Technology Education in Russia : Socio-Cultural Limitations to Design- Approach

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Abstract

This article examines the reasons that limit the applicability of the English design-based model for technology education in the Russian setting. In doing this, the main socio-cultural factors which influence the development of technology education are analysed first. Among these features are the potential (non-utilitarian) nature of Russian culture, the essentialist educational tradition, the strong engineering tradition in interpretations of technology, the historical development of the subject, and the main trends in the educational policy since the 1980-s. Then it is argued that the specific context established by the above factors creates tensions between the ideology of economic rationalism that appeared as a result of market reforms in Russia and the non-utilitarian approach to understanding and the acquisition of knowledge; and between humanisation as a current trend in educational policy and the traditional subject oriented approach to teaching.

In the second part of the article, the model of technology education in Russia and a discourse on it are presented. It is demonstrated that a design-based approach to technology education is among the major tendencies in developing the subject area. Then the findings of the research, aimed at the assessing the results of such implementation in pilot schools in Nizhny Novgorod are presented. It is shown that there are limitations to the extent to which the English version of the design-based approach can be applied to Russian schools. There appear to be some deep, culturally rooted 'misinterpretations' of the approach. These are reflected in the students' attitudes and understandings of the design-based project and teachers' interpretations of their teaching activities.

It is argued that the limitations are shaped by the socio-cultural framework discussed in the first part of the article. Thus, it is argued that this design-based approach should not be taken as universal but it should be specific for each particular context.

Introduction

This paper is aimed to analyze and explain some tendencies in developing technology education in Russian schools. Such type of analysis is always required to contextualise a

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phenomenon, in this case - technology education, in broad socio-cultural settings. Thus, the paper consists of two parts. In the first part main socio-cultural factors which influence the development of technology education will be analysed. In the second part the model of technology education and discourse on it in Russia will be presented. It will be shown that limitations of applying the design-based approach to Russian schools are shaped by the socio-cultural constrains.

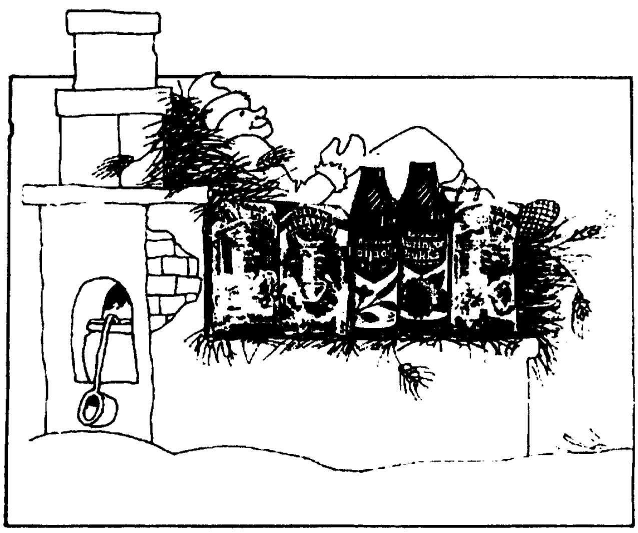
Part 1 Influences on technology education

In this part several important factors which have their impact on technology education will be explored: cultural background, educational tradition, educational policy, engineering tradition, historical development of the subject.

Cultural background

Potential nature of Russian culture

One of the features that shows historically a difference between Russian culture and the English-speaking countries is a belief in magic and fortune and not in the hard work. In Russian fairy tales there is no emphasis on the need to work hard to achieve the desirable results. For example, a person was sleeping for 30 years then woke up and became a very strong hero. Another example is an oven that is standing in the field, cooking by itself and is used as a carriage to transport Emelja, the other hero of the fairy tales.



Picture 1

The youngest brother (usually the third one) Ivan the simple - again, was always sleeping on the oven but became the most successful in the family. The fish that can do what you asked her. You catch her by fortune. Through these stories the child does not receive the message that to work hard is good. Fantasy is good, ideas are good and they will be implemented into life by magic. This approach is very different to the Protestant ethic where hard work is very important. Several Russian thinkers (see Krasavin in Pavlova, Pitt, 2000a, p.62) defined Russian culture as potential. There is no pragmatic orientation in it. Creation of ideas is going on faster than the possibility to realize them but this does not stop the process of ideas development. This attitude has its influence on understanding the concepts of project and design and is visible through the historical process of technological development.

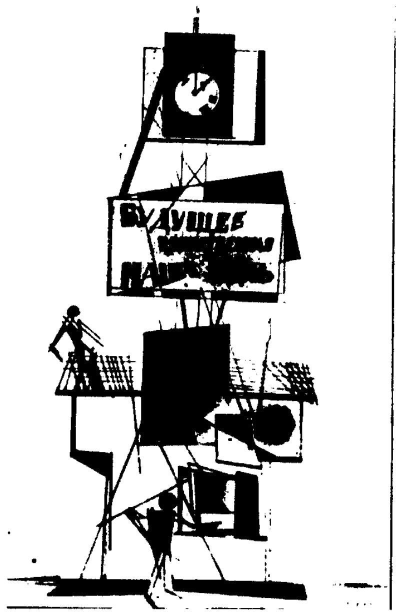
Understanding of the concept 'project'

Traditionally, project is understood as a piece of theoretical work. It reflects your ideas, dreams, theories that should not be necessarily implemented into practice. There is a phrase in Russian language: 'project and its realization'. For a long time projects have been used in higher education. They have been the basis for assessment, thus lecturers never helped students to do their tasks. Implementation of the project is not the measure of its success. The same attitude could be found in the history of Russian design and in the history of Russian technology.

Design

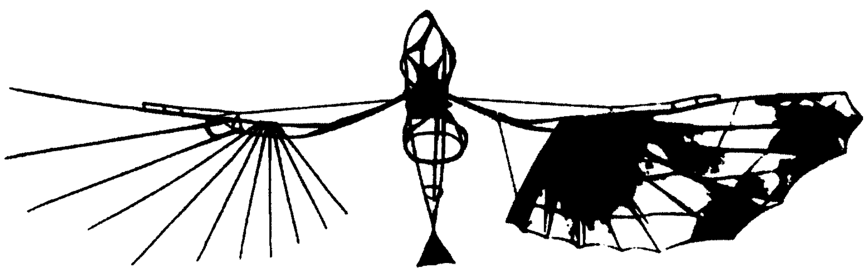
In the history of Russian design the period after the revolution of 1917 was very productive. Artists were trying to find a new fresh approach to life. In 1920 the higher art-technical workshops were established as an institution in Moscow.

