Allgemeinbildung—Readiness for Living in Risk Society

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Abstract

Sociologists increasingly note that we live in a risk society, characterised by the unpredictable consequences of techno-scientific innovation and production and by increasing complexity. Life in risk society, particularly in truly democratic societies, to a greater extent requires competencies not only to understand and change one's own circumstances, but also to participate in collective decision-making and to care for others who, for various reasons, have less control over their circumstances. We argue that *Allgemeinbildung* encompasses exactly the kind of competencies that are required by risk society. We us concrete case materials from our research to illustrate participation in risk society by adults and educational contexts that allow children to develop *Allgemeinbildung*.

Introduction

Many teachers and teacher educators are old enough to have experienced not only a rapidly changing world, but also the increasing tempo with which such changes occur. Airplanes became larger, fast, and safer; computers metamorphosed from room-sized dinosaurs into desktop devices a billion times more powerful than their ancestors; and genetics evolved from rudimentary understanding of inheritance to almost routine practices of producing new organisms. With these ever-developing changes came not only benefits but also dangers, potentially catastrophes. How will humankind be able to cope with this ever-increasing speed of scientific-technological world? More importantly for edu-

cators is the question, how do we teach and how should students learn to live in what many have come to call 'risk society'? Some sociologists and educators seem to know what it takes—teaching and learning for democratic citizenship in societies where all forms of knowledge are equally considered in the search for solutions to the rapidly increasing number and size of the problems that humanity faces. What kind of citizen do we envision while thinking about teaching and learning in risk society? We find the following case from an ongoing research project to be instructive. In this case, the local government pitted scientists against the residents of the only street that is not connected to the watermain. Despite constant attempts to discredit the local and historical knowledge of the residents about the water resources in their area, the citizens engaged the scientists during a public meeting and through their engagement were able to show the limitations and problems in the science and scientific method.

The residents of Saline Drive, located in a suburban municipality on the Canadian west coast, are not connected to the watermain that supplies the remainder of the community. For the past thirty years, they had to rely on their own wells. Twenty or thirty years ago, when the residents first purchased their homes and properties, well water was plenty and the quality was fine. The community was smaller and had much more of a rural character than it has now, when new housing developments have sprung up in many areas. There was no reason for the residents of Saline Drive or the community to predict that the well water was diminishing in quantity or quality, although after the fact, some community officials say that these changes should have been predicted based on the increasing urbanization of the area and the pressure on ground water specifically and the health of the entire watershed more generally.

Over the past five years, repeated tests showed that during the dry summer months, the water is not potable and the regional health board recommends extended boiling or importing it from another water supply Most residents drive five kilometres to get their drinking water. Although the residents propose to get the connection to the watermain paid for through special grants and by topping up the remainder out of their own pockets, the municipality (mayor, counsