Education and International Relations: Science Education for Science Diplomacy

Güliz Sütçü

University of Sussex, Science and Technology Policy Research (SPRU),
Sussex House, Falmer, Brighton, BN1 9RH, United Kingdom

Keywords: Science Education, Foreign Policymaking, International Relations, Science Diplomacy

Abstract. Science education has been on the state agenda since the 1970s and has been discussed from several perspectives. Despite the abundance of issues that shaped the debate on science education, the impact of science education on international relations has been neglected so far to an important extent. Even though the studies conducted seem to have a global outlook, the concern has been mostly national for the states or at best, regional. Policymakers have usually tended to assess the issue from a national perspective considering the need for raising scientists with the knowledge of basic scientific facts and/or citizens with scientific literacy. Whatever the goal was, science education was assumed to embrace universal values, such as openness, tolerance, and respect for diversity. However, despite acknowledging the close relationship between science and universal values, significance of these for achieving peaceful international relations was almost skipped by the education policymakers. States' emphasis on performing science diplomacy in the recent decade made this deficiency of science education much clearer. As states have recognized scientists' potential to be employed as science envoys for achieving peaceful mode of international relations, the need for scientists and policymakers that are cognizant of their global responsibility has become more urgent. It has underlined the immediate need for a science education that is capable of raising students with global awareness, instead of the one offering a mere acquaintance with universal values. In other words, recent novelties in the foreign policymaking process required adding an international dimension into science education matters. It has become clear that science education should shift its aim towards raising people with a collaborative spirit and with the awareness of their global responsibility. This study, concerning this, will introduce the close relationship between education and international relations, or in other words, between science education and science diplomacy. It will point out the need for reforming science education to attain peaceful international relations, and hence, will make suggestions to re-design the science education today for peaceful international relations tomorrow.

1. Introduction

The debate on education is endless by its nature and will most probably go on as the world revolves around. One of the important dimensions of this debate is 'science education.' Not differently from the debates on education, science education so far has been discussed within the framework of curriculum, pedagogy, assessment, and recruitment issues.

At first, the way in which the curriculum should be designed was under question. It was mainly related to find out the purpose of science education. Almost all agreed on the need for science

ISBN: 978-605-64453-0-9

education and almost none agreed on the purpose and hence, content of it. As the disagreement on its purpose went on, several changes in the curriculum were suggested. The debates on curriculum have incited several other ones as the education system includes the issues of teaching methods, assessment strategies, and the required capabilities of teachers as well. Besides the discussion on curriculum, teaching strategies and methods, the ways in which to assess students' performance, and the required capabilities that science education teachers should attain have also become issues of concern for a dynamic and effective science education.

The increasing importance of science and technology (S&T) in the recent decades incited these debates to a greater extent. As the S&T have been started to be recognized the solution of each and every problem in political, social, and economic aspects, the issue of science education has become a matter of hot debate. However, despite the abundance of issues that shaped the debate on science education, the impact of science education on international relations has been neglected so far and this has become more obvious with the latest developments in states' foreign policymaking and policy implementation.

The increasing pace of globalization, revolutionary improvement in communication technologies, increasing number and variety of international actors led states to look for new ways of establishing and maintaining international relations. This quest for new ways and methods to carry out its international relations resulted with an unanticipated discovery of S&T as the new diplomatic tools. States found out that through the use of S&T they can establish peaceful relationships and also, can ameliorate their existing relationships, which have been unstable so far. This resulted with the birth of the concept of science diplomacy and this, in turn, polished the importance of science education.

The emergence of science diplomacy made clear the need for policymakers and scientists that are conscious of their global responsibilities. Besides the need for institutional, legal, and financial arrangements and mechanisms, it has appeared that it is the individuals, either the policymakers or the scientists, who will make an important impact on the quality and consistency of science diplomacy. Once recognized irrelevant, target groups of science education and foreign policymaking diplomacy have become closely connected to each other with the emergence of science diplomacy and this made clear the need for re-designing science education with an international outlook.

Concerning the novelties in foreign policymaking and the role of science education for the implementation of this new kind of diplomacy, in this study firstly several dimensions of science education will be discussed and secondly, the role of science diplomacy in international relations will be mentioned. Having presented an overall picture of both, the relationship between science education and science diplomacy will be clarified and based on these, several suggestions will be made with the aim of maintaining a science education capable of raising students with global awareness.

2. Science as a Matter of Education

Science education has been a matter of hot debate particularly since the 1970s. It has become one of the primary topics at the core of states' agenda due to the increasing importance of S&T. As the S&T have been started to be recognized as a panacea to states' problems, policymakers felt the need to reconsider the sufficiency of science education given the rapidly changing conjuncture. The importance of science education was agreed upon by all of the stakeholders, but its design was under question. The ongoing debates on curriculum, teaching techniques, assessment methods, and the proficiency of teachers to teach science made clear that different perceptions of science resulted with different suggestions.

To begin with the debates on curriculum, we witness that the gains expected from science education shaped the discussions to an important extent. The debates were mainly related to find out the purpose of science education and the best way of curriculum to serve this purpose. Almost all agreed on the need for science education and almost none agreed on the purpose and hence, content of

ISBN: 978-605-64453-0-9

it. This mainly resulted from the perception differences in interpreting the tie between science and society or in other words, in interpreting the tie between science and children [1].

Given that different perceptions resulted in different ways of curriculum, one of the suggestions about the purpose of curriculum was about the idea of preparing students for having science careers in the future [2, 3]. The other was to provide the students with the history and philosophy of science [4, 5, 6, 7]. Another was to engage students with science through investigations [2, 4, 5, 6], and the final was about introducing the concept of technology into science education for scientifically literate citizens [8, 9, 10, 11].

It has been argued that designing the curriculum to enable public having an understanding of science would have scientific, individual, social, economic, political, and moral benefits. The idea was that as people have better understanding of science, they would support it and this would end up with a larger number of human resources and higher funding for science, in addition to new economic gains. Furthermore, it was suggested that people with an understanding of science would be able to benefit from it in their daily lives and would also be capable of questioning and analyzing, which are required for the survival of a democratic system. Besides all, understanding of science was also considered as the way for fulfillment and a higher self-esteem [12].

More clearly, science education was deemed as necessary for building a tie between science, technology, and society. Having a quite similar philosophy to the Science, Technology, and Society Movement in the 1970s, knowledge about science rather than scientific knowledge was promoted [2, 13, 14, 15]. Compared to learning science from a theoretical perspective, its practical dimension was considered as much more useful. This way of science education was also reflected as more inclusive compared to the one targeting only a small group of children to be trained as scientists [16]. In relation to this, the inclusive idea behind this way of science education was clarified with the fact that only through this way, students can have a knowledge of scientific facts, of science philosophy, and of the relationship of science to real life [17, 18].

However, besides these suggested uses of 'science for public understanding' approach, it is also obvious that this approach is not perfect and lacks some necessary dimensions that should be considered important about the effects of science education. Since this perspective is mainly based on an active-passive relationship given that the students are on the passive and the teachers are on the active side, it neglects the fact that science education has the potential to trigger a social change through individual and community empowerment [19]. Besides this, it also does not make emphasis on the ideas of the two important stakeholders' of science education, which are the teachers and the students [20].

Teachers come into discussion when their quality is questioned. Their capacity to teach science education with a variety of techniques and using up to date information is considered. Training teachers to enable them use discursive teaching methods while discussing science issues is one of the points [21]. Moreover, teachers with a clear understanding of the purpose of curriculum are also considered necessary for a successful science education [22]. Considering this, the issue of training teachers with the goal of improving their skills appears as another aspect of the discussion [23].

Discussing teachers' ability to teach science education is not independent from the need for developing teaching strategies and finding out the best assessment methods [19, 22, 24, 25]. The novelties in the content and purpose of curriculum create the need for improving teaching and assessment methods. Not being dependent on textbook, using various teaching materials is on the one dimension and considering different reflections of students' performance is on the other dimension of the debate. The need for keeping students' interest on science education issues and motivating them to learn about these is important. Applying assessment methods with a holistic approach contributes to this as well. Evaluating students' performance on their ability to understand, interpret, analyze, and discuss scientific knowledge would encourage students' curiosity in science education to a greater extent compared to one based on exams and tests [22, 23].