Very often that workshops are compared with Bauhaus. They both had the aim to change the approach to teaching arts. Russian painters had a strong influence of on development of Bauhaus. Unfortunately in 1930-s all experiments were stopped in Russia. The only style that was accepted was Stalin 'Empire style'. Among the last design images was Letatlin.



Picture 2

It was exhibited in 1932 at the Art Exhibition in Moscow. This conceptual object is a visual expression of



Picture 3

Andrej Platonov's writing. This image gave some fresh impulse to the Western designers.

After the Second World War in 1945 some universities started to teach artists for the industry. At that time it was very difficult to introduce some design ideas into practice. There were several reasons for that:

- economical system was established in the way that it rejected design;
- technology was developed more slowly than ideas, so there were no necessary materials, colors, equipment, etc.;
- design as a concept had not been theorized and developed;
- ideas per se were meaningful.

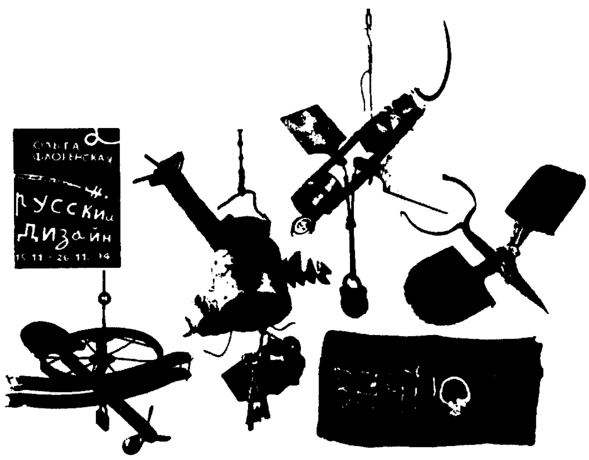
At that time a lot of ideas were never realized, they have been stored on shelves in the offices. It was a time of verbal and paper projects.

Picture 4

This is an example of one of them. Again, it is a conceptual object "Optic -electronic device for digging the sun fire". It was financed through the Government sponsored program. The device is moving after the sun, always catching the focused sun light. Hence, the firing mixture has been ignited. Within a centralized economy development of such paper projects were financed by the Government. The word design had not been used in Russian society up till the 1980s. New specialization at the universities "Design" was opened only in 1988. Before that the name of that specialization was "Industrial Arts".

Design as a combination of utility and beauty is appropriate to the Protestant ethic, in Russia - beauty is enough. As Dostoevky said beauty will save the world. Beauty is self-sufficient. Design never has the meaning of the full process from ideas to their implementation. Most common understanding of design is patterning or projecting which means development of ideas or development of ideas up till the point of realization.

Picture 5



Picture 6

Another feature of Russian design is orientation on personal ideas of the designer and not on someone's needs. There is a strong tradition to make what you want, to develop your own ideas. Express yourself first and then somebody might like it. Since 1990s designers have to find their place in the market economy. They have to make something to meet the needs of particular people to earn some money, but they still see their pride to do what they want.

Through the following illustrations the difference between the Russian and the Western understanding of design is visible.

In Russian case there is no problem solving! Self-expression! Compassion and kindness to the objects and to the person are presented in that collection of Russian design.

Technology

Talking about the history of Russian technology several examples from the article by Graham *The Fits and Starts of Russian and Soviet Technology* (Graham, 1992) will be used. Graham illustrates the cyclical nature of the history of Russian technology - the pattern of momentary excellence followed by obsolescence. In the sixteenth century the casting technology of the Moscow Cannon Yard astonished Western visitors. The largest church bell ever made was cast there. In 1766 a Russian inventor, Polzunov, developed a 32-horsepower steam engine to pump water out of mines. Polozov's engine preceded that of James Watt by several years.

It was stated in the official report of Tsar Nicholas's visit to Tula that in 1826 they produced guns with interchangeable parts. It was not achieved elsewhere until the 1840s, when Americans in new England reached this goal. In 1835, a Russian father- and -son team, the Cherepanovs produced a steam locomotive that could pull a sixty-ton load. All these inventions had not been well implemented into practice. Another example is the invention of the street light system, which was developed by a Russian.

> When the streets and public gardens of Paris and London were first electrified in the late 1870s and 1880s, the method of illumination was the arc light, patented in Paris in 1876 by the Russian inventor Pavel Iablochkov … The new street lamps were popularly referred to as "Russian lights". Impressed by his success in Western Europe, Iablochkov returned to Russia and attempted to manufacture and sell his lights there. (Graham, 1992, p.16)

It was a failure. Eventually the major cities of Russia were electrified by foreigners. From the point of view of the Western person the failure to implement the innovation is a problem which should be explained and solved:

> What we see in the history of Russian and Soviet technology, then, is a pattern of fits and starts, repetitive cycles characterized by early achievement

> and subsequent failure. These cycles have occurred so often that we must look for a set of underlying causes. While the explanations for the cycles will be somewhat different in each case, I strongly suspect that social and economic barriers, rather than technical ineptitude, will be the common explanation. (Graham, 1992, p.21)

From a Russian's point of view the failure to implement ideas was not necessary considered as a problem. The idea or model has a very important status by itself. However, not only cultural tradition, but the other factors associated with difficulties in ideas realization.

As it will be shown later in the paper this theoretical understanding of projects and design has its influence on understanding of projects in technology education by Russian teachers.

Bi-polarity of culture

Another point I would like to make here is the bi-polar nature of Russian culture:

> a fundamental polarity [of the culture] which is expressed in the dual character of its structure. The basic cultural values (ideological, political, religious) in the system of medieval Russia are arranged in a bipolar value field divided by sharp line and without any neutral axiological zone. (Lotman & Uspenskij, 1984, p.4)

Such an approach was connected with religious understanding of the world:

> In the Catholic Christian West life after death is divided into three zones: paradise, purgatory and hell. Similarly life on earth is thought of as demonstrating three kinds of behavior: definitely sinful, definitely holy and a neutral kind which permits salvation beyond the grave after an ordeal in purgatory. Again in the actual life of the medieval West we find a wide band of neutral behavior and there are neutral social institutions… This neutral sphere becomes a structural reserve from which tomorrow's system develops… The Russian medieval system was constructed on a marked dualism… The Russian system divides life beyond the grave into heaven and hell. There is not provision for an intermediate zone. And correspondingly, behavior in this life is either sinful or holy. This dualism extended also to the concepts unconnected with the Church. The secular authorities might be regarded as divine or demonic, but never as neutral in relation to these concepts. (Lotman & Uspenskij, 1984, p.4)

Throughout the whole history from the introduction of Christianity (X century) up till now the "inside-out" process characterize the development of Russian society. The sharp distinction was made between old and new, between Russia and West. At some stage West was labeled as a "devil's territory" (ibid., p.16) and Russia as a holy land. Posing the problem of Russia and the West gave a relativistic character to all Russian ideologies from the start.

