Policy in the area of technology education - a framework for theoretical analysis

Margarita Pavlova
Technology Education
Griffith University

Introduction

"It is not difficult to find the term policy being used to describe very different 'things'" (Ball, 1994,15). According to Ball (1994) there are two main ways of conceptualization of policy: *policy as text* and *policy as discourse*. In this paper the analysis will be limited by the texts. It is accepted that the purpose of this inquiry is to investigate the focus which had been built into the texts and make a case on this basis. Comparative perspective is used to analyze what is chosen for presentation, what has been omitted and what words are used for the description of policies. "Words are ordered and combined in particular ways and other combinations are displaced or excluded" (Ball, 1994, 22). It is accepted that if something is explicitly mentioned in the text this is a key aspect or the writers presume that this will be a key issue for the readers, and if something is not mentioned - this might be because the writers have not considered it or it is assumed that readers and writers take this for granted. In this case, it is important that for any reason the writers do not feel the need to spell it out.

Curriculum documents which have been developed at the national level for compulsory school in four countries (Australia, Russia, UK and the USA) will be studied. The status of the analyzed documents is different in each country. In the UK and Russia they are statutory Orders describing the frameworks for organizing technology education in state schools. In Australia and the USA - they are consultative documents. In Australia, on the basis of the consultative documents all States have elaborated their own curriculum. In the USA states may or may not use them as a framework for curriculum development.

But one of the main features of the American documents was a process of nation-wide consultation in the search for a consensus among a very broad audience of educators all over the country. Thus it is possible to suggest that the rationale presented in these documents will have an influence on developing policies all over the country.

Another starting point for this paper is the need for the inclusion of different type of theories for the analysis of the educational policy, as theories provide "the possibility of a different language" (Ball, 1997, p. 269).

Thus, the aim of this paper is to look at the educational policies of four countries through a modern/post-modern approach as a framework for the analysis. It is accepted that there are limitations of 'policy as text' approach which are connected to the absence of analysis of the processes of developing and implementing the policies. However, it is also accepted that curriculum documents are a valuable source of data. The study is limited by considering of the concept of knowledge in technology education as it is provided a distinguish basis for the interpretation of educational policy in each country.

First of all, I will show the main ideas of modernism/postmodernism in their epistemological part and propose dichotomies which could be applied for the analysis of the curriculum documents. Then I will use a comparative perspective to see what approach to the concept of knowledge has been chosen in each country and how it could be interpreted. For this I will briefly analyze the influence of two factors on the formation of knowledge understanding in the countries under consideration.

Understanding of knowledge on philosophical/sociological levels

Sharp disputes over what knowledge is are important standpoints for both modern and postmodern projects. The arguments in the philosophical and sociological literature demonstrate how a new forms of economic, political and cultural relations influence the production and dissemination of knowledge, and on understanding of the changing nature of it. Enlightenment as a historical starting point for modernism has knowledge at

the heart of its project (Lyotard, 1996). “The Enlightenment was a product of the expansion of knowledge. It was also a statement of faith in knowledge both as a way of understanding truth and as the essential instrument in ensuring human progress” (Coulby and Jones, 1995, p.25).

When analyzing modernist definitions of what constitutes knowledge, Jeanne Connell (1995) identify three defining characteristics taken from the legacy of Descartes: “(a) a quest for certainty; (b) a clear delineation between subject and object; and, (c) a view of progress that is always forward moving toward a unified system of knowledge” (Connell, 1995, p.1)

Modernist theories of knowledge aim to prevent interests, desires, and values from influencing the objective outcomes. Objectivity is obtained through carefully controlled scientific method which leads to a unified system of knowledge. Thus, progress is generally viewed as “movement toward a single, absolute truth by revealing universal principles obtained by a unified method of science” (Connell, 1995, p.2).