ISBN: 978-605-64453-0-9

Hence, one debate on science education triggered another and it did not change for decades. The changes in the approaches about the purpose of science education have led the policymakers to question other parts of the education system, which are pedagogy, assessment, and teachers. The scientific and technological improvements and their increasing impact on economic and social life influenced policymakers' way of thinking about science education and its requirements. However, the increasing political power of science, which is in particular on foreign policymaking, did not reflect upon these debates. Despite the fact that science has become an instrument of politics in a more different way than it has used to be, it did not fire science education debates from an altered perspective and did not bear the required novelties in science education as will be analyzed through the next sections.

3. Science as a Matter of Diplomacy

Before going on with the relationship between science education and the newly rising role of science in politics, this newly emerging role of science should be explained, which has been due to the states' quest for new ways of diplomacy with the purpose of establishing stable international relations. States seeking for a tool to carry out its international relations with a number of actors have recognized science as a new dimension of foreign policymaking and implementation. The routines of science as scholarships, international conferences, and exchange programmes have been interpreted as international cultural activities enabling foreign publics to interact with each other [26]. This caused an awakening in states to apply "scientopolitical" initiatives by focusing on education and science (but not on science education, as will be discussed in the following section) [27]. As states started to use S&T to interact with foreign publics and to facilitate their already ruined or yet less-developed relationships, science has become the newest tool of diplomacy [28].

Science diplomacy has started to operate on different dimensions with different stakeholders. In other words, the use of S&T in foreign policy pointed out the fact that foreign policymakers and scientific community are the main actors in its implementation [28, 29], while its implementation varies in three aspects: science in diplomacy, diplomacy for science, and science for diplomacy [30].

Science in diplomacy is about the contribution of science to foreign policy objectives. As policymakers give attention to the recommendations provided by the scientists about policy issues with a scientific dimension, they can be updated about the controversial issues and informed about the existing uncertainties before making their policy decisions. The second dimension of science diplomacy, diplomacy for science, is about facilitating the establishment of international S&T collaborations. It is about the formation of new networks among foreign researchers and research institutions. Through diplomacy for science, scientific community becomes able to build new partnerships, execute projects with high budget, access to developed infrastructure, and invest on their knowledge and expertise [30], while the states can access to "researchers, research findings and research facilities, natural resources, and capital" [28]. The other dimension, science for diplomacy, is about the use of S&T collaborations to improve states' international relations with each other. It enables people from different countries encounter with each other under real conditions and allows the global spread and assertion of civic values. Going beyond national interests and cultural or religious differences, scientists internalize the idea of mutual respect and mutual tolerance to replace biased evaluations [31, 32].

However, in order to be able to use science effectively in and for politics and the vice versa, it is a must that the people who are in charge of performing science diplomacy should have a clear idea about the purpose behind their activities. In other words, science as a recent tool of diplomacy should not be politicized and should not lead, in the end, to a power struggle. Since science diplomacy can bear positive results only in the long run, foreign policymakers and science envoys should be aware of the fact that their acts will not produce immediate outcomes and should beware of exploiting science for short-term political goals.

ISBN: 978-605-64453-0-9

In addition to the need for awareness of the fact that science diplomacy takes time to bear fruits, policymakers and practitioners should remember that science itself has limits for making changes in international politics. Its impact is not only visible in the long-run, but also depends on a number of factors operating simultaneously Regarding it as the mere panacea to political and international conflicts would be nothing else than an illusion. Instead, it should be regarded as science at first and then, as a catalyzer for establishing peaceful relationships rather than as a tool under the service of foreign policy.

Despite making different remarks, these two points share a common point and emphasize the importance of human resources for the conduct of effective science diplomacy and to avoid science's exploitation. They do highlight the importance of mentality of the people that are responsible of making foreign policy and of the people that are charged of implementing it. In other words, it draws attention both to the maturity of policymakers and the scientific community to stay focused on the benevolent use of science instead of its exploitation. The three different paths of science diplomacy mentioned through this section also reflect the same idea.