> Throughout the nineteenth century, the "problem of Russian history," i.e., the questions concerning Russia's cultural characteristics, destiny, and mission, was one of the central themes with which all social thought, from Chaadaev to Stalin and Berdiaev, had to deal … two schools of thought forked out in Russia as well, the Westerners - rationalists, utilitarian in orientation, mechanistic in method, who regarded Russia as an integral part (however backward) of western civilization - and the Slavophiles, cultural nationalists, who asserted the distinctness and superiority of Russian or Slavic culture, the irrelevancy of European experience for Russia, and the inapplicability of historical laws of the West to Russian soil. (Meyer, 1952, p.407)

This dual approach to life, these extremes were at the base of historical development and stay in the "cultural memory" (Lotman & Uspenskij, 1984, p.28) for generations. In the further analysis of educational reform in Russia such 'inside - out' approach for changing the educational paradigm become evident. It's always the movement from one side to the other. When we are talking about design approach to technology education, it's a similar attitude: "Why do we have to use this western concept of technology?" On the other hand: "Yes, this is the universal approach, the best one that mankind has ever had".

Educational tradition

Russian educational tradition can be defined as encyclopaedist one, started from the ideas of Comenius (1967) with the belief that all students should acquire as much knowledge as possible about all valid subjects appropriate to their age. Pansofia - the general wisdom was considered as the general aim of education.

After the revolution of 1917 there was a strong belief that transmission of the universal curriculum was a route to liberty, equality and fraternity. These ideas found their roots in the French revolution. Lyotard (1979/1996) described educational policy of the French Third Republic as follows:

> the nation as a whole was supposed to win its freedom through the spread of new domains of knowledge to the population… The State resorts to the narrative of freedom every time it assumes direct control over the training of the "people", under the name of the "nation", in order to point them down the path of progress. (p.484)

The same description can be used to characterize the understanding of the relationship between education and State in Russia. All students had to follow the same basic core curriculum and all state schools had to offer the same subjects with the standard numbers of hours per week and the main aims and topics of each subject. Universalism implied uniformity of students' achievement and school quality. The process of learning was associated with the acquisition of systematic knowledge about the physical world. The abilities of logical thinking, deduction and abstract thinking, together with a systemic approach to understanding the world, were seen as the aims of education. Analysis, classification of ideas - were more important than synthesis. Moral issues considered from an intellectual rather than emotional viewpoint; logic as well as comprehension - through the construction of models and systems. Central control of the school curriculum became the main managing principle for decades. Knowledge about people (for example, a person's opinion) was not considered as important. Persons' views are subjective, thus there was no reason to study it.

A brief comparison between Russian and Britain educational traditions could make the point clear.

Table 1.Some characteristics of Russian and Britain educational traditions

Russia	**Britain**
• focus on group	• focus on individual
• universalism and uniformity	• child-centred humanist approach
• Pansofia - general wisdom, encyclopaedism of knowledge, width of knowledge	• specialisation, individual needs, depth of knowledge
• moral issues considered from intellectual rather than emotional viewpoint	• moral capacities - sensibility, commitment to duty, capacity of decision making based on action
• theoretical approach to scientific inquiry	• empirical approach to scientific inquiry
• emphasis on content	• emphasis on process

After 1917 technical, practical subjects were articulated with general education. The course Labor Training together with politechnical principle were proclaimed as a foundation for developing Soviet school. This meant teaching scientific principles of manufacturing processes through all subjects (like a cross-curricular theme) and training in practical skills with different tools and equipment. Vocational schools, as separate institutions offered broad general education together with qualification. Studies there began with rational scientific ideas. Application of rational scientific principles to practical work organically linked vocational studies with academic education by the same intellectual principles with the emphasis on the abstract and formal learning of structures, theories, and connections.

From the middle of 1960-s, on the basis of Vugodsky-Leont'ev psychological theory of activity it was approved that students have to have knowledge not only about reality but also knowledge about the activity in this reality.

Educational policy

Structure of educational system

Compulsory education in Russia comprises nine years at school. Children commence school at the age of six or seven, attending primary school for three or four years. Then they move to secondary school. At the age of fifteen they may leave the main secondary school and go to work or to study at the different types of vocational schools, or they may stay in the main school until seventeen. 45% of children left school in 1996 at the age of 15 and went to study at full-time or part-time vocational schools (Tkachenko, 1996). The state guarantees free education for all until the end of the secondary education. Access to further levels of education is based on competition.

The educational system in Russia is governed by the "Law about Education" of 1992 and amendments to this Law of 1996. Power is divided between federal, regional and school levels: the development of curriculum for primary and secondary schools is their shared responsibility. In 1995/ 1996 academic year there were 523 private schools in Russia, compared to 70, 200 schools all over Russia (Tkachenko, 1996).

Educational reform

Introduction of technology education was a part of a large-scale reform in Russia. In modern history, the educational system was one of the first social institutions to react to the process of stagnation in Soviet society. At the beginning of the 1980-s attempts were made to change the educational system with the aim to keep society stable. The reforms of 1984 and 1988 did not make the change.

In 1991 the break-down of the Soviet Union provided the opportunity for establishing an educational system for the new Russian Federation. President Yeltsin's first order was on the development of education. In June, 1992 a Law of Education was adopted where priorities of the reform were stated as the principles of state policy. They included ***humanistic and human approaches towards education, decentralization, the diversification of types of schools, and the reform of teachers' training***. The essence of the 1992 law was the move ***from a political paradigm to a teaching paradigm*** and from totalitarian society to a civic society (Yeltsin, 1992).

All proposed changes were based on the full rejection of the previous educational policy. Any 'golden mean' had not been considered as a possibility. Here we can see how the bi-polarity nature of Russian culture works in practice.

Carrying out the reform under the conditions of economical and political crisis provoked further conflicts inside the educational system. Reform of the content of education included developing of state educational 'standards' and defining the compulsory component of curriculum. These 'standards' can be viewed as a curriculum order, or a 'minimum starting level of education to which the state is obliged to bring all its citizens' (Ministry of Education of Russia, 1996). The growth of regional and school-based components for the curriculum was seen by many as a resource for freedom and one of the main advantages of the changes. Equally important was the further movement on the way ***towards education which develops the student's personality***.