Postmodernity is not an alternative to modernism. It is rather a critique of it (Coulby and Jones, 1995, Green, A. 1994). The concept of postmodernity is too diverse, eclectic and non-systematic. It is a body of ideas which demonstrate their skepticism “towards the ‘Enlightenment metanarratives’ of universalism, unity, reason and progress”(Green, 1994, p.68). One powerful aspect of a postmodernist critique concerns knowledge.

A challenge to modern epistemology had been articulated by a number of authors. Dewey was among the first ones. He replaces two key constructs of certainty and separate subjectivity. According to Connel (1995), he radically changed the view of what constitutes knowledge by emphasizing uncertainty and ‘transactional’ view on relationship subject - object. “A transactional epistemological perspective influences conditions of inquiry by foregrounding: (a) the need for communication; (b) an interest in change and indeterminacy; (c) a consideration of context; (d) a recognition of the

connection between theory and value; (e) a redefinition of subjectivity and objectivity that acknowledges values, interests, and beliefs; and , (f) a focus on practice" (Connell, 1995, p.3).

These critiques have shaken the faith of modernist knowledge. "No truth system is seen as been superior. Individual taste and discrimination are encouraged, eclecticism prized and all canons subjected to furious attack … modernist knowledge … no longer carries any widespread legitimacy" (Coulby and Jones, 1995, p. 37).

The crisis in confidence in what is knowledge, and what is worthwhile knowledge has its influence on the development of the concept of knowledge in different school disciplines, including technology education.

Understanding of knowledge in a modernist/postmodernist perspective presents several dichotomies which could be useful in analysis of educational policy and particularly, curriculum documents. Some of them are: universal v. particular, formal v. experienced-based, value-neutral v. value-laden, bounded v. unbounded, search for truth v. utilitarian, context-free v. context-dependent.

Understanding of knowledge on the level of curriculum documents

The starting point for the analysis is the influence of understanding Technology as a phenomenon on curriculum development.

Influence of understanding technology as a phenomenon

Understanding technology as a phenomenon plays a different role in each country. In the USA the nature of technology is discussed as the basis for developing aims and structure of the subject. In the other countries (such as Russia and UK) technology as a phenomenon is not considered at all: the aims of the subject are the starting point for the curriculum development. In Australian documents there is some discussion on what is the nature of Technology but it does not seen as an important standpoint.

Thus, only in American case understanding of technology as a phenomenon plays an important role and has a strong influence on the concept of knowledge in technology education. A systematic structure of it has been developed. Knowledge is considered as one of the Universals of technology, the structure of which includes "the nature and evolution of technology; linkages based on impacts, consequences, resources, and other fields; and technological concepts and principles. This includes much of the knowledge of how the technological processes are developed, applied, and used" (ITEA, 1996, p.16).

In the third draft of the USA *Standards*, for the purpose of the study knowledge and process are considered as one unifying component. This shift has been explained by the difficulty of separating cognitive, procedural and tacit knowledge which work together in technology. As the result, *Standards* consists of 9 Dimensions which correlates with the Universals of technology. Some of them such as *The History and Nature of Technology*, *Technological Connections* are only knowledge based, the other dimensions specify separately what students need to understand and be able to do. It is also mentioned that traditionally technology education focused on the process, the completion of a project or activity with a little attention being given to the knowledge base (ITEA, 1998, p.178) which is however is an important part of technology education. Development of systems-oriented method of thinking is presented as foundation for technological activity (ITEA, 1998, p.21).

In the case of the other three countries, the rationale of the subject plays a crucial role in defining knowledge in technology education.

Influence of rationale (curriculum orientation)

Technology education was introduced at the period when education became "less clearly distinct from that which is the economy"(OECD 1989b:18-19, cited in Marginson, 1993, p.20). The emergence of new technologies has changed the patterns of everyday life, and restructured work and the global economy. This led to "call for the creation of an

educational system more responsive to the changing labour market needs of nations" (Taylor, Rizvi, Lingard and Henry, 1997, p.4).

