A Review of Jerry Wellington's *Teaching and Learning Secondary Science: Contemporary Issues and Practical Approaches*

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Jerry Wellington. *Teaching and Learning Secondary Science: Contemporary Issues and Practical Approaches.* @2000. Routledge. Tylor & Francis Groups. London and New York. ISBN 0-415-21403-3 print version, 293 pages

Introduction

Jerry Wellington's "Teaching and Learning Secondary Science: Contemporary Issues and Practical Approaches" is a resource book for the teachers and teacher educators working in the field of science education. It has introduced the recent issues and hands on activities for teaching science primarily, considering the secondary level students. Jerry Wellington taught science at the school level and is now teaching education at the university level. The author has written so many books before and this science teaching book has been published in New York, London and Canada. It has been published in the print version and e-book version for available for all. It has tried to develop teachers as trainers and mentors. It has tried to cover the ten areas such as planning and managing, differentiation and special needs, practical work…and what it is for, investigations, Information, Communication and Technology (ICT) in science teaching and learning, building on children's prior learning, handling controversial issues, language in science education, the nature of science, why to teach science . . . and why it is to learn¿ The writer focuses on the contemporary issues of teaching science which are seen quite relevant in the context of teaching science eduaction at both the school and university levels. The book is equally useful for university-level students who are going to be school and university-level science teachers to understand the issues of teaching and to select and use the approaches and methods for teaching science. Due to changes in society and the changes in Science and Technology, science teaching has been complex for novice secondary-level science teachers. They need to understand the recent issues and be familiar with the practical approaches. In this sense, this book provides support to the trainee science teachers on how to instruct in the classroom using innovative ways, how to use new teaching strategies for successful science teaching, how to use ICT in science teaching, how to plan science teaching, what types of questioning strategies to be used in science teaching, how to motivate students

toward knowledge construction and how to develop collaborative and cooperative though among students. This book recommends a variety of techniques including field trip, laboratory techniques, science competitions, and different ways of assessments. In this review, we have focused on three pertinent themes of the book: Arguments of teaching and learning, the beneficieries/recepients of science and the science curriculum development.

Arguments of Teaching and Learning Secondary Science

The book begins with some valued arguments for the essence of teaching and learning of science at secondary level. The writer has tried to show the use of concept mapping in science teaching linking similar concepts together with the criteria comparing water and electricity supplied in a single and separate pipe. The author uses the word analogy and comparison in concept mapping of science teaching. The writer has also tried to justify the use of multimedia for providing micro-scientific concepts such as electric electrons flowing in a wire pipe and an electron orbiting in the nucleus. Models are used to show things either very small or very big. Examples, illustrations and analogies are gender-free. Regarding the value of science, the author argues, "Science is about language. But it is also about doing things, seeing things happen, measuring and controlling things" (Wellington, p. 8).

Further, the author admits that science teaching requires hands-on and mind-on activity that helps to learn in artistics way through predicting, observing and explaining actively in and outside the classroom. Science practical labs could be completed with ICT as well as other required materials, however, technical support for ICT use is a major problem in science teaching (Wellington, p. 10). The book focuses on outside curricular knowledge rather than merely laboratory practices. Settlage (2020, cited in Brown, 2019), in this case argues that the students say " I feel like a scientist" when they put on goggles and an apron first time and enter the lab and the teacher also appreciate them for further scientific work. But here the writer focuses on contextual, provisional and not being value-free science rather than only the positivist scientific arguments. Similarly, the author focuses on self-assessment (metacognitive assessment) rather than summative assessment. It has a focus on speaking and doing science rather than writing science. Following two arguments have been raised in the book to discuss the essence of science teaching and learning.

Treating the students in the knowledge transformation process

It is considered that varied students may gather in school from the feeder schools and some teachers treat new gathering pupils in the secondary school as a blank slate or *tabula rasa*, imagining (as some have put it) that they are 'building on a greenfield site' (Wellington, p. 15).

The author views it as a cause of the rigid national curriculum system and the

dominant view of the teachers as a deliverer of knowledge to the students. The author prescribed 11 crucial metaphoric life skill-related characteristics that should have to be developed by an enthusiastic science teacher.