Educational Policy kept an honorable position of systematic knowledge in school curriculum and at the same time - introduced a humanistic approach towards education. These are partly contradictory demands.

Engineering tradition

Another influential factor is the engineering tradition which exists in society. In very broad terms, the humanistic tradition proclaimed by educational reform is opposed to the engineering tradition that has very strong roots in Russia. In Soviet times the engineering tradition was connected with the philosophy of technological determinism, which was part of marxist-leninist ideology. The development of the productive force was seen as the main factor which determines the historic process. Tools, equipment, machines and technical systems were counted as the leading elements in the development of the productive forces.

> They have seen technology as "the highest form of culture," emphasized the development of the productive forces in the creation of communism, declared that "technology decides everything," and put their faith in the so-called scientific-technological revolution and the transformation of science into a direct productive force to achieve political, economic, and social goals. (Josephson, 1992, 27)

Technology was considered as an applied science (the politechnical principle at school appeared on this basis). Thus on the theoretical level there was a straight path from scientific knowledge to the technical device. In this paradigm there was a need to learn theory first and then apply it. Engineering students have a very broad theoretical basis for their university studies. Technology was not considered in a social context. This is in contrast to an humanistic approach, in which technology is seen as part of social development.

The belief that science and technology is value neutral is still a dominant understanding of technology.

> Scholars hesitate to recognize science and technology as products of social, political, and economic forces. They reject the argument that technology is inherently political, requiring the creation of specific infrastructures and social relations for its introduction. Rather, they argue that technology can be used or abused in any social or political setting. (Josephson, 1992, 26)

Historical development of technology education

The ancestors of technology education in Russia were Labor Training and the 'polytechnical principle' which meant teaching scientific principles of manufacturing processes through all subjects (like a cross-curricular theme) and training practical skills of using different tools and equipment. As it was mentioned above, it was set up in Russian schools after the Socialist revolution of 1917 as an ideological basis of education. Everyone had to have experience and knowledge in practical areas. This opened the opportunity to develop more effectively the productive forces of society and as a result, - the society itself. As it was shown above, the overall approach to the curriculum was essentialism which means that all important knowledge that enable each child to function adequately in society was divided into subjects and Labor Training was one of them.

The 1920-s was a short period of pedagogical experiments. Educators were trying to push the essentialist tradition of Russian education into the direction of humanist paradigm. Child-development was considered as the main aim of education. Using new active methods of teaching became popular in Russia. Curriculum was restructured around themes (or projects), but not subjects. Development of practical skills became part of each project. At that time it was a mixture of Dewey's ideas (Vulfson, 1992) and progressivist influence. At that time, project approach in the English sense (or 'practical' projects), to Labor Training was used for the first time. Very soon educators realized that this method did not allow teaching a structured knowledge to the students. Working in the group gave the chance to some kids not to be involved in the process of learning, it was very time consuming, etc. "Practical" projects were strongly criticized. Another argument against innovations was the economic needs of the country which at that time required a quick training of workforce, which had a minimum level of literacy so that the students could start working as soon as possible. It was more important to meet the needs of society rather than the interest of the students.

The ideas of progressive educators had not been applied at that time in Russia. Practical projects were rejected. This turn was too radical to the educational tradition of the country.

Labor Training remained as a separate subject in school curriculum for most of the Soviet period. It was compulsory for students of all grades. Very structured knowledge and skills were transferred to students. They made identical objects following the instructions given to them. For the process of teaching the 'object-process' system of training had been developed and it was very effective in training skills. Students had to make a required variety of objects and mastered a required list of processes. Curricula for boys and girls were different with metalwork/woodwork/electricity for boys and cooking/sewing and electricity for girls.

However, for a period of ten years (just after the Second World War) Labor Training was omitted from schools. The main aim then was to train engineers and scientists to enable them to win the competition with capitalist countries. As the result of this policy, almost 100% of school graduates entered universities, colleges and institutes. There were more engineers than workers (Tkhorzevskiy, 1987).

With such technological achievement The Soviet Union was able to put Sputnik into space. The 'Sputnik syndrome' was significant; Soviet education started to be considered to be among the best in the world, largely because of the excellent science and maths education at school. The Americans published a report ***A Nation at Risk*** (National Commission on Excellence in Education, 1983) in which they advocated improvement in maths and science education in the US as being essential for national security. Although there were a number of critiques of this report it had a big impact on further development of educational systems including the increase of financial support to it in different countries. At this stage Labor Training came back into schools, closely connected to maths and science through the polytechnical principle.

The main change to Labor Training within the 1984 reforms was to strengthen links between school and industry. Each factory had several schools appointed to it as partners. The school had to organize productive labor at school for students up to the age of 15, and at the factory from 15 till 17. Thus policy-makers tried to cultivate workers' ideology among students as well as help them with their future careers. This policy was extremely inefficient. Few children graduating from school had any desire to work at a particular factory.

During the whole Soviet period, on the basis of 'internationalist' ideology students were taught 'neutral' working process which might be used in industry in any part of the world. Russian craft tradition was not mentioned at all. During the Gorbachov period a lot of schools received permission to teach Crafts instead of Labor Training. It was a progressive movement towards further changes at that time.

Pressures on technology education

Considered above pressures on technology education could be characterize as internal and summarized as the follows:

- Project is a piece of theoretical work
- Design is patterning or development of ideas
- Clients needs are not so important
- Ideas or beauty are important *per se* without any utilitarian application
- Radical changes of paradigms in different spheres of life
- Traditional essentialist paradigm ('basics' as important knowledge) in education
- The aim is all-rounded person, thus practical subject are part of general education
- Technological determinism, technology is value-free, objective

- Educational reform aimed at humanistic approach to education within 'existentialist' paradigm (self-awareness as important knowledge)
- Development of minimum compulsory content of curriculum "which the state is obliged to bring to all its citizens", content is specified in details
- Different content for boys and girls
- Emphasis is on transmission of knowledge and skills

Together with internal factors, external influences play an important role. Among them are:

- process of globalization;
- politics of economic rationalism.

Globalization is a complex process where developing of a supernational connection is one of the directions. International circulation of ideas through social and political networks brings common elements to curriculum documents of different countries.

In the case of technology education, British ideas of design-based approach to technology education gradually attract more and more supporters in Russia.

Politics of economic rationalism bring the principle of utility to all spheres of life in modern Russia. Utilitarian approach to knowledge now is finding its way in the ideas of applicability of the concepts of the market economy to education. Through the interviews with Russian academics conducted by the author, it was found that one out of ten key people who have been interviewed argued to limit the amount of knowledge which is transfer to technology students at school and at university. The requirement of the broad knowledge had been questioned.