Thus, economical argument provides a political framework for developing a rationale for technology education. The attempt to change the relationship between education and work became the basis for the competency-based training reform which influence curriculum development process in all discussed countries. A greater emphasis is placed on the assessment of student performance rather than knowledge. Thus, the ability to perform and the readiness for job became main motives of such changes.

The governments around the world while introducing technology education in curriculum see it mainly for its instrumental outcomes. However, they also point to its potential for human emancipation. Thus, in Western countries the *role* of technology education is specified as an attempt to go "beyond economic vitality" (ITEA, 1996, p.6). In spite of this, preparing students for work (which is the only role put on in Russian *Standards)* received a detailed treatment in curriculum rationales of all countries. The competency-based approach switched the emphasis from knowledge to understanding which could be seen through the students' performance, which in turn became the main category in describing assessment, aims and outcomes of the learning process.

The name of the required competencies are different in each country: in Russian it is 'creativity', in Britain it is 'capability', in America 'literacy' and in the Australian case its nature is not specified. However, in terms of the students' performance the meanings of the required competencies are very close. In the knowledge component more systematic knowledge is required in the case of Russia and the USA.

In American documents the description of technological literacy is developed in full detail, and has a broader interpretation compared to the requirements specified in the other countries. The performance of students is as important as their knowledge about technology. Thus, the description of competencies are not content free in the USA and

Russian documents (they contain knowledge). For example, in the requirements for the students' level of proficiency in the Russian *Standards*, it is specified: "students have to know machine classification on the basis of their function", "have to know the role of technic and technology in the history of mankind" (Lednev, Nikandrov, Lazutova, 1998, p.270). In UK and Australia competencies are more specifically focused on process. They are associated with the use of knowledge, but do not contain knowledge. For example, in the UK *Order*, the fifth level of description of the Attainment Target 1 requires that pupils use "their knowledge and understanding of the appropriate programme of study to help them"(DfE and Welsh Office, 1995, p.14) to clarify ideas.

Academic rationalist/ Utilitarian

Along with the aims, general orientation of curriculum plays an important role in defining (shaping) the concept of knowledge. In the USA technology education was developed as an *academic* (intellectual) discipline (started from academic analysis of Technology as a phenomenon), and is based on a curriculum theory of academic rationalism. Even it is a competency-based oriented approach, the transmission of knowledge from one generation to the next and involving students in the creation of a new knowledge are one of the main purposes. Knowledge for its own sake, not for its utilitarian value remains an important purpose of education. The new subject does not want to be associated with its ancestor "Industrial Arts" (ITEA, 1998, p.4) which had a very low prestige in school curriculum. In the USA *Standards* the cognitive dimension of the subject is stressed as "person needs a certain minimum knowledge about technology: what it is, how it is developed, how it used, and how it affects and is affected by the larger society" (ITEA, 1998, pp.3-4). Although theory is an important component of the curriculum, there should be a balance between theory and practice.

In UK, Australia and Russia the subject has been grown from practice and has a strong links with a previous 'practical' subjects. In UK and Russia the *utilitarian* approach has been used: at the beginning it was decided what students would be expect to achieve as a result, and then, the decision was made about what content (or structure) of curriculum

would be appropriate. In the case of UK it was what students be able to do; in the case of Russia it was what content they have to pass through (with a detailed description) and as a result - know and be able to do. A strong straightforward ends-means viewpoint is presented in rationale of technology education. In Australia the approach is utilitarian to a high extent, but the nature of technology is also considered to some extent as the point for curriculum development. Although in all three countries the subject is viewed as primarily practical, the place and importance of knowledge are treated differently:

UK

Technology education is essentially practical activity, theory only if it needs to support practice. Ability to *apply* knowledge is important. Knowledge always means to an end, rather than an end in itself.

