club activities, independent studies, and attendance at seminars, workshops and conferences. It also involves pursuing the career choices of graduates in the biological sciences. Having been involved in teaching biology at all levels ranging from the introductory biology courses to the upper division courses, I recognize the fact that every student is different, every teacher is different in approach, every course is different and every institution is different. I am also cognizant of the differences in the character of students of a given course and period of time. Therefore, the suggestions and recommendations presented here should be viewed as a contribution from which one can borrow to suit his/her own and their students' needs and circumstances.

Living things are complex systems and to study them involves dealing with a wide range of variables and analyzing highly complex data which requires skillful interpretation. Such a study generally exposes students to real life management of problems and cultivates in them a sense

of perseverance and tenacity in the face of difficulties. The use of the scientific method as a legitimate way of approaching issues and problems emphasizes orderliness in practical and theoretical work. It also helps the students to recognize the limitations of science and equips them with the capacity to resist claims unsupported by evidence or theory. To further develop their world view, we incorporate the history and philosophy of life in our instruction.

Foundational Biology

For the first year of biology, the tendency to limit teaching to classroom activities and laboratory sessions suffices, in my view. Later in their first year, they are introduced to field activities and independent investigation. During this period the students mainly learn to cope with large amount of information and technical knowledge at a faster rate than in high school. They need time for this adjustment. They soon find out that besides memorization, they must also demonstrate a high level of understanding of the concepts and be able to apply them in real life situations. The moral in the heavy academic workload is that the student has to learn to set priorities and work to deadlines. Among other activities in the classroom is a devotional at the beginning of the sessions in which all members of the class are given a chance, one at a time, to share in turns throughout the year. Laboratory sessions especially provide the students with an opportunity to interact academically with each other and with their instructor and exemplary senior-student laboratory assistants. This interaction is primarily accomplished through the guidance offered by performance of experiments on the part of the assistants and instructor and the asking of questions and sharing of views and opinions on the students' part. At the end of foundational biology, the students are generally competent in collecting, recording, analyzing, organizing and communicating ideas and information.

They are also at ease working with others and in teams. My observation is that at this stage the students exemplify a very high level of intellectual curiosity and a willingness to participate in activities and discussions beyond the classroom.

Beyond the classroom

During the Sophomore and Junior years of Biology, besides classroom and laboratory sessions, courses that open doors to field experiences have proved very fruitful. Fieldwork often involves the students working in groups. This not only requires the individual student to be responsible for his/her own part in the projects undertaken, but to also learn to work with others at a deeper level. Field trips enhance natural history studies by way of critical observations of flora and fauna on mountains, valleys, game parks marine and freshwater environments. The students draw both academic and moral lessons by their detailed observations. They are required to sometimes make collections for the natural history museum which is based at the University's Biology department. They are also mandated to make reports of behavioral observations made in nature and on the live specimens brought back to an animal and plant study enclosure and house, also based at the department. This exposure to field work creates in the students an awareness of the detail that exists in nature and an appreciation of natural designs. They soon become sensitive to environmental issues ranging from degradation due to population and technological explosion to conservation and management of environmental resources and living things.

Co-curriculum activities

The mid-course years are the period when most students in the department are actively engaged in co-curricular activities offered by active student societies such as the Biology Club.

The Biology Club at our University has enabled large numbers of youngsters to find expression for their interests and to develop their talents. For instance, this club is on record with several awards for activities such as church building, and town clean-ups in the community which were accomplished solely by its members. This activities have refined the participants focus and attracted a high membership in the club. According to Thurber and Collette (1964) young people are able to delve into special areas of interest through such student societies than they can in regular classroom activities. They receive help and encouragement from their senior colleagues which is absent in independent work.

Exemplary activities

A case in point is the group of Students Engaged in Environmental Awareness Schemes (SEEAS) and the Student Research Center (SRC) founded and run by biology students under the guidance of the faculty members in the Biology Department. In this particular instance students have carried out a biodiversity study within a radius of 5Km of the University Campus, and established the absence of important fruit trees in the area. This finding has helped to explain the high rates of nutritionally-related diseases among school going boys and girls from the community. The Students Engaged in Environmental Awareness Schemes has then strategically initiated and successfully conducted free medical days, tree planting sessions, including indigenous fruit trees which were once abundant in the area, and carried out an awareness campaign whose impact has spread beyond the immediate University surrounding. These two groups of students are also on record for actively participating in other participatory community projects independent of any class requirements. Such activities have impacted on the students' approach of dealing with issues and situations positively.

