

INNOVATION AND PRACTICAL USE OF KNOWLEDGE IS A WAY TO FUTURE EDUCATION

Gisli Thorsteinsson

Assistant Professor, University of Iceland

Tom Page

Lecturer, Loughborough University, UK

Introduction

This paper will present the entrepreneurship education in the Nordic countries and the innovation education policy in the Icelandic school system as a part of it. The entrepreneurship education has taken its form in Iceland as a new cross curricular subject called “Innovation and practical use of knowledge” as presented in the new National Curriculum Guidelines, as a part of the new area for Information Technology and Technology Education. Innovation Education, in this form can be said to be the results of 11 year’s work, aimed at developing the new model for entrepreneurship 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.

Entrepreneurship education in Nordic schools

The past decade or so has seen a rise in entrepreneurship across Scandinavia in the education system. The effects of which can be seen in recent National Curriculum Guidelines in those countries. In some places the effects are clear while in others they are less defined and dispersed in various course areas. The reason for this trend is the need for people to take an active approach to creating their own enterprise opportunities as well as to influence in large and small scale their immediate environments.

Since early 1990’s the Nordic countries have all been re-evaluating and reforming their school systems. Each country places great emphasis on the importance of creating opportunity for pupils and students to develop their creative talent, initiative and entrepreneurship. This can be clearly seen in National Curriculum Guidelines for compulsory and upper secondary schools. An emphasis was thus apparent in the Nordic Entrepreneurship Project 1997 through to 2000 to link development of curriculum and course content, which might encourage these goals. The expectation being that returns from the new educational emphasis be a boosting of innovation and entrepreneurial thought throughout the school systems in Nordic countries.

As E. Karlsen states in his report about entrepreneurship in the Nordic countries:

Traditionally the concepts *entrepreneur* and *entrepreneurship* have been attached to the economic sphere and economic science. Within economic science, especially three characteristics have been connected with the entrepreneur: courage for economic risk-taking, eye for profit and ability for innovation.

When entrepreneurship was introduced as an educational aim in the Nordic schools in the 1990’s, the original political intention seems to have been innovation in business. Relatively soon it became clear, however, that entrepreneurship used in connection with schools would have an

extended meaning. Relatively broad strategies to promote entrepreneurship were emphasised. The background for this was the theory that entrepreneurship is not only promoted through strengthening what could be called *specific entrepreneurship qualities* (knowledge about economy and markets, insight into modes of production, eye for profit and resources etc.), but also through *general entrepreneurship qualities* (independence, self-confidence, creativity, ability to co-operate etc.). Consequentially, the potential for future entrepreneurship do not only increase through direct training in how to establish and run an enterprise, but also through what we call progressive teaching and other methods for stimulating active learning (Karlsen, E. 2001).

The social targets of entrepreneurial education are that individuals become responsible participants in the formation and innovation of their immediate environs in the areas of work, social and cultural issues for themselves and society as a whole. The Nordic countries are entering an era of increasing international competition. They are poorly placed to compete with other markets in the manufacturing of inexpensive industrial goods. The push to support the development of individual creativity and ingenuity via better education can be a panacea to create new employment opportunities and maintain their social welfare states.

Interesting points from Karlsen -

“Almost simultaneously with the dawning interest for entrepreneurship in the -90’s, a more general interest for new teaching methods seems to spring up in all the Nordic countries. Generally, this was probably a reaction to what was perceived to be a very conservative school regarding teaching methods. Specifically, new teaching methods and new ways of working in schools was seen as a means to meet the challenges in the new, globalized society with its continuous, comprehensive and fast changes. The thought was, and still is, that the best way to prepare the pupils for this society, was to strengthen their ability to act, their self-confidence, independence, creativity, ability to co-operate etc. These qualities are supposed to be strengthened, the way the theory goes, trough what we call progressive teaching and other methods for stimulating active learning.” (Karlsen, E. 2001, p.9)

The development of the Icelandic Innovation Education Project

The Innovation Education project has developed in Icelandic elementary schools over the past eleven years. This began with a meeting of several concerned individuals who wished to encourage young innovators and help them to develop their ideas and a working group was established. 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 plan to bring 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 content of these after school sessions should be integrated in the ordinary 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 in the attempt 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 and processes from own concept to realization.
2. To teach individuals to use their creative ability in daily life so that they would become better equipped to adapt to their environment and re-creating it.
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 improve their environment (Thorsteinsson 1998, 143).

The groups' first effort was the establishment of a course for the pupils at Folda School in Reykjavik. This course was supported by, the Youth and Sport 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 became an annual event in 1991. 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 compulsory schools with a view towards the future graduates and their career options.

The experimental project called The Little Inventors School was originally constructed 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 many years of curriculum development supported by several developmental funds for compulsory schools administered by the Ministry of Education, Science and Culture, the Reykjavik Local Educational Authority and 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 Folda School. 'Innovation and Science' has primarily been taught to students between the ages of 9 to 12 years of age 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 pedagogy of the teacher in creative work with children.

The content is in the following parts:

- ⇒ Initiative-creativity, students explore and solve the needs seen in their environment.
- ⇒ Creativity-technology, how to use technical solutions to solve the needs found.
- ⇒ Ideas-Ingenuity, about production, marketing and selling the products.
- ⇒ Environment-Design, about solving the environmental problems through innovation.

