Readings in History and Philosophy of Science and Technology Education:

Does Science Teaching Need History and Philosophy of Science *by Peter Slezak*

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1. What makes science and mathematics education a daunting task among educators. Cite evidences from the reading material.

In the article, the utilitarian view of teaching science leads to “anti-intellectualism”. This view of teaching can be countered by HPS. Having said this, the integration of HPS in the curriculum makes science and mathematics teaching a daunting task among educators. Slezak (n.d.) discussed the following aspects to consider in integrating HPS in the curriculum: “The Inevitability of HPS in the Curriculum”, “Naive Philosophy of Science”, “Close Mind or Open Mind”, “History of Science as Subversive”, “Contextual Approach: Is Content Knowledge HPS-free?”, “Paradox of HPS in Science Teaching”, “A Role of History: The Bias of Science Textbooks”, “Science and Subjectivity”, “Should the History of Science be Rated X?”, and “Realism vs Instrumentalism”. Considering all of these, he posits “an outlook which seeks to convey a picture of science as the highest achievements of the human intellect”. This will spur students and teachers to appreciate science and mathematics, leading to enriched culture and human lives (Matthews 2001).

We cannot teach the content of science and mathematics without explicitly addressing issues about these subjects. For example, how will you teach the content of calculus – abstract in its notations – and let your students have a sense of purpose in studying it without discussing its origins, the different mathematicians who contributed to its development and their successes in the field, the issues about it that were settled through the years, etc.? This is where HPS comes in; making it inevitable in the curriculum. Thus, the need for teachers to study HPS.

Another aspect of HPS in the article is the naive philosophy of science. This can be said with respect to the mutability of science. Science and its ever changing body of beliefs seem to be the reasons why people have become open-minded about miraculous or paranormal phenomena instead of dogmatic dismissal of these phenomena. This should not be the case. There is a need to emphasize that there are conclusions we can draw from the fact that science is historically changeable when incorporating HPS in science teaching.

The issue of closed mind or open mind in the article is about the education system unknowingly promoting closed mind or convergent thinking; teaching students the correct answer to given questions. The education system should promote divergent thinking and criticism; a central feature of science which can only be brought out by integrating HPS.

In science teaching, the article also explained “history of science as subversive”. One might see in science a model of objectivity and rationality. However, history reveals that there were mathematicians, like Isaac Newton, who attributed mathematics to God. This will in effect undermine this model of objectivity and rationality that one sees in science. Thus, there is a need to dismiss matters that are not scientific – matters of pseudo-science or religion – when discussing HPS in teaching science subjects. One can consider the history of science be rated X or censored as discussed in the last parts of the article.

Another discussion in the article is that HPS themes should be integrated into the curriculum as an intrinsic part. This emphasizes the contextual approach that content knowledge is not and should not be HPS-free. This will help the students learn about not only the content but also the nature of science.

In addition, HPS being good as it may seem, the article pointed out that theories of HPS are controversial and changeable. This might make someone think not to teach HPS explicitly in a science subject to do away with these controversies. However, this will just weaken the content of the subject. This is the paradox of HPS in science teaching. In teaching HPS explicitly in a science subject, the teacher should make his or her students realize that controversy and change is innate in science and that this is the reality of science and practicing science. This will help students accept, appreciate and learn from these controversies and changes in science and not be dismayed from it.

The article also mentioned the role of history in undermining the bias of science textbooks. Try to imagine being confined to use only one textbook in teaching a science subject, one can simply say that there is bias. Whether this book is written by a renowned outstanding scientist, he would only be speaking for himself and his generation. History will help us compare the topic to the same topic from various generations and authors thus bringing out the best learning for that topic.

Furthermore, one may view science as the product of psychological and social forces rather that of rational thinking. Now, this is in contrast with science being fundamentally objective. The article points out the need to reconcile these things – science and subjectivity – since there is a need to acknowledge also the non-rational elements in science. The article emphasized the difficulty of the task.

There is also the issue of realism vs instrumentalism. The article cited that there is too much emphasis on theory and not enough on experiment; this is instrumentalism. This, however, is the thing of the past. In incorporating HPS in science education, we should focus on the experimentation aspect of verifying the veracity of an entity rather than the use of ability to explain or theory aspect.

Finally, the article concludes that all of these issues on HPS have a direct bearing to the manner and substance of science teaching. Thus, considering all of these things makes it daunting on the part of educators to teach science and mathematics.

1. What are the traces of HPS in the development of curricula (basic & higher education)?

In the higher education, the Commission on Higher Education is committed to outcomes-based education in tune to liberal education – an aspect of HPS pointed by Matthews (2001).

HPS is explicit in the curriculum for general education. In the CMO No. 20 (2013), the teaching of the general education subject Science, Technology and Society is described to tackle scientific and technological developments throughout human history. Moreover, the general education curriculum in the country is explicitly carrying out the liberal nature of general education.

In the BS Math and BS Applied Math programs, HPS is all over the curriculum for both programs. Their program goals include that graduates are expected to develop deeper appreciation and understanding of the importance and application of mathematics throughout history and the modern world (CMO No. 48 2017). Most of the math subjects in these programs start with a brief history of the subject. Nonetheless, philosophy of mathematics is explicit in the program outcomes.

# References

CMO No. 20. 2013. “General Education Curriculum: Holistic Understandings, Intellectual and Civic Competencies.” Commission on Higher Education.

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