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Journal of Pancreas and Advanced Research

CASE REPORT

Some Considerations about Training and Education of Young Scientists Is The Concept of "Teacher" Obsolete?

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Citation: Coulic V, Kempeneers J, Messe Y (2019) Some Considerations about Training and Education of Young Scientists. J Pancreas Adv Res 1: 102

Abstract

Presently some questions are rising concerning the renewal of the qualified scientific researchers. The present considerations present a short review of the causes leading to a weak preparation in the secondary schools and lack of motivation in high schools. The example of Scientific Student Societies is given as one of the ways which were and probably are still efficient in some countries (mainly Russia). Other propositions are pointed to try to develop the scientific mind and interest for investigation in the young people of high schools.

Keywords: Education Systems; Scientist Formation; Research Policy; Health Educational Policy

Introduction

"You can learn anything to anybody, but not anyhow" - Jesuit wisdom

The following quoted exchange took place during a morning briefing in a hospital surgical unit:

- This case is diagnosed as "xxxx". I propose surgical treatment on the basis of Guide Lines and clinical studies which report a success in 61% of the cases"
– OK, but are you aware that it means 4 out of 10 patients will receive inappropriate treatment?
– Oh! I did not realize, I have never thought this way.
– Precisely

Main body

Our time is wonderful and controversial, as every other one indeed. On the one hand, we possess the most dreadful means of mass destruction ever known and are still far from the ideal "love each other" or even "try to understand each other". On the other hand, life is tremendous, scientific and technical realizations are various and incredible, solidarity is planetary. It is also necessary to note that among intellectual people, including physicians and other members of the "medical cohort", a tendency of "formatted" way of thinking is well developed: diagnostic and treatment algorithms, evidence based medicine, fear of originality, of 'being different from the other, from the majority'. We have examples in different domains: for instance, diabetes mellitus treatment is associated with glycaemia measures, insulin (sometimes + glucagon) administration and, except interesting improvements or modifications of existing methods [1,2], the way of thinking, the approach of the question is the same, the complications remain the same (hypoglycaemia and "yo-yo" phenomenon, progressive organ and system disorders). It is difficult (except surgery in some situations) to find something quite different that could allow a real progress to understand and treat this complex, probably multi etiologic disease.

In this context the question of the young scientist education/training seems central. Many lectures, publications and books [3-5] are devoted to it. They mainly concern techniques of experiment planning, use of statistics for result evaluation, and so on. These publications are necessary and very useful. Administrative, health and academic authorities seem also concerned by the influence of environments, gender, race, educational systems, monitoring on both scientific production (evaluated by publication outcome,

trainees' fate) and health care advances [6-13]. Nevertheless, the involvement of young researchers becomes a problem for several reasons: insufficient interest of the young people for the investigation process, their main aim being constructing their personal life (family, house, car, life standing), the difficulties of obtaining grants, of winning support from National and private institutions, short delay for the work realization (2 years), sometimes renewable once or twice, not more, i.e. not enough for serious investigation in fundamental work. And, as ever, credits are given to laboratories and institutes which have already proved their capacities, and under conditions making it difficult to embark on truly risky fundamental investigation work. So how can new ideas, new conceptions arise, develop, prove their pertinence or not?

There are questions mainly addressed to the deciding "elites" of this world who have the possibilities to make the scientific policy and have the financial keys.

There is also another problem which the present considerations are devoted to: how to help the student discover and develop in himself the hidden talent of an investigator so as to become a Researcher? And, in addition, how can the student be strong enough as to persist and remain 'a man of science'.

Traditionally the process begins when a Teacher discovers a talented Pupil or (more rarely) a talented pupil chooses his Teacher. There are many examples in the history of science, such as Louis Pasteur and Emile Roux, or Marie Curie and Frédéric Joliot [14-16]. But now it seems to be not so easy, and anyway it is an individual approach.

In our European countries, in order to prepare the students to their future life including scientific career, the "end of cursus" work is demanded either after each year of high school formation or at the end of the whole cursus. This task is obligatory and supervised by the teaching staff and when circumstances are favourable, it may be a step to further scientific careers. But once more, it is an individual, though planed, approach.

Quite different is the experience of such countries as Russia (since the end of the 19th century, including the former USSR and the present Russian Federation), East European and some other countries: it is the creation in every University and High School of so-called 'Scientific Student Societies' (SSS) [17]. Let us consider them more closely.

Their aims were: (1) to popularize scientific research among students, (2) to find out the most talented among them and (3) to help them develop towards a prospective scientific career. It was also a way for the departments to obtain out-staff qualified helpers, as a just return for the personal investment of the responsible for the student's formation staff-member scientific workers.

As soon as they wanted, students were invited to join a student scientific circle by the department of their choice and to begin their initiation according to their trends with one of the assistants or docents.

At this level, the students learned step by step how to manage scientific literature, to review it, to deepen their knowledge in the chosen branch, to acquire technical skills and, last but not least, to take part to the research of their mentor/supervisor, or even to start their own investigations and research topic. The most promising students were further recommended for scientific work in their first department or research institutes or high school faculties (according to the young specialist's will and to the possibilities of research institutions). The Ministries took into account the SSS activity of ex-students when a decision was to be taken as to their future.

In the circle, students / members elected a responsible person who organized periodic reviews of the work given by the circle members. The best reports were selected and recommended for faculty and inter faculty student scientific conferences. During these meetings, lectures were presented by experienced assistants and docents or professors to help the students with the peculiarities of the branch and the specific research.

The department circles joined forming faculty and institute student scientific societies (SSS), handed by students and only supervised by a member of the faculty staff. Students elected their president and delegates for contacts with other faculties, institutes of the country and of foreign countries. They organized faculty conferences, inter-faculty scientific sessions financed either by the Professional Union of their School or by the University budget. Sometimes compendia with the best scientific articles of students were published.

So the students made acquaintance not only with the searching process itself, but also with elements of organizing scientific research, discussion and peer evaluation of its results both by other students and by the faculty scientists. Students also learned to communicate at different levels and, if they so wanted, to prepare themselves to a scientific career. If not, the aptitudes obtained during their work in the SSS were nevertheless precious for their further professional activity (good acquaintance with special literature research, reviewing and critics, with some technical acts, with scientific meeting organization).

About 20% of the students attended the SSS. Among them about 30% could present a valuable work (compilation, fundamental or applied research). Most of the former SSS members have pursued a career in the previously chosen specialty. Most of those who have followed a successful scientific or pedagogical career were ancient SSS members.

All through the years 1930-1990 many of the students, even foreign hosts, who have passed through this "school", have been later eminent scientists of their countries (for instance SP Korolev - father of Soviet cosmonautics, V Shumakov - Director of the first Transplantation Scientific Research Institute in the USSR, and many others).

But the realization of such a program also requires an excellent basic training with a good command of, at least, the mother language and, preferably, of 1 or 2 foreign languages for the best. All this is necessary (1) to read the literature and (2) to contact foreign scientists, which is a condition of the present scientific evolution. That is the minimum required from the secondary school formation.

What have we been doing during these last 10-20 years in many of our West European countries?

Due to the impressive range of education systems in Western Europe, the situation may vary from country to country as far as the relations between societies, science and scientists are concerned. Unless some people in power all over the place seem tempted by burying their heads in the sand, the overall situation of science education is on the downward slope. Let us consider the example of Belgium, without losing sight of the fact that the situation might 'roughly' be comparable in other West European countries, not to say in most of them.

Let us tackle the problem at its very start, i.e. by asking the right questions!

What could lead an individual to feel attracted by sciences and develop a 'scientific temper'? More precisely, how would it be possible to make an individual display such tendencies during her/his intellectual development? How would it be possible to make her/him use abstraction and formulate ideas with precision, not to say accuracy, which is by no means restricted to scientific approaches? How could someone be led to formulate problems, hypotheses and check the latter? In addition, as most scientists (even the would-be ones) do not live in isolation, would they all be able to communicate with each other so as to exchange ideas and derive benefit from their mutual advanced research? No one is the wiser as to propose the sole right answers to these somewhat 'tricky' questions!

All of the tersely aforementioned intellectual processes rely, however, on a common basis: the mastery of language. Would it be conceivable to untangle a problem by using concepts that are not well defined, and in addition, nearly lost in grammatical structures the use of which is approximate? The obvious answer is: no! But...you never can tell!

If you have a closer look at the curriculum of an average citizen, you can't but be astonished at the ever decreasing amount of time devoted to grammatical analysis and the correct use of structures linked with tenses and syntax. And ...please forget that dreadful word: "spelling"! Let us give way to creativity and self-expression instead! Any honest (and conscious) native language teacher has now and then experienced the feeling of being in charge of a foreign language course. And the outcome is, as far as both Belgian (French and Dutch speaking) education systems are concerned : grotesque but revealing results at PISA (a slight bit less so as far the Dutch speaking system is concerned, but on a downward slope all the same) or reading comprehension tests.

Let us open an apparently irrelevant parenthesis at this stage: foreign language teaching. The most conscious among foreign language teachers sooner or later realize that a more 'structured' approach to teaching is required if they want their pupils to reach a higher level of mastery of the language they are studying, i.e. by using some more 'grammar',. How is it possible for them to do so if their pupils display such a poor command of their native language as to make it hardly possible to understand how a foreign sentence works – in plain words, if their ability to analyse a grammatical phenomenon is practically non-existent? Just try to imagine mastering Russian or German without commanding the "declension system". Parroting sentences will not help and, at any rate, will not bring you very far unless it provides food for thought some day! If you now proceed to a still higher command of a foreign language, every scientist should use an international language someday whether on training purposes or just to communicate and keep up with her/his pairs. Haphazard and inaccuracies are not allowed. Should we then reject the search for accuracy and command of language as elite concepts when teachers try to raise the level of their pupils beyond everyday usage? The sooner good language habits are made, the better!

Let us come back to our subject after what is after all not a digression. Once confronted to reality, promoting the scientific approaches eluded to so far very often turn up to be like making dreams come true! Some science teachers do not have other solutions to awake the first stirrings of a scientific temper than having their pupils play within their labs with test tubes at the end of a lengthy and exhausting school day! All this might perhaps prove useful if what has been taught is of a significant quality but… the aforementioned shortcomings due to the lack of language command of pupils might reasonably lead you to question this assertion! So do numerous - and far less unrealistic than might well be imagined - young people who increasingly make other choices than embarking on scientific studies. Those who dare do so are often brought back to reality no sooner than at the end of their first year at bachelor level! Are they really responsible for this dreadful outcome?

Anyway! He who does not command language may imagine neither thinking in an abstract way nor developing those "clear and distinct" ideas cherished by René Descartes [19,20], a capacity that is by no means restricted to scientists but is to be extended to all members of a society worthy of the name! Is it not the aim of the education system of a country worthy of the name to provide citizens with the ability to think, formulate their ideas and communicate with other people? All this requires the mastery of language as a corner stone on which knowledge is based, whether scientific or not! Negating this only leads to creating 'brainless' citizens whose sole preoccupation is to hide that unavoidable background noise called anguish that goes hand in hand with existence by means of the artefacts of a consumer society. An unrestrained consumer society, there lies the ultimate goal of the "educative" techniques cherished by the "elite". All you need to reach such a 'level of development' is to breed brave brainless citizens unable to build up, on their own, a worthy and fruitful life! Never mind the scientific callings (or of any other kind) that are lost in the process! Not only is it by promoting the mastery of language that scientific thought is promoted but, thought of any kind is promoted, first and

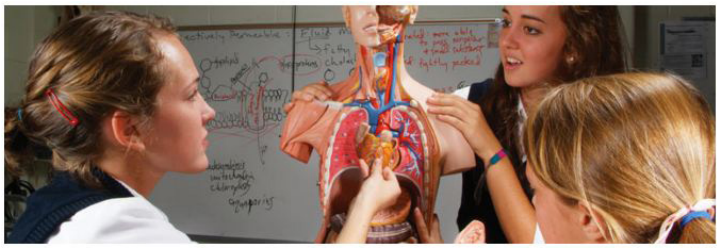
foremost. A society worthy of the name must take these elements into account! If the reader allows both to borrow a quotation attributed to Georges Clemenceau [21], President of the French Republic, and to drop the name of the victims of his pun, the conclusion of the present argumentation might sound as follows: If a society does not promote the mastery of language and, as a consequence, does not promote thought, whether scientific or not, "it is likely to proceed directly from barbarism to decadence without making a stop at what is called elsewhere: Civilization".

