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# Innovation and practical use of knowledge

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# Innovation and practical use of knowledge

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**Abstract**

*This paper will present the Innovation School Policy in the Icelandic school system and our new cross curriculum school subject called 'Innovation and practical use of knowledge' in the National Curriculum as a part of the new area for information technology and technological education. The paper presents how innovation has developed, its character, pedagogy, the ideology behind it, its ethical aspect, practical applications and Icelands cooperation with other European countries around Innovation Education, as a new Minerva project, under the name InnoEd. Over the next three years the European Union (EU) is providing funding for setting up Innovation Education as an open and distance learning (ODL) option for European educational systems for both primary and secondary schools and teacher training linking teacher training institutes. The project's main aim is to build up a databased Internet software for European competition for primary and secondary school students and to make possible research on children's world of ideas.*

**Keywords**

*innovation, InnoEd, technology, curriculum, creativity, practical knowledge, IT, ODL*

**Introduction**

This paper will focus on Innovation Education as a school policy within the Icelandic school system. It has taken form as a new cross curriculum subject called 'Innovation and practical use of knowledge' as presented in the new National Curriculum, as a part of the new area for information technology and technology education. Innovation education in this form can be said to be the result of 11 year's research work, aimed at developing the new model for education. This was done in cooperation between the school system and the work place. The paper presents how the curriculum subject has developed its character, the pedagogical framework it is based upon as well as the ideology behind it, practical applications and cooperation with other European countries around Innovation Education as a new Minerva project under the name InnoEd.

**The development of the Icelandic Innovation Education project**

The Innovation Education project has developed in Icelandic elementary schools over the past 11 years. This began with the meeting of several concerned individuals who wished to encourage young innovators and help them to develop their ideas. The primary goal was to connect the schools and the work place through innovation. Interested companies were brought on board and an incubation department started at the Technical College of Iceland, with the aim of bringing the ideas to market (Thorsteinsson, 1998: 305).

The first step was to establish an after school community of interested students. It became apparent that the teaching materials produced for these after school sessions belonged with the general schoolwork and regular classes in Innovation Education began. This result was based on the premise that everyone is creative and it was possible to base regular classroom teaching on the concepts of children. The group decided to develop teaching methods in Innovation Education so it was possible to maximise activity in all areas of elementary school education. The decision was also made to set up an innovation competition.

New primary aims were set up based on pedagogical views.

1. To stimulate and develop creative abilities of the students and teach them certain approaches or processes from own concept to realisation.
2. To teach individuals to use their creative ability

in daily life so that generation becomes better equipped to adapt to their environment.
3. To encourage and develop the student's initiative and strengthen their self image.
4. To make students aware of the ethical values of 'objects' while teaching them ways to better their environment. (Thorsteinsson, 1998: 143)

The committee's first effort was the establishment of a course for the students at Foldaskoli in Reykjavik. This course was supported by the Athletics and Crafts Council of Reykjavik. In response to this initiative, several schools, outside of the capital region, received assistance in establishing innovation courses in their schools.

The Young Inventors Competition has since become an annual event. The main theme of this competition has been to encourage students to tackle works within the framework of innovation. Another goal has been to point out the benefits of Innovation Education to the elementary schools with a view towards the future graduates and their career options.

The experimental project, called The Little Inventors School, was originally construed as grounds for developing subject materials for Innovation Education in the elementary schools. The course was a one-week summer school for children and youths. It was there that teaching methods were further developed with an aim towards using them the next two winters under the direction of the author. The result of this was several years of curriculum development supported by the Reykjavik Local Educational Authority, the development fund for the primary schools and funds from the Teachers Association. Initial teaching of the course materials began at the Folda School in Reykjavik, Iceland.

Built on the experiences from The Little Inventor School, the author wrote the course materials in Innovation Education under the name 'Innovation and Science' for the elementary schools curriculum, along with Rosa Gunnarsdottir a fellow teacher at Foldaskoli. The content is in the following parts:

Footnote: The latest National Curriculum was re-written in 1999 and will be implemented in 2002/2003.

- Initiative-creativity
- Creativity-technology
- Ideas-Ingenuity
- Environment-Design.

'Innovation and Science' has primarily been taught to students between the ages of 9 to 12 years and later also for students up to 20 years. The last few years have seen roughly 30 to 40 schools, around Iceland, include Innovation Education in their curriculum.