The new national curriculum in Iceland

The Ministry of Education has established Innovation Education as a new subject in the National Curriculum, 1999 called 'Innovation and practical use of knowledge'. The National Curriculum Guidelines shall have come into full effect the school year 2002-2003 but will not be obligatory in the beginning. 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 (Aðalnámskrá grunnskóla 1999, 31). (Translation of the author).

'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 the students who decide what is worked on with each school term or year. That might be a practical project that is made up of the students' 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 Craft, (Sloyd). Craft works 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 21 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 entrepreneurial training, the core of technology as a subject in compulsory Schools. Aims, course content and knowledge

and technical aspects are then the same as those identified for the technologies as a whole. In the picture you can see clearly the new proposals (Aðalnámskrá grunnskóla 1999).

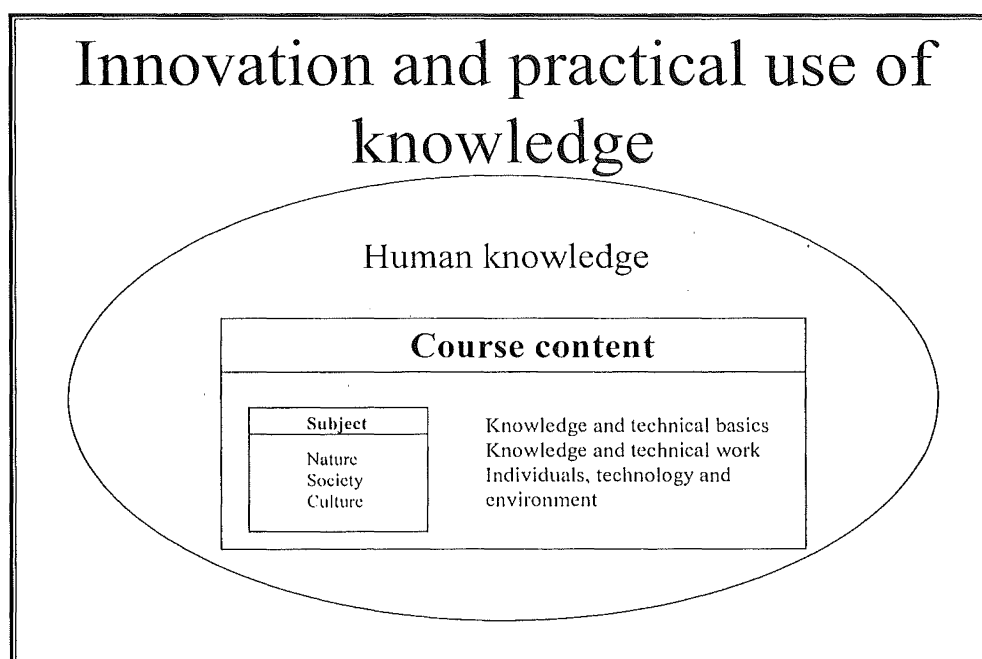


Figure 1. The course content of the curriculum subject: Innovation Education and the Practical use of Knowledge.

Innovation is cross curricular

Innovation is based on creative emphasis in both teaching and course work. The mainstay of the course is ideation 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 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 education (Thorsteinsson 2000).

Concept Theory

Innovation Education is premised on the statement that everyone is creative. Students can best utilize 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 education of children 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 emphasized 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, realize 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 students' daily thoughts. This is how the educator can open up 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 feel themselves to be whole and independent people.

The thinking and understanding of adults is different than that of the 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 children attain 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.

How successful has it been?

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 or another form. 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 student and teacher can take while they are the methods that will work in each course area. In addition there are several schools that are holding specialized 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 website 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.

Teacher Education

Innovation is a new course in the education of elementary educators at the Iceland University of Education. The University now oversees the Innovation Competition and introduces Innovation education materials to the schools. Students in Craft and Design take a special course in Innovation teaching theory and assist young inventors with development of their ideas. The emphasis in the theory is that the students as well as the teachers learn to understand their role in creative work with children wherein the child and their idea are the core of the course. The University assumes responsibility for storing the data from Innovation competitions for potential future research. In addition the University holds courses for educators and consults with schools.

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 Skyr.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 website 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

compulsory schools will become, to a much larger degree, the platform for emphasizing creativity and initiative as a building block for life.

References

- Aðalnámskrá grunnskóla, Nýsköpun og hagnýting þekkingar, Menntamálaráðuneytið 1999.
- Gunnarsdóttir, R. 2001. Innovation Education: Defining the Phenomenon. Doctoral thesis. Leeds, University of Leeds.
- Thorsteinsson, Gisli. 1996. Frumkvæði-sköpun. Nýsköpun og náttúruvísindi.
- Thorsteinsson, Gisli. 1998. Nýsköpunarstarf í grunnskóla, Uppeldi (6) : 141 – 148.
- Thorsteinsson, Gisli. 1998. The Innovation Project in Icelandic Elementary schools. Development of Technology Education - Conference -98. University of Jyväskylä. The principles and Practice of teaching 33, 303-323.
- Thorsteinsson, Gisli. 2000:2. Skolen i idéernes tidsalder Nyskabelse i islandske grundskoler.
- Karlsen Eivind, Skolen i Norden / Entreprenørskab).: *Entreprenørskab i skolen. Et satsingsområde for nordiske skolemyndigheder?* NF-rapport nr. 10 • 2001. ISBN-nr.: 82-7321-440-0