However, some light might be cast on that rather gloomy picture as it seems to have dawned on some politicians that the stream should be reversed. What is referred to in the Belgian French Speaking Community by the phrase « pacte d'excellence » (excellency Pact) [22] - displays such an attitude by promoting an education system in which teenagers would, among other measures, follow the same common courses (« le tronc commun ») during the first three years of their secondary school, two hours a week being devoted to the study of Latin, not for its own sake, but in order to enable French speaking Belgians to master their native language in a better way by studying a language (and culture) with which it is closely connected (not to say from which it is dependent) - the focus of this study being laid on grammatical analysis.

Results of this trend are, of course, not to be expected at short notice but in the long run. As the reader will notice, there is still room for hope…

Is it still possible to "awake" even formatted young people to knowledge, pleasure of well performed work, research, in spite of above mentioned defects in their education? Let us hope/believe in the power of that golden rules which have to be observed: respect of the auditorium, no wide or great words, direct, frank and clear contact as possible, but without familiarity, a perfect knowledge of the matter on the part of the speaker/Teacher, no fear to propose complex, difficult to the understanding topics unless the explanations are clear so the eagerness to win the difficulty is boosted. If treated with consideration as responsible persons able to make the necessary effort, most of the young will consider the challenge worthwhile and will answer to the trust accorded to them…

Figure 1: The lesson of anatomy by Professor Tulp (1632- Rembrandt Harmens van Rijn)



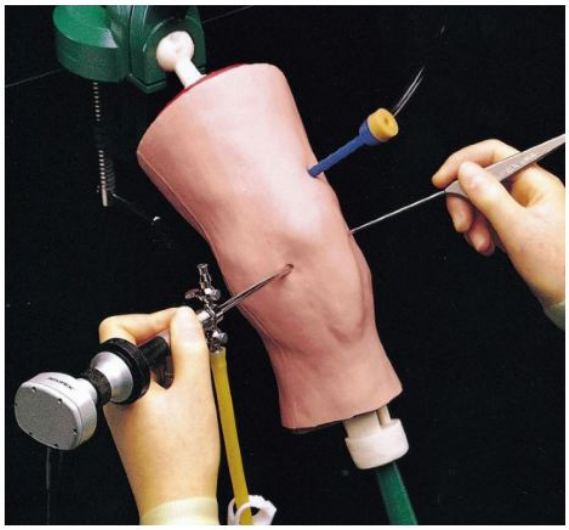


Figure 2: Contemporary teaching anatomy (Neck and thoracic vessels 3D topography, 3D "Neuroteacher") and surgery (Arthroscopy technique) by means of different simulators

A tight collaboration between contemporary means of acquiring knowledge and skills seems to be necessary and quite possible (Figures 1 & 2). But the Teacher must be left present, and not only as a mentor, supervisor or promotor. His role is to be an example but also and mainly to boost the scientific curiosity and research inspiration.

Young people must be taught the difference between "virtual reality" and real life of living, suffering, blooding creatures, who also need sensible, human approach: not cases or nosology units but patients. And though adequate material and financial support is required, living, clever, good willing and honest guiding is also necessary.

And we do not forget Albert Einstein's [23] words: the three indispensable qualities of a researcher are: "cleverness fantasy and unselfishness".

Conclusion

The formation of the new generations of scientific workers is presently compromised by several factors: weak secondary school preparation, financial and institutional difficulties of the scientific research units and institutions, a lack of motivation on the side of young people attracted by other considerations (money, standing and so on).

Scientific Student Societies according large initiative and autonomy to their members, were and maybe still can be an attractive way to acquiring knowledge and practice of scientific investigation among University and High School students.

The role of the Teacher as a model or guide and helper in the young people education as a scientific worker is not to be underestimated and can be in harmony with the contemporary technical progress in pedagogy.

Acknowledgements

Several persons – members of the family, of the elementary school, college and University staff - had a crucial influence on the manner according to which the authors have conducted their life. To these "Teachers" we express our deep thankfulness.

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