It is apparent that in order to apply science diplomacy effectively and to remain within the borders of its focus on promoting collaboration in international relations, both the policymakers and the scientific community should be conscious and clear about the limits of their power. In other words, they should have a clear understanding of science and of their responsibilities in global terms.

All of these points come together at a junction point, where science education interacts with science diplomacy. More clearly, science diplomacy is based on the maturity and good will of individuals to a greater extent than it is for the traditional performance of diplomacy. While traditional diplomacy has certain borders and definite rules of conduct, science diplomacy has a more flexible nature. In the absence of certainly defined rules, intentions of the policymakers and the practitioners including the scientific community are much more significant for its outcomes. Concerning this, it can be argued that science diplomacy is mainly based on ideas and trial and error learning. Hence, it is much more open to be abused by the actors involved in its making and implementation and requires human resources not only capable of implementing it but also capable of implementing it in the way how it should be. In other words, both the scientific community and the foreign policymakers should remember that they have global responsibilities beyond their national identities when the matter is science and this enables science education and science diplomacy make inroads to each other.

4. Science Education and Science Diplomacy

As mentioned above, science education debates had various dimensions, all of which are interrelated to each other. Similarly, science diplomacy has its own ways and methods, none of which can be considered as irrelevant to each other. When looking through the several layers of both, they seem to be not converging at a point. However, both of them share a fundamental aspect, which is the bond between science and individuals. Apart from the slogans that were put forward to publicize science education, individuals' approach towards and understanding of science was at the center of debate. Not unlikely to this, science diplomacy has been formulated as a way of diplomacy that would be carried out on the basis of interaction between science and individuals. In other words, while science education is about shaping students' vision of science and embedding them with a certain amount of scientific knowledge, science diplomacy is about getting benefit of the unifying power of science.

However, even though these two come together easily on an academic paper, the connection between them has been neglected so far by the policymakers. Foreign policymakers, who express the need for a society that is supportive of science and is aware of its capacity to change, did not apprehend the importance of reaching out the education policymakers. In the same way, education policymakers stressing the need for raising people with an understanding of science did not realize the

ISBN: 978-605-64453-0-9

influence of students in politics as ordinary citizens, until it has become an issue of higher education. It was only when the issue has been higher education, i.e. graduate studies, post-doctoral careers, exchanges and any other international education activities, the education and foreign policymakers shared an agenda.

Nevertheless, the link between education and international relations should be considered before the higher education years. Differences between target groups of science education and science diplomacy made them appear as unrelated and irrelevant to each other. To avoid this, science diplomacy should clarify its need for citizens, either policymakers or scientists that are conscious of their global responsibilities for achieving international cooperation, while science education should be aware of its duty to raise students with global awareness. In other words, the ongoing neglect of science education and science diplomacy towards each other should be replaced with awareness about the importance of each to the other.

In order to achieve this, different components of science education should be reviewed with this understanding. It has to be re-designed to have an international outlook and to educate students with a feeling and idea of global responsibility. That is to say that for making a difference in the outlook of students and in their understandings of themselves as beyond the borders of their nationalities, reforming science education from different dimensions is vital.

At first, the curriculum should have an international outlook. It should not be for pampering one's own achievements on S&T but to reflect the global effects of scientific and technological achievements and more importantly to reflect the power of S&T cooperation to change global dynamics towards a better point. It should aim nurturing students with an awareness of universal values and their global responsibilities. With this purpose, rather than presenting a history of science based on scientific facts and history of success, contribution of different cultures to science should be mentioned.

However, including an international dimension to the curriculum would not be sufficient to meet the requirements of educating people with global consciousness. Any policy change requires implementation for it to be successful. Designing the curriculum with an international outlook to raise students that are globally conscious would not be enough in the lack of capable teachers. Teachers should be capable to communicate the importance of the relationship between science and cooperation for a peaceful world. Hence, it is also necessary to train teachers to get a global perspective and to be able to reveal the link between science and peaceful international relations to their students. Science teachers should have an understanding of the fact that the world needs people who are aware of the integrating and unifying power of science. It is the teachers with a wider perspective to science who will make an impact on students' attitude to science and policy.