They have developed problem-solving skills that are reflected in their positive attitudes and perceptions about learning and life generally. They have also demonstrated a high sense of intellectual disposition.

Academic outcomes

Experience in teaching in the department has shown that the students involved in these community-based help groups perform better academically than non-participant students. There is a carry over effect from the Biology Club to the classroom . In fact this realization has attracted a high turnout of both biology and non-biology majors in these two areas of co-curriculum activities. Such a positive outcome has been partly attributed to the high moral and academic standing exemplified by the teachers.

Teaching biology at the Senior year level, in my experience, has taken the students beyond the classroom, laboratory and field levels of study. The senior students are guided into self-improvement and into contributing to the body of knowledge in biology. They carry out independent research studies which result in participation and presentations at seminars, workshops and conferences. The students keep themselves informed of the new developments in science and they find new contacts which have helped in securing holiday employment for some of them. In many cases the students have developed skills and attitudes toward research which they carry back to the classroom and senior-student projects. They write scientific reports and some of the recommendations from this articles have been published and used in implementation of community projects.

IMPLICATION OF APPROACH

This trend in teaching biology has proved an eye-opener to some of the essential characteristics of education as summarized by Rasi (1998) from Ellen G. White's book *Education*. First, the students are motivated toward informed, independent, and responsible thought. They learn to approach the surrounding culture with critical discernment, from God's perspective, learning to choose the true, the good, and the beautiful. They also discover their talents and vocation and prepare themselves for a useful life of self directed learning. It has also exposed the students to opportunities for further studies, and for employment in diverse areas. There is a high rate of employment and advancement in studies of biology graduates attributed to this approach. Feedback from the various destinations of these graduates reveals the superior worker in employment and graduate studies.

SUGGESTIONS AND RECOMMENDATIONS

What is unique about this approach of teaching biology? We have incorporated in our teaching an informal invisible process by which the students' potential is tapped and sharpened for release through the development of certain transferable personal skills. These include communicative skills, problem analysis and solution techniques, leadership, teamworking, adaptability, technical capability and a sense of achievement. These personal qualities are what most employers and higher degree programs require irrespective of the academic discipline of the student. White (1952) encourages this incorporation of real life situations in instruction through co-curriculum in her words:

"Every youth should be taught the necessity and the power of application. Upon this, far more than upon genius or talent, does success depend. Without application the most brilliant talents avail little, while with rightly directed effort persons of very ordinary natural abilities have accomplished wonders."

We should heed to this counsel in order to maximize the God-given potential in students by recognizing and paying more attention to opportunities for individualized, practical work.

According to Thurber and Collete (1964), communication should be concise and objective. This entails sharpening the listening, speaking, reading, and writing abilities of students. The responsibility of communicative skills cannot be left to the language teachers alone. They can only lay the foundation upon which other teachers should build. However, non-language teachers need not think of themselves as teachers of communicative skills. They, in my view, make the greatest contributions when they set up or speak about their individual experiences. In these situations students are stimulated to practical application that is essential for increase in the powers of self-expression.

Problem analysis and solution seeking techniques are propagated by student participation in planning processes of co-curricular activities. The students have the opportunity to define their own problems, suggest methods to attack, delegate responsibilities, and accept their own results with minimum guidance from the teacher. Such an independent process of thinking and acting is stifled in the teacher-dominated classroom. The teachers' primary role in co-curricular activities is to encourage, cooperate with, and guide the students by stimulating voluntary participation in the following suggested ways:

- (i) In institutions where interest groups, seminars and congresses are not established, students can be taken for visits to institutions where the activities are conducted.

- (ii) lectures and laboratory sessions can be planned to accommodate demonstrations by students with exceptional abilities and exemplary projects
- (iii) Recognition and praise (including award of scholarships) should be granted to students with outstanding presentations and performances.
- (iv) Teachers should bring their students into contact with outstanding professionals in their area of study through visits and lecture invitations.

Leadership skills are discovered and nurtured through appointments as officials of clubs and other societies. To further explore student leadership potentials, Thurber and Collete (1964) recommend the method of grouping in science programs . This technique, when properly employed, maximizes the leadership potential in students by providing for full individual participation and maximum practical experience in the democratic processes involved in group leadership. Teamworking, adaptability and a sense of achievement become evident when students have the freedom to discover their strengths and limitations. They learn that each one of them is talented differently and that as individuals they rely on others and more so on God, for abilities they do not possess, in dispensing communal tasks.

Equipped with these personal skills, students graduate knowing that they are communal creatures ready to take up assigned roles in the society, and above all, they recognize that they are creatures, belonging to the Creator, ready to continue with education throughout eternity with God.

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