Australia

Technology education should integrate theory and practice, both components have almost equal treatment. However, 'practical application [is] perhaps the most relevant way of demonstrate the learning'.

Russia

Technology education is essentially a practical activity (understood in a narrow sense of making). The ratio between theory and practice is 25/75. However, theory has to underpin practice and it is important. It should be taught first (through formal instruction) and then have to be used in practical activity.

Local/universal orientation

Another important aspect of curriculum orientation which contributes to the discussion is local/universal nature of it. Different approaches are visible: the USA documents emphasize commonalties (global societies, global economies, global culture), the UK and Australian documents have an emphasis on differences of each particular country. Russian *Standards* includes the 'universal' technical tradition and craft tradition of different regions of the country. Thus, the 'universal' (meaning of European origin) character of technological knowledge is important for the USA and Russian understanding.

These two major factors, discussed above: understanding of Technology as a phenomenon and curriculum rationale influence the understanding of role, nature and structure of knowledge in technology education. To summarize the above analysis modern/post-modern dichotomies could be used and the findings could be presented in the following table (Knowledge in technology education).

When using a broad categories as modernism/postmodernism it is difficult to be sharp. In each case we are talking about to what extent this or that characteristic is presented rather than: is this characteristic presented or not. Using the dichotomies is always leading to some simplification of the really complex issues. Nevertheless, each classification helps to deep our understanding. The proposed modernist/post-modernist approach is considered as a valuable tool for analysis of educational policies.

KNOWLEDGE IN TECHNOLOGY EDUCATION

		Australia	UK	USA	Russia
Ways of acquisition of knowledge	formal vs. experienced-based	integrate theory and practice; practical experience first	through experience - practice first; based on interests, desires and values of the students	through formal instruction + active methods	through formal instruction
Subject-object relationship *Character of knowledge*	value-neutral vs. value-laden	close interrelation between knowledge and values *subjective*	knowledge and values sometimes are used interchangeably *subjective*	knowledge is separated from values *objective*	knowledge and values are strongly separated *objective*
Structure of knowledge	Bounded vs. unbounded	unbounded - different technologies are based on different knowledge	unbounded, difficult to predict what you will need for practical activity	knowledge is structured in dimensions + knowledge from other areas	bounded by studied topics + knowledge from other areas
Nature of knowledge	search for truth vs. utilitarian	directed towards utility	directed towards utility	academic rationalist approach - knowledge *per se* is important (to understand truth)	knowledge is important, it should guide practice
Universal/ particular	context-free vs. context-dependent	strong dependence on context	context dependent only	universals, unified system of knowledge is possible	context-free level (technical systems) + context-related level (urban-rural; industry-house)

Conclusion

As a result of the above discussion, it is possible to propose that in the studied countries there is the distinction between the required knowledge in technology education, the ways of its acquisition, its role and place in curriculum. A useful framework which explains the difference is modernism in the USA and Russia, and post-modernism in the UK and Australia.

In American documents theoretical understanding of different types of technological knowledge discussed on the theoretical level have been used to develop the concept. Knowledge is structured in dimensions. It is seen as an instrument for human progress; objective truth is possible (fixed in the concepts, principles); 'Universals' or unified system of knowledge is possible, achievements of science are translated into technological progress; there is knowledge which are certain - technology is an academic discipline. The ways of acquisition of knowledge are through formal instruction as well as through the active methods of teaching. There is a belief in a specific body of technological knowledge (which is different from technical knowledge). Knowledge *per se* is important.

In the Russian document the scientific and systematic character of knowledge is specified. Values are not considered. Thus, it is widely agreed that knowledge is objective and universal. It underpins practice and therefore should be taught first.