Tensions within internal pressures and between internal and external factors are reflected in conflicting demands which are quite opposite to the cultural traditions: people have to be ready to function in the market economy, it should be utilitarian approach to knowledge; humanization of the process of schooling is required.

On the other hand, if we take into account the bi-polar nature of Russian culture and the aim to move quickly from one paradigm to the other, even theoretically situation could not be stable.

Part 2. Current policy in the area of technology education

Technology education

"Technology education" as a learning area in Russian schools was introduced as a compulsory one in 1993 with 808 hours allocated over the period from Year 1 to 11. As it was stated above, this change occurred in the framework of the educational reform in Russia. Since 1993 the situation in Technology Education has been very confusing.

During the period of 1994-1995 the Ministry of Education announced three rounds of competition for the best standards for technology education. Only by 1997 the ***Draft of the***

Standard appeared as a non-published report. Since then the process of discussion has been going on. At the end of 1998 the full Standards were approved and published by the Ministry (Lednev, Nikandrov, Lazutina, 1998). To become a law Standards should be approved by the Parlament. At the moment it has not been passed through Duma, however the Ministry of Education recommends them for implementation.

As rationale of the subject and standards had been published for the first time in 1998, it was very difficult for teachers to understand what is the nature of a new subject and why did they need to change their own practice. Most of schools kept their old program of Labor Training. Traditionally, the main way of introducing changes in Russia was development of the theoretical basis for the change. After this, implementation has followed. In the case with Technology education, the ideas have not been conceptualized for a long time; the theory has not been developed. To illustrate the current situation in technology education a quote from the interview with associate professor from Lipetsk is given as an example:

> Do you think we have technology education and the aims are clear?... Everyone in our region [Lipetskaya region] teach students to take part in different technological process. The program of Labor Training is based on such processes as sawing, planing, etc. while making a pointer. For what reason do we need some project [design-based activity]? During the process of making simple pointer student will mark, saw, plane, finish. He will learn all main stages of the process... Technology education is still understanding in a technocratic way... I understand technology education not as a technical education, but as a way of developing students' thinking and I, as a teacher, have to supervise the student, to increase his motivation... Every technological process starts with generating the idea and finishes with a result... Student who is starting the life has to be ready to make a decision, have to develop a project 'What he wants from his life', so he has to project himself... Nowadays we prepare the screw to the State. I train him, he knows how to do some processes, he can find a job, but tomorrow it will be not enough... We have to change the didactic of the subject - now there are reproductive methods of teaching, we need the problem-oriented ones, so we can develop not only hands, but the way of thinking...

In practice Labor Training is the school subject in majority of schools. This respondent is critical to the technocratic aims of Labor Training and demonstrates his humanistic approach to technology education. For him technology education is much wider than a technical education because the emphasis is made on development of the generic skills of students. Technology education should develop not only manipulative skills, but also the capability of thinking creatively.

The current Standards include:

- the compulsory minimum content of the learning area Technology for the city and rural schools (one set -for boys, another set - for girls). In Russia 70% of schools are rural in which each teacher teaches three or more subjects at all levels
- requirements for the level of students' achievement;
- the evaluation of fulfillment of Standard requirements.

They have been developed for 11 years of schooling.

Through the Standards, at the level of official government policy, Technology is proclaimed and defined as

> a science [body of knowledge] regarding the transforming and using of materials, energy and information for the purpose and interest of man. This science includes the study of methods and means (machines, ***technic***) for transforming and using the mentioned objects [material, energy, information]. (Lednev, Nikandrov, Lazutova, 1998, p.247)

This understanding is different compared to other countries (Britain and Australia, for example) where Technology is defined as an activity. In Russia, at school, Technology is

> an integrative learning area which synthesize the scientific knowledge from math, physics, chemistry, biology and demonstrates their use in manufacturing, energy industry, communication, agriculture, transport and other activities of the person" (p.247).

In practice it is a subject Technology education is developed in applied science paradigm. As a result of knowledge-based understanding, the aims of Technology Education are:

- to develop students politechnically, to acquaint them with modern and prospective technologies of processing materials, energy and information via the application of knowledge in the areas of economics, ecology and enterprise; develop general working skills;
- creative and aesthetic development of students;
- to acquire life-needed skills and practices, including the culture of behavior and non-conflict communication in the process of work;
- to provide students with the possibilities of self-learning and studying the world of professions, the acquisition of work experience which could be the basis for career orientation. (Lednev, Nikandrov, Lazutova, 1998, p.248)

Still, the main aim of technology education is " to assist in preparing students for the independent working life, for the mastering of mass-professions" (ibid., p.248). They use the old concepts of mass production which needs the trained workers. They did not consider generic competencies.

As it was mentioned, different content has been specified for the city and rural schools. For the city schools it is structured within the following areas:

1. Mechanical sciences and technology of resistant materials.
2. Electronics, electrical engineering, radio electronics, automatic machinery,

computing.

3. Informational technologies
4. Graphics
5. House culture, food and textile technologies. Technology at home.
6. Building technologies (painting and maintenance work)
7. Artistic development of materials, technical creativity, artistic construction design, artistic-decorative creativity
8. The branches of industry and career guidance.
9. Manufacturing and environment
10. Home economics and the basics of entrepreneurial activity.
11. Choosing of career (there is a separate standard on this).(ibid, pp.250-251)

As the differentiation is an important issue there, students have to choose one of the courses according to their interest:

- technic (processing the resistant materials and electronics), or
- the culture of the home (house-keeping work).

In practice this leads to the different curricula for boys and girls. For both courses the following areas are common: Informational technologies, Graphics, Artistic development of materials, The branches of industry and career guidance, Home economic and the basics of entrepreneurial activity.

The content and skills are strictly specified. However it is written that the best way of developing students creativity is through the system of projects (Lednev, Nikandrov, Lazutova, 1998, p.247). In the programs associated with this Standards students should do one project of approximately 20 hours at the end of each academic year. All other aspects of the program remain the same. Students have to learn through training different skills with some theoretical lecturing and instructions. The essence of the subject is rooted in traditions of Labour Training - content/module-based and knowledge/skills oriented curriculum. The old philosophy of Labour Training and old methods of teaching have been used.