Valuing of Science Connecting Cultural Context

Science teachers' main characteristic is 1) to have content as well as pedagogical knowledge of the subject matter. The author also provided the value of both in secondary-level science teaching. But technological knowledge is also seen as relevant to achieve the 21st century sustainable development goal, however it is not staged with connecting content and pedagogical knowledge. Hennessy et al (2007) also supported the author's view of technology-based pedagogy that supports the learning of science) Another main character is a reflective practice which helps to evaluate the teacher themselves, develops the metacognitive capacity in the teachers, support find out the weakness of his teaching-learning process and suggests the innovative, creative and critical way of teaching science within or outside the classroom. Valuing the cultural science author argues:

Science is a part of our past culture, and a big chunk of our contemporary culture is also a global activity, even if it may differ from one culture or nation to another. Our heritage, history, and many of the important stories of the past are based on science and scientists. Part of science education is about science stories or stories about scientists. Knowing these stories, and understanding science is part of what it means to be a cultured and educated person (Wellington, p. 33) Interestingly the author focuses on social experts and cultural practices to validate science. Bookish knowledge only would not carry scientific and experimental knowledge, but the socially knowledgeable person verifies it through the interactive social process. So, the author has tried to justify social science by viewing the argument as: ultimately, scientific knowledge will not decide for us. Knowledge of science is a necessary but not sufficient basis for a decision. In the final analysis, decisions are made based on values as well as knowledge and understanding of science (Wellington, p. 33) The decision of science depends upon the social reality and social benefit. All the scientific decisions are not found conclusive and are socially beneficial. Science does change (falsified) slowly over time but social norms, values, skills and practices consist of a long rigid time which the author has justified saying, "science proceeds in social, moral, spiritual and cultural context" (p.34).

The Recepients or Beneficieries of Science

The author has attempted to justify whom to teach science and why in his book. It has been admitted that all students who study science at the basic and secondary level could not choose science for their future career and would not be scientists either. Those students who studied science at the basic and secondary levels can choose different areas for their career development as well as survival in society. For that, students

should interlink the scientific facts with social events and cultural practices for 21st century individuals to adjust to local industries and to obtain lifelong employment. The author claims that science should be connected with technology. In the process of modifying the Nuffield Science Project in the UK for 21st century, Reiss et al. (1999) viewed that the rapid pace of technological change and the globalization of the marketplace has resulted in a need for individuals who have a broad general education, good communication skills, adaptability and a commitment to lifelong learning (p. 68). They further argue that 'restricted', 'success in formal examination', 'experimental and investigative science' and mark insurer reliability science exam' declined the students' interest in science (p. 68). The above argument also supports Wellington to provide the cultural science based on sociocultural context to suit for 21st century society.

Curricular Development for Science Teaching

In the same spirit, the author has explained the principles of curricular development for science teaching. The 21st century science teaching should be for all, i.e., for girls and socially, culturally, geographically and economically marginalized students. So, the author also focuses on the present science curriculum for all people, abilities and sexes to achieve the slogan of "science for all" debating with "some science for all". To achieve the slogan of science for all, the integrated science curriculum is prescribed, which was implented in the UK in a different form from 1970 but not successfully implemented.

In the text, the author proclaims that learning by experimenting and learning by discovering science is challenging for school-level students. All the students studying science cannot be involved in discovering new science being a scientist but are engaged in discovering the events that are found around them. Focusing on integrated teaching for secondary level science as subject pillars, Wellington argues that science has of connection with mathematics, English, technology, the humanities, arts, physical education, and religious education (p. 45)

It shows that science is not only discovering scientific facts. Diverse knowledge found in society could be the area of science and science curriculum. So "Nuffield Science" near about 1970 revised its goal and science curriculum and focus on children's practical and investigative science, which focuses on the day to day events and is based on short-period investigation not being long as discovered any things being involved in many years.

Conclusion

All of the above arguments of the author indicate that contextual curriculum is to be developed and it must be based on critical and creative thinking. The contextual curriculum supports the culturally-based integrated Science Technology and Society (STS) curriculum. Moreover, the book focuses on the multidisciplinary science curriculum to solve social problems and obtain the goal of science for all. For the

active involvement of students in science learning, Science, Technology, Engineering, Art and Mathematics (STEAM) education has to be introduced. STEAM either works as an approach or integrated discipline. It is seen as appropriate to achieve the 21st century learning goals of sustainable development which is entirely different from single disciplinary science curriculum.

Based on the conclusion, it can be recommended that the contemporary issues like contextual curriculum, culturally appropriate pedagogy and technologies should be adhered by the teachers. The practical approaches suggested in the book can better support the teachers achieve the 21st century learning skill for the secondary level science students.

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