In UK and Australia, the general approach to knowledge is developing more closely to the post-modernist understanding of knowledge: rejection of systematic knowledge, close interrelation between knowledge and values, stress on subjective character of knowledge received through personal practical experience; multiplicity of truths; strong dependence of knowledge from the context. The process of acquisition knowledge is based on interests, desires and values of the students, which strongly influence the

outcomes. Relativism of knowledge is stressed by emphasizing different solutions for the same technological problems in different cultures and within one culture. Individual taste is encouraged. Knowledge is directed not towards the truth but towards utility and effectiveness.

Thus, modern/post-modern framework could be a useful tool for approaching the analysis of the policy in technology education. However, we have to remember that in each country there is a mixture of different features in technology education. In the current era we could not accept the idea that "no systematic knowledge … is possible" (Giddens, 1990, pp.46-47). On the other hand, postmodernism assists in focusing on "complexity, plurality, fracture and conflict" (Coulby and Jones, 1995, p.7).

References

Ball, S. J. (1994). Educational reform: A critical and post structural approach. Buckingham: Open University Press.

Ball, S.J. (1997). Policy Sociology and Critical Social Research: a personal review of recent education policy and policy research. British Educational Research Journal, 23 (3), 257-274.

Connell, J. (1995). Reconstructing A Modern Definition of Knowledge: A Comparison of Toulmin and Dewey. Philosophy of Education. Yearbook [Online], 6 pages. Available: http://www.ed.uiuc.edu/EPS/PES-Yearbook/95_docs/connell.html [1998, August 4]

Coulby, D. and Jones, C. (1995). Postmodernity and European Education Systems: cultural diversity and centralist knowledge. London: Trentham Books

Department for Education and Welsh Office (1995). Design and Technology in the National Curriculum. London: HMSO.

Frey, R.E. (1989). A philosophical framework for understanding technology. Journal of Industrial Teacher Education, 27(1), 23-35.

Giddens, A. (1990). The Consequences of Modernity. Stanford, CA: Stanford University Press.

Green, A. (1994). Postmodernism and State education. Journal of Educational policy, 9, pp.67-83.

Herschbach, D.R. (1995). Technology as Knowledge: Implications for Instruction. Journal of Technology Education. 7 (1), pp. 31-42.

International Technology Education Association (1996). Technology for All Americans. A Rational and Structure for the Study of Technology. Reston, Virginia: Author.

International Technology Education Association. Technology for All Americans Project (1998). Standards for Technology Education: Content for the Study of Technology. Third draft. Blacksburg, VA: Author

Lednev, V.S., Nikandrov, N.D., Lazutova, M.N. (Eds.). (1998). Учебные стандарты школ России. Государственные стандарты начального общего, основного

общего и среднего (полного) общего образования. Книга 2. Математика и естественно-научные дисциплины [Learning Standards for Russian Schools. State Standards for primary, secondary education. Book 2. Mathematics and Science]. Moscow: Sfera, Prometej.

Lyotard, J.-F. (1996). The Postmodern Condition: A report on Knowledge. In E. L. Cahoone (Ed.), From Modernism to Postmodernism. An Anthology (pp.481-513). Cambridge, MS: Blackwell Publishes.

Marginson, S. (1993). Education and public policy in Australia. Cambridge: Cambridge University Press.

Mitcham, C. (1978). Types of Technology. Research in Philosophy and Technology. Vol.1, pp.229-294.

Ropohl, G. (1997). Knowledge Types in Technology. International Journal of Technology and Design Education, 7 (1-2), pp.65-72.

Taylor, S., Rizvi, F., Lingard, B. and Henry, M. (1997). Educational Policy and the Politics of Change. London and New York: Routledge.

Appendix

Australia - the *Interim Statement* (1992) and A *Statement on Technology for Australian Schools* (first published in 1994).

UK - Design and Technology in the National Curriculum: A Statutory Order (1995)

USA - Technology for All Americans: Rationale and Structure for the Study of Technology (1996) and *Standards for Technology Education* (third draft, December 1998)

Russia - The *State Standards for the comprehensive schools: Learning Area Technology* (Draft recommended for implementation, December 1998)