Many educators all over Russia have criticized the developed approach to technology education. On the basis of the interviews that had been conducted by the author in 1997 and 1999, the following arguments were emphasized:

- too eclectic nature of the subject - what is the basis for the integration of those modules;
- specified content is too broad; there is not enough time to cover it;
- the approach to subject rationale is the extension of Labor Training - the same philosophy, same methods of teaching;
- project at the end of each year is not enough to get students to understand what is the nature of design-based approach;
- theoretically, the concept of the subject has not been developed;

- the nature of technology has not been analyzed as the important source for subject development;
- there is a separate curriculum for boys and girls;
- there is no explicit statement in connection to values.

Taking into consideration the critique, the Ministry of Education in July 2000 put a request to the research project *Technology and Enterprise Education in Russia (TEEiR)* to develop an alternative program based on a design-based approach to the subject.

Before turning to the results of the *TEEiR* research project, it is important to examine the concept of technological culture which is widely discussed in Russia nowadays.

Technological culture

This discussion has emerged parallel to the process of writing and publishing Standards on technology education. Some official documents on technology education (see for example, Ovechkin, Simonenko, 1998) stated that transmission of technological culture is considered as the main aim of technology education.

> The main aim of technology education is the developing of technological culture, which supposes the mastering of the system of methods and means of transformative activity [of the person] for the creating of material and spiritual values. (Atutov, *et al*, 1998, p.7).

What is the difference between technology and technological culture? In the Russian context, technology is associated with engineering, technocratic interpretations. To add values they have to use another concept. In the English-speaking countries, the concept of technology is interpreted in broad and narrow sense.

> When technology is discussed in a more restricted way, cultural values and organizational factors are regarded as external to it. Technology is then identified entirely with its technical aspects, and the words 'technics' or simply 'technique' might often be more appropriately used (Pacey, 1983, p.5)

In a broad sense the concept of technology includes values. In Russia they use the concept of technological culture to overcome the technocratic interpretation of technology:

> Technological culture is an important sphere of the general culture of mankind which reflects on each historical stage … the aims, character and the level of the transformative, nature-friendly, creative activity of the people which is realized on the basis of science and technic, ethics of production relations. (Atutov, *et al*, 1998, p.5)

In the consultation materials on the concept of technology education (Ovechkin and Simonenko, 1998) technological culture is defined as

> a transmission for the further generations knowledge about technosphere, ability to use its achievements in the interest of the person with taking into

consideration the conformity with nature and culture. It defines the place of the person in the nature and the limits of his safe interference into the natural processes. Technoculture defines the Weltanschauung (world-outlook) and self-understanding of the modern person, unity and harmony of the material and spiritual culture of the society. (Ovechkin and Simonenko, 1998, pp.12-13)

Here the concept of technosphere is introduced as a source of knowledge for the technological culture. It is developed on the basis of Vernadski's theory presented at the beginning of the century (Kuznetsov, 1988). Technosphere is considered as a part of the planet Earth system together with nature, person and society. Mankind has created an artificial world for its existence. The activity for designing and making material artifacts, these artefacts and the results of their influence on the person, society and nature, are organized in a global structure. This structure is exist reality, a part of our planet's system. Technosphere consists of non-natural elements which have been created during the purposeful transformative activity of the people. It is a result and the pushing force for the development of the human society.

Thus, in Russia the concept of technological culture is used to broaden understanding of technology, to present it in a humanistic paradigm.

Design-based approach in Russian schools

As it was stated above, Ministry of Education decided to develop a new program for technology education based on the design approach. This decision was made on the basis of the results of the research project ***Technology and Enterprise Education in Russia***. The project was established in 1996 with the aim of developing rationale, standards and curriculum in technology education using the project (or design-based approach) as its basis, at national, regional and local levels, preparing teaching materials, enhancing competencies among teachers and teacher trainers and organizing effective dissemination of the results. It has been developed in four official pilot regions. Since 1998 the British Council has been involved in funding projects in two regions - Nizhnij Novgorod and the Greater Novgorod. Written teaching materials are in the process of receiving approval through the Ministry's committee.

In October 1999 the author made a formal evaluation of results in Nizhnij Novgorod. The aim of this research was to evaluate how the design-based, or project, approach has been used in the pilot schools.*

15 pilot schools are involved in the project in that region. Technology teachers from each school have been trained, over a series of eight workshops, to use 'the project approach' - as the central method of Technology education (in England projects are called 'design and make assignments'). These projects are supported by (a) 'exercises' in which

children learn both generic skills of designing, as well as how to work with materials, and (b) 'design analysis' or product analysis. The emphasis is on encouraging children to enquire, think for themselves, take their own decisions and generally be pro-active in their learning, as well as learning how to process materials.

Methodology

The qualitative methodology employed in this study was a combination of individual and group interviews among the participants of the project, questionnaires, observations, analysis of documents, informal talks at schools and analysis of documents. To ensure the triangulation of material, evidence was gathered using a variety of techniques.

Data was collected from 4 schools. 66 students from classes 5 - 7 (ages 11 - 14) completed the questionnaire. There were 8 group interviews with students (two in each school, with 3-5 pupils in each group). There were 5 individual interviews with the teachers, 4 with the school administrators (principals/vice-principals), and interviews with the programme co-ordinator and consultant. The use of different sources adds to the validity of the results.

To organise data in a systematic way and in a form which could be analysed and interpreted, a coding system was used. Data was coded in order to develop and redefine tentative themes, ideas and interpretations. Major coding categories were identified. For the purpose of this paper two categories were chosen - nature of the projects and humanisation of the learning/teaching process.

Educational change can be analysed from a variety of perspectives. A cultural analysis approach has been adopted here, rather than a socio-analysis approach, as it appears that cultural factors are the more important. (For detailed description of the methodology, see Pavlova, Pitt, 2000b).

Findings

The findings demonstrate that in all schools, the project method is popular and well accepted. Teachers, students, school administrators and parents see it as a valuable, and an important method of learning and teaching. The main role is the development of students and, in particular, their creativity. Creativity is a key word associated with the 'project approach'. The results of the study demonstrate that project activity has a positive influence on different features of students' personality - both students and teachers emphasis this. Among these characteristics are a creative attitude to the task, initiative, independent thinking, and hard-work. The other positive results include the development of making and designing skills. The basis for professional choices becomes more realistic. Introduction of projects increases the rating or status of Technology when compared with other subjects. Teachers and school administration stress the following positive features of the project approach:

- positive influence on economy
- the possibility of differentiated approach
- the ability to work with limited resources
- satisfaction of the teacher
- broad possibilities of student development
- the ability to use knowledge from different subjects

All 66 students participated in the questionnaire answer that they like projects very much: "in the project you are not copying, you are searching". During the interviews, boys and girls show a great interest in working with non-traditional materials (wood and metal for girls, textiles and food for boys). This suggests a need for joint projects in which two or more teachers of technology are involved. It seems that the students are in front of both teachers and curriculum authorities in requesting this change.