Furthermore, new teaching strategies should be developed as well. Given the aim of embedding students with the feeling of responsibility towards peoples of different countries, adding a social dimension to teaching is required, even though it has so far aimed providing students with role-models to inspire them for science careers. With a social dimension, however, students can have a more realistic image of science and scientists. Also, it can help in increasing the visibility of science's global character and can help students for recognizing the link between science and foreign societies. This can be possible through the use of documentaries focusing on the contribution of different cultures to the improvement of science and organizing talks with researchers from different nationalities or the ones that are taking place in some internationally performed research projects [33, 34].

Therefore, meeting the needs of 21st century requires changes both in mentality and practice. Establishing links between education and international relations at earlier ages becomes much more significant. This makes the issue of science education one of the most important aspects of debate and clarifies the need for reforming science education given the undeniable impact of S&T on politics.

ISBN: 978-605-64453-0-9

5. Conclusion

This paper indicates that science education is lacking of an important dimension, which is the international one. The emergence of science as an instrument of foreign politics has made it much more obvious. Following the recognition of science as a tool of diplomacy and of science diplomacy as a new way of international relations, need for a different kind of human resources has appeared. It has been understood that for the conduct of science diplomacy, having people that are cognizant of their global responsibility is vital. The flexible nature of science diplomacy has made it necessary as well. Concerning the fact that science diplomacy does not have clear cut rules and includes a number of actors, it is the people's mentality, which will make an impact and difference in its conduct. The ones who will take initiatives in its conduct are much more significant than the ones who perform traditional diplomacy within an already determined set of rules and routines and this is the point which clarifies the shortcomings in science education.

As science diplomacy aims establishing peaceful international relations, it needs people with global awareness. However, science education, under those circumstances, is understood to be insufficient and incapable of raising people with global consciousness as it mostly focuses on the issue with a national and hence, narrow perspective. Its' being lack of an international dimension and being designed within national frameworks clarifies the urgency of making changes in its design.

Science education should look beyond national borders. For achieving a change in its attitude towards a more global one, it should include an international perspective. In relation to this, its curriculum should be redesigned to emphasize the global nature of science and its relation to the global society. Moreover, teaching strategies should be reviewed with the aim of embedding students with a more global and collaborative outlook. It also requires teachers that are capable of and willing to apply a curriculum, which emphasizes the responsibility of science and citizens for a peaceful world order. These all should be complemented with the implementation of new teaching strategies and assessment methods that attaches importance to raising students who are aware of their global responsibilities.

Hence, even though it is almost sure that these suggestions form a minor part of the required changes in science education, it can be concluded by saying that they can be helpful for clarifying the need for making many other proposals of change in the design of science education today for peaceful international relations tomorrow.

References

[1] A. R. Bell, The childish nature of Science: Exploring the Child/Science Relationship in Popular Non-Fiction, pp. 79-98 (Newcastle Upon Tyne: Cambridge Scholars Press, 2008).

[2] S. Turner, School science and its controversies; or, whatever happened to scientific literacy?, *Public Understanding of Science*, vol. 17, pp. 55-72, 2008.

[3] D. Kennedy, J. Austin, K. Urquhart and C. Taylor, Supply without Demand, *Science*, vol. 303, no. 5661, p. 1105, Feb. 20, 2004.

[4] P.J. Gaskell, Authentic Science and School Science, *International Journal of Science Education*, vol. 14, pp. 265-72, 1992.

[5] S. Turner, K. Sullenger, Kuhn in the Classroom, Lakatos in the Lab: Science Educators Confront the Nature-of-Science Debate, *Science, Technology, and Human Values*, vol. 24, no. 1, pp. 5-30, 1999.

[6] D.C Phillips, The Good, the Bad, and the Ugly: The Many Faces of Constructivism, *Educational Researcher,* vol. 24, pp. 5-12. 1995

ISBN: 978-605-64453-0-9

[7] M. Monk, J. Osborne, Placing the History and Philosophy of Science on the Curriculum: A Model for the Development of Pedagogy, *Science Education*, vol. 81, no. 4, pp. 405-424, 1997.

[8] M. Ratcliffe, Science, Technology and Society in School Science Education, *School Science Review*, vol. 82, pp. 83-92, 2001.