The main component of the subject materials is the child's own idea work. This is based on their needs assessment of the environment and requires of them a basic knowledge of work processes to enable them to produce their finished concept. The course material follows the ideology behind Innovation Education and is a clear resource for the teaching methods. Therein is discussed the role of the teacher in creative work with children: concept; pedagogy, mental inhibitions, needs analysis, search for solutions and employment of them, technical literacy, how to provoke the mental abilities in children (imagination etc.,) and suggestions for evaluation.

**The new National Curriculum in Iceland**

The Ministry of Education has established Innovation Education as a new subject in the National Curriculum from 2001 called 'Innovation and practical use of knowledge' which will come into full effect next year. Knowledge that is a by-product of science, theory and art is an important resource in our modern times. Its value is two fold. It has an inherent value by and of itself and it also has a value that can be harnessed by the world of work. In this age of the information superhighway, the practical use of knowledge is thus important as a type of pre-production. In this respect all knowledge is equally important. The natural sciences, social sciences, economics, linguistics, philosophy, art and mathematics are, each in their own way, the basis for the most important employment of our modern times.

The following is a quotation from the draft of the new Icelandic National Curriculum:

> 'Innovation and practical use of knowledge' is thus a new subject. The main emphasis is to train students to produce valuable and practical results of their knowledge through creative work. We are not proposing that this course be required, but would be the choice of the schools instead. The goal will be, that over time the course becomes a part of the regular school curriculum and timetable. Ideally this course develops in co-operation with the schools and partners in the labour market. These partners form a nucleus that will automatically add to the wealth of knowledge and experience of the course, which will be available on the WWW.'
>
> (A_alnámskrá grunnskóla, 1999: 31)

'Innovation and practical use of knowledge' has no pre-planned activity other than the technical solutions via a practical use of knowledge, based on creative endeavours. It is the schools, teachers and

students that decide what is worked with each school term or year. That might be a practical project that is made up of the student's education in single subjects (for example: science, linguistics, social science, art and mathematics), or cross-curricular pursuits.

Innovation and practical use of knowledge is a technological subject. Its pedagogy is, in some ways, built upon foreign influences. Ministries of Education around the world have put a lot of emphasis on the development of technological education. In many instances techno-ed has developed from craft or industrial art teaching co-operatively with the teaching of science. The results have been a new subject that often has replaced the sloyd (craft) teaching.

The planning committee for the new technology curriculum has placed great emphasis on making sure that we do not follow that path. The sloyd has an inherent right to be a basis for practical education and training. On the other hand, it is proposed that there be an exchange of work between innovation education and practical use of knowledge and industrial art (sloyd). Industrial arts work with certain technology parts that are connected to practical work but, Innovation Education and the practical use of knowledge will concentrate more on those factors which are dominating in our information age (service, communication and use of information). This division of aims provides 'Innovation Education and practical use of knowledge' legitimacy as a career choice in the 21st Century while the industrial arts will remain the basis for vocational teaching.

With the subject 'Innovation Education and the practical use of knowledge' a new direction has been opened up for innovative and developmental work in the elementary schools.

**Course content**
Innovation Education and practical use of knowledge are, along with vocational training, the core of technological studies in the elementary schools. Aims, course content and knowledge and technical aspects are then the same as those identified for the technologies as a whole. In Figure 1 you can see clearly the new proposals. (A_alnámskrá grunnskóla, 1999)

**Innovation is cross curricular**
Innovation is based on creative emphasis in both teaching and coursework. The mainstay of the course is ideation (Gunnarsdottir, 2001) in the widest sense. This entails the search for solutions to needs and problems in our environment or the improvement or further development of known objects. The student chooses the course content but must then learn the