However, two main areas of concern have been identified during the study. Most of the identified problems are connected with traditions and factors analyzed above.

Understanding of the nature of projects in technology education

The data demonstrate the need to use a variety of approaches towards including projects in the process of learning. Three main approaches used by teachers in the pilot schools, for including projects in the curriculum have been identified:

- A - using a closed design brief, aimed at the acquisition of skills. During the projects students learn skills of working with specific material - wood and food in this case (the skills are specified in the official programme of study),and design skills (Class 5)
- B - using an open brief to strengthen learnt skills (Class 7). Students use skills which they learned during the exercises before the project, use just one material, but they have to make design decisions.
- C - using an open brief. Students (Class 6) do projects that are not connected to the programs of study. They develop making skills (required by the official programme) during the exercises before the project. During the project students could design and make what they want from all sorts of material. These projects reach far beyond traditional themes/products of Labor Training.

For some teachers the presence of the state curriculum and inspectors seem to constrain them in their approach to classroom teaching. It limits their willingness to explore new teaching strategies with the project approach. However, one of the major problems is that many teachers misinterpret the nature of projects. They think that 'the project approach' is a new didactic method of teaching, one which could be used just in one 'right' way. Each teacher chooses the best way of using projects, and is very critical of the other approaches. They try something and it works, so they do not want to experiment further.

The attitude is, "I know the right way to do things, why should I be flexible?" This limits students' understandings of the nature of projects.

The difference between 'projects' and 'exercises'

Many students are not clear as to the difference between projects and exercises. This confusion appears in different ways as exemplified in the following attitudes:

- Projects can be realised only on the basis of the knowledge and skills developed before the project: "in the exercise you learn something new, some new stitching method, in the realisation of the project there is nothing new, you already know everything", "during the exercise we learn how to sew and while realising the project we already knew how to do this", "there is nothing new in the project", "exercise is the preparation for the project, the project is the realisation". One of the teachers mentioned that if the student does not know how to use a certain tool for the realisation of their project, the teacher should find another way of solving the problem, or postpone the project until the next year when this skill will be learned. The idea that new skills and knowledge might be acquired during a project is not considered.
- The project should be without mistakes, as its realisation is for assessment purposes. This is in contrast to exercises: "in the project we are sewing for the assessment, in the exercise - not", "the project should be without mistakes" as it is the exam!
- The teacher does not help much during projects as s/he considers the project as the assessment unit: "when we are doing exercises our teacher helps us, when we are doing the project - it is an independent piece of work"
- The exercise is the practice, the project is the associated theory. The students consider a 'project' as the designing of a product, without its realisation.

These understandings of students could play a negative role in the development of the project approach and in the developing of students' attitude to it. They reflect a misinterpretation of the nature of projects by the teachers. Russian educational tradition plays its role in this. As it was shown above, historically, the dominant view has been that you have to base your activity on prior knowledge and skills. During the activity you can only improve on what you have already learned. Traditionally, a 'project' is considered as the final piece of work at university level. At school level, the word 'project' has not been used hitherto, so the nature of the university level piece of work has been extrapolated to the new form of learning at school level. Also, traditionally, the terms 'project' and 'projecting' mean designing on the paper, developing something up till the stage of realisation. Thus, the whole concept of project-approach and project terminology are new to Russian teachers, and these difficulties have been highlighted during this study.

Students' answers demonstrate that they recognise the following factors which differentiate projects from exercises:

- the structure - in the project there are several components or stages, in the exercise there is one part
- the setting of the problem - in the exercise the teacher specifies the task, in the project students' do what they want
- the duration - projects last longer than the exercises
- the emotional side - "projects are more interesting", "the project is much more interesting", "exercises are not interesting as you do not use your imagination".

However, they do not see important differences such as projects being oriented towards the real needs of people, whereas exercises are devised by teachers to teach particular areas of skill or knowledge. Here again, we see the absence of utilitarian tradition.

Many students identify the main results of doing projects as the improvement of their making skills (47 out of 66), and 50 out of 66 say that projects influence their personal qualities. In a very few cases students mentioned the dual characteristics of designing and making. This indicates that teachers give insufficient emphasis to design activity within projects or interpret it differently.

The above analysis suggests that this 'misunderstanding' has its deep roots in cultural traditions and could not be moved away quickly.

Humanisation and epistemology

The other issue is humanisation. It was shown that it is a central aim of educational reform in Russia (Yeltsin, 1992). Most of the Technology teachers interviewed identify humanisation as the process of student development, via projects, forgetting about the other side of humanisation - the orientation of the projects to human needs. As mentioned above, students fail to see this as a significant difference between the projects and exercises. Teachers did not emphasise that the needs of people play a crucial role in the whole process of project realisation. The same trend is visible in the other activity - design analysis. Usually, students evaluate and assess only technical and aesthetical characteristics of the product. The analysis of the impact of the product on nature and society as well as assessment as to how needs are met by this product has to be included. There is a strong influence of engineering tradition with its emphasis on instrumental, technocratic consciousness.

In summary, the study demonstrates that students like the project approach very much, and it has a strong impact on their personality. Even this limited way of introducing projects opens the possibilities of different ways of learning, and freedom of choice. However, there are some deep, culturally rooted misinterpretations of the approach. These are reflected in the students' attitudes and understandings of design-based project and teachers interpretations of their teaching activities. Among them are:

- The attempt to teach about projects through theory before the actual projects starts, rather than work inductively from students' experience of projects
- The attempts of individual teachers to use projects in the classroom in just one way. (e.g. only open-ended tasks, so projects are not connected with the national curriculum at all, only using projects to sum up making skills already learned - in effect the projects are just another exercise, only using closed design briefs to teach very specific skills)
- The attempt to look on projects as a terminal exam (so the teacher can asses the student) but not as an important learning experience in itself
- Insufficient attempts at teaching of designing and making skills through projects (as well as in exercises)
- The attempt to demand very beautiful, over-presented design-folios from students (students have to re-draw and re-sketch the pages to make them really nice)
- Insufficient focus on human needs
- Insufficient attempts to teach designing skills across a range of projects, or to use exercise to develop strategic design skills (see Pavlova and Pitt, 2000a for examples of such exercises)
- Insufficient use of mini-projects
- Insufficient attempts to use group work
- Confusion based on lack of agreed terminology

Most of this interpretations could be explained on the basis of socio-cultural influences presented in the first part of this paper. The cultural issues still need to be resolved.