[9] J. Ziman, The Rationale of STS Education is in the Approach, pp. 21-31 (New York: Teachers College Press, 1994).

[10] J. Solomon, Teaching Science, Technology, and Society (Buckingham: Open University Press, 1993).

[11] M.H. Shamos, STS: A Time for Caution, pp. 65-72 (Washington, DC: National Science Teachers Association, 1993).

[12] J. Gregory, S. Miller, Science in Public: communication, culture and credibility, pp. 11-16 (New York: Plenum, 1998).

[13] R. Millar, (ed) Doing Science: Images of Science in Science Education (Falmer Press: London, 1989).

[14] D. Layton, STS in the School Curriculum: a Movement Overtaken by History?, pp. 32-44 (New York: Teachers College Press, Columbia University, 1994).

[15] G. Aikenhead, STS education: A rose by any other name, pp. 59-75 (London: Routledge, 2003).

[16] J. Osborne, J. Dillon, Science Education in Europe: Critical reflections (Nuffield Foundation, 2008).

[17] J. Durant, What is scientific literacy?, pp. 129-138 (London: Science Museum, 1993).

[18] R. Millar, A. Hunt, Science for Public Understanding: a different way to teach and learn science, *School Science Review*, vol.83, no.304, pp. 35-42, 2001.

[19] R. Zahur, A. C. Barton, and B. R. Upadhyay, Science education for empowerment and social change: a case study of a teacher educator in urban Pakistan, *International Journal of Science Education*, vol. 24, no. 9, pp. 899-917, 2002.

[20] E. W. Jenkins, The student voice in school science education, *Studies in Science Education*, vol. 42, pp. 49-88, 2006.

[21] J. Osborne, R. Duschl, and R. Fairbrother, *Breaking the Mould: Teaching Science for Public Understanding* (Kings College, London & the Nuffield Foundation: London, 2002).

[22] R. Millar, J. Osborne, Beyond 2000: Science Education for the Future (Nuffield Foundation, 1998).

[23] Education, Audiovisual and Culture Executive Agency, Science Education in Europe: National Policies, Practices and Research, 2011.

[24] M. Oscarsson, A. Jidesjö, H. Strömdahl , and K. G. Karlsson, Science in society or science in school: Swedish secondary school science teachers' beliefs about science and science lessons in comparison with what their students want to learn, *NorDiNa*, vol. 5, no. 1, pp. 18-34, 2009.

[25] Lord Sainsbury of Turville, *The Race to the Top: A Review of Government's Science and Innovation Policies* (London, HM Treasury, 2007).

[26] A. F. de Lima Jr, The Role of International Educational Exchanges in Public Diplomacy, *Place Branding and Public Diplomacy*, vol. 3, no. 3, pp. 234-251, 2007, p. 235.

[27] A. H. Zewail, Science in Diplomacy, *Cell*, no. 141, pp. 204-207, April 16, 2010, p. 204.

ISBN: 978-605-64453-0-9

[28] T. Flink, Schreiterer U, Science Diplomacy at the Intersection of S&T Policies and Foreign Affairs: Toward a Typology of National Approaches, *Science and Public Policy*, vol. 37, no. 9, pp. 665-677, 2010, p. 666.

[29] J. Lijesevic, Science Diplomacy at the Heart of International Relations, *E-International Relations*, p. 2, 2010.

[30] The Royal Society, New Frontiers in Science Diplomacy: Navigating the Changing Balance of Power (London: Royal Society, 2010).

[31] Science and Technology in U.S. Policy Towards the Islamic World, Saban Center for Middle East Policy, The Brookings Institution, pp. 1-14, January 2005, p. 14.

[32] J. Manzione, Amusing and Amazing and Practical and Military: The Legacy of Scientific Internationalism in American Foreign Policy, 1945-1963, *Diplomatic History*, vol. 24, no. 1, pp. 21-55, 2000, p. 24.

[33] The Royal Society, Taking A Leading Role (London: The Royal Society, 2005).

[34] D.W. Chambers, Stereotypic images of scientists: the Draw-a-Scientist-Test, *Science Education*, vol. 67, no. 2, pp. 255-65, 1983.

ISBN: 978-605-64453-0-9