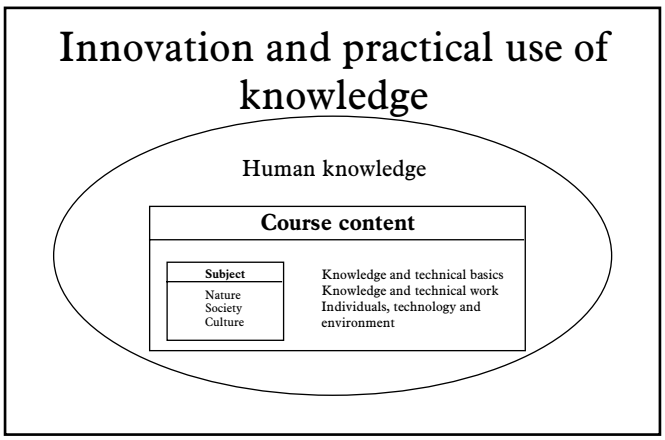



Figure 1. The course content of the curriculum subject: Innovation Education and the practical use of knowledge.

work processes needed to bring their idea into being, gaining what is now known as creative relevant skills. (Gunnarsdottir, 2001)

The resulting effort is seen across the curriculum because the individual relies on critical knowledge from all sources to search for viable solutions. Innovation work can take place in all school courses if educators will encourage and enable the child's creativity in every area. Innovation Education is thus construed as an opportunity as well as encouragement towards creative use of knowledge and production of new knowledge on all levels of elementary education. (Thorsteinsson, 2000)

**Concept theory**
Innovation Education is premised on the statement that everyone is creative. Students can best utilise their creativity when given the opportunity to mature and develop in a conscious and targeted manner. The theory of innovation work emphasises that the individual use their powers of creation to mould their environment. Innovation work is intended to encourage this aspect of a child's character and thereby strengthen the stability of future societies.

The heart of the theory might be stated, 'Man is the creator of his human world.' (Thorsteinsson, 1996)

**Innovation work encourages ethical maturity**
Innovation also encourages ethical awareness as part of the individual's morality if the student can take a step beyond that which would have occurred if they had done something by rote knowledge. The student has acquired ethical awareness when he/she knows and can think about the value of his actions and defend them.

Ethical awareness is an important aspect of modern children's education and supports the responsible

participation of individuals in forming and developing society. Ethical awareness is developed through innovation work because it builds upon solutions to daily problems.

**Practical use of knowledge**
School policies have emphasised the acquisition of knowledge and a fundamental set of skills to prepare the child for the demands of life on as wide a scope as possible. In our modern information society, where information is so easily accessible, we discuss placing a greater emphasis on a targeted search for knowledge that leads to increased maturity. In innovation work, however, the child's idea or task dictates the process and the form in which it is presented. Innovation work builds on the concept of practical use of knowledge predicted by a systematic search for and acquisition of knowledge. This new skill level can thus be used on other current or future projects. The child's efforts ought to strengthen initiative and the creative individual abilities to tackle life.

Everyone who has observed children exploring their environment and attempting to understand it, realised that children are actively developing their inner and outer realities. (Thorsteinsson, 2000). Children are not afraid to create their ideas or express their opinions if circumstances permit. A child's ingenuity is something that we, as educators, need to preserve because that is the basis for and individuals maturation and the positive development of societies.

For the child to blossom teachers have to put themselves into the mindset of the child, and let the children work on their own level. The teacher also has to acquaint himself with the methodologies an inventor would use when handling the child's ideas. The teacher encourages the child to use those methodologies so they become a part of the student's daily thoughts. This is how the educator can open the well of ideas in the child and their daily use of them. When the child succeeds in solving problems in daily life they develop their ethical maturity and abilities to use their creativity better. Their self-image improves and they are better able to take positive directions in life, believe more in the future and be whole and independent people.

The thoughts and understanding of adults are different to those of a child. The adult's thoughts are modified by experience and their culture. A child's thoughts are not influenced as much or limited by culture. Creativity and ingenuity are unchecked in both work and play. The adults role is to see that the child attains their maximum level of maturity while keeping their mind open or that they do not limit their creativity and are allowed to mature on their own terms. That is why adults have to make a concerted effort to be open to the child's world and be conscious of their own thought limitations. Through quality cooperation, between adult and child, the child can mature as an independent person and mould their inner and outer realities with their thoughts and creativity.

**Has it been successful?**
Students in Icelandic schools have overwhelmingly embraced the new direction and give us great hope that Innovation Education will become permanently entrenched in school activities. More and more schools are trying out innovation. These past few years has seen over 60 of 196 Icelandic schools take part in Innovation Education in one form or another. Most of these schools use the materials from the innovation and the science teaching materials. These materials take into account teaching methodologies that support innovation work, along with several course options that students and teachers can take. In addition, there are several schools that are holding specialised courses for young inventors and attempting to connect with individuals in the work place who offer their experience and support with developing solutions with the students.