Afterword

The analysis of different influential factors demonstrates the main points to consider in development of the approach to technology education. Modern policy in the area of technology education does not appropriately reflect the interrelation between the new trends and demands and culturally rooted 'memories of generations'. Design approach to technology education has been tried in pilot regions in Russia and it demonstrates that it is interpreted differently (comparing to the British understanding) even by the trained teachers and as a result, by their students.

The British design-based approach could not to be implemented by force through the Ministry's Order and mandatory policies. That push for technology education from one extreme of formal teaching and curriculum structured through the content modules, to the other extreme of informal teaching and curriculum structured around the process would not bring a positive result. In the Russian case a new model of technology education is in the process of development. It has to combine the best features of Russian traditions and design approach.

*The results of this evaluation had been presented in Loughborough, August 2000

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〈Commentary〉

Design-based approach for technology education

Projects form the heart of this programme. In each year the students are given up to four projects, which are supported by **exercises** (to develop particular areas of skill or knowledge), and through **design analysis**, in which students investigate products made by other people (especially mass- produced products) in order to understand they design decisions behind them. Design analysis is an active way of acquiring theory.

This programme is constructed so that pupils will progress in their capability both as **designers** and as **makers**. Planning for progression in projects is not easy! This programme is based on the concept of a **spiral curriculum**. Thus each **component** of the project method is introduced in Class 5, and each year the students go deeper into each component through doing harder and more complex projects.

A complete project has a number of interlocking components. The basic components of a complete project can be represented in diagrammatic form (Fig. 1):

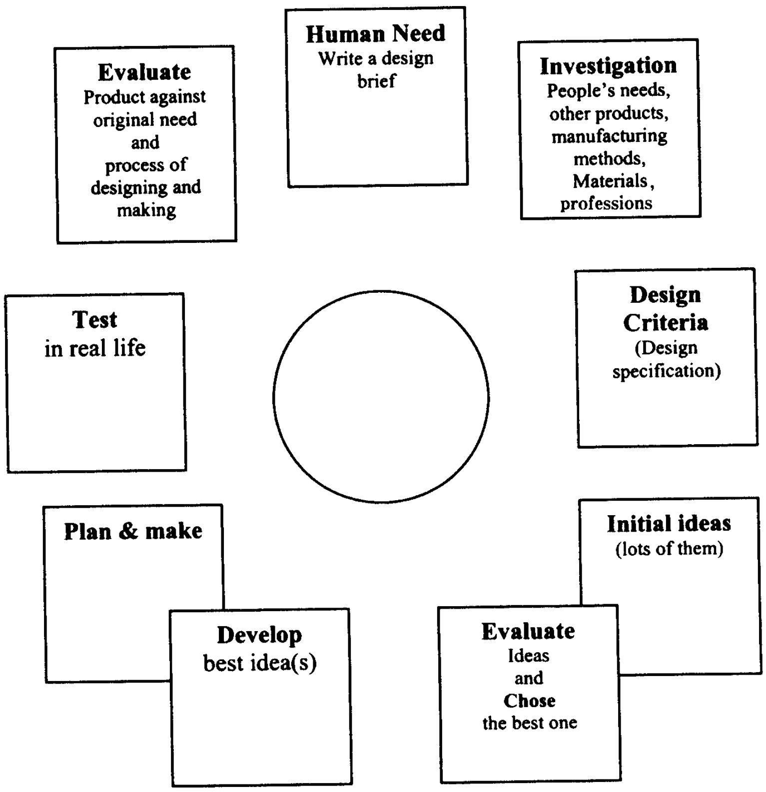

Figure 1 : Schematic representation of the design process or Project Method

The project approach can be represented schematically as a **holistic process** of investigation, thinking, decision-making, planning, making and evaluation (Fig 1). It should NOT be seen as a series of distinct stages - indeed the order in which the components are addressed, and how often each is touched, will vary from project to project.

All designing and making should be to meet a human need. There is no purpose in making a product that no one needs! Thus in the course of a complete project the students might investigate a need, see how other products might meet that need, develop criteria to which the product must conform if it is to be successful (sometimes called a 'design specification'). The students generate a wide range of ideas, on paper and through experimentation, and evaluate their ideas in order to choose what to make. They develop one idea (or a combination of ideas) to the point that they can make it. Often they will need to learn certain skills in the process. They make the product, and then test and evaluate it, and do self-evaluation on how effectively they have addressed the problem (Fig. 1).

These components are all addressed during a complete project, though not necessarily in the logical order below

1. Identification of need and the Design Brief

This sets out the aim of the project, and puts it into context. It is short and simple.

2. Investigetion and analysis

The purpose of research is to find out more about what is needed and possible. Investigate

- the needs of the user - ALL relevant human factors (including anthropometrics where appropriate)
- currently available products (design analysis)
- market considerations
- manufacturing methods in industry
- manufacturing methods possible in school
- what materials and equipment are available, etc.

Some of this is done through experiments.

3. Design specifications or criteria

This is a detailed list of the criteria to which the product must conform if it is to be successful. It might include

- the nature of the product
- function - what it has to do
- who will use it, who will buy it, potential market
- how many to be made (one-off, prototype, batch, mass production)
- sizes
- materials
- colour
- finish
- manufacturing methods
- ergonomic factors (including safety)

• legal requirements (standards)
• cost
• environmental, social and economic issues

4. Initial ideas

A wide range of annotated sketches, mock-ups etc., or ideas for food products. These should be diverse and quickly produced.

5. Choosing best idea

Do this against the criteria laid out in the design specification: it might involve further investigations, experiments, making mock-ups.

6. Development and record of development

As the chosen idea(s) are developed (through further thought, research, mock-ups, experimentation), the student needs to keep a record of all decisions taken AND THE REASONS BEHIND THESE DECISIONS. These thoughts can be jotted down on the design sheets as work progresses. (It is almost impossible to write it up later.) The end of this stage might also include a technical drawing / set of recipes / computer printout / model.

7. Planning and making the product or prototype

This will involve planning, experimenting and (possibly) acquisition of new skills. Between 50% - 80% of the time is spent on making.

8. Evaluation (a) - the product

The product needs to be tested and evaluated against the criteria of the design specification. Additional comments can come from other people (professional evaluations are especially useful). The key question is "Does it meet the need expressed in the brief?" Suggest improvements to the product.

9. Evaluation (b) the process

This is the chance for students to evaluate how well they used their time, and how successful they were at the different stages above. Suggest how it could have been done better - i.e. improvements to the process. This develops the child as a reflective practitioner.