Along with myself, another of the pioneers of innovation in Iceland has gone to great lengths to develop teaching methods for innovation. Dr Rosa Gunnarsdottir, from the University of Leeds in England, defended her Doctoral dissertation this past autumn. Her research was based on the children in the Innovation Education in Icelandic schools. Her results prove our theory that it is feasible to build a measurable course with a creative emphasis into schoolwork.

The Iceland University of Education has overseen the Icelandic Young Inventors Competition. This competition serves as a motivator for students to be creative and inventive as well as an incentive for teachers to increasingly direct their school activities in creative ways. Last year, 64 schools took part in the competition and a total of 3000 ideas were submitted for judging. The competition was also held on the Internet for the first time last year (www.inet.is/keppnin). Two Icelandic computer companies SmartVR (www.smartvr.com) and Skyrr (www.skyrr.is) sponsored the competition by creating a specialized data driven website. This web site stores the participants ideas as well as provides a communication link between students and specialists in the work force. This database will continue to grow and, besides being a repository, will serve as a market for ideas that businesses can access in cooperation with the inventors. The database will also serve the academic community as a repository where research can be done into children's imagination. The Iceland

University of Education will oversee the storage and use of the database.

**The Minerva Project and Innovation Education (InnoEd)**

The Iceland University of Education is currently directing the three-year European Union project InnoEd, which is sponsored by the Minerva Project. InnoEd is a cooperative venture of four countries in the area of Innovation Education: Iceland, Finland, England and Norway, and is premised on the 11 years of experience in Innovation in Iceland. In this project the course in Innovation Education is online and real time based instead of the traditional distance learning or classroom based model. In addition, the participants will develop a specialized data driven website used for communication and teaching as well as storage and research for all participants. Here the envelope of information technology will be pushed to new extremes in the area of Innovation Education. Smartvr.com and Skyrr.is will continue to develop and oversee the Internet software and data storage for the InnoEd project.

The project is set up in three stages.

1. First stage is the culture specific dimension and preparatory stage. Where the work will be aimed at finding suitable solutions to fit the existing educational surroundings in each country participating. Building on the existing experience and expertises in each country, sharing those experiences and structuring a flexible open distance-learning environment for teachers and students and teacher training in the field of Innovation Education.
2. The second stage is the dissemination of Innovation Education within each country, training teachers and setting up learning environments based on the previous stage.
3. The third stage is a European dissemination of Innovation Education based on the experience of the first two stages.

The project is targeted towards the European educational system, teacher trainers, teachers and students. The main outputs of the project will be learning and teaching environment linked to a database, equipped with relevant tools for ideation and Innovation Education. The InnoEd project has set up a web site at http://innoed.khi.is where interested parties can find more information.

**Conclusion**

Work with Innovation Education encompasses many possibilities, which can be opportunities for individuals to both develop their talents and contribute to their environment, as well. Some people may not see the possibilities involved and feel that the activities are not in rhythm with daily realities. But small steps become yardsticks by which change can be measured and new avenues to progress unleashed. The ideas proposed in innovation are supportable in all areas of education as well. Its basis lies in creative endeavours, which help the individual mature on many levels with the emphasis being on individual empowerment, initiative and working with ideas.

The participation of teachers needs to be re-defined. In innovation he does not judge their proposals. He introduces them to the different work methods and takes the position that these people are his equals with abilities to take decisions and he merely helps them find technical solutions to the problems and functionality of the design.

All ideas are valid. They may have more or less intrinsic value, for the individual, and it does not matter that the concept does not succeed at first. The proposal holds its value nonetheless and merely waits its time before it becomes a reality. The teacher does everything in his/her power to motivate and keep alive the creative wisdom of the child. They do not evaluate the child in relation to its cognitive stage of development but rather look at the child and its project as a whole. That is the target for the teacher. Our inherent creative wisdom is something that needs to be stoked and encouraged in a larger measure in the future. The author proposes that the elementary schools will become, to a much larger degree, the platform for emphasizing creativity and initiative as a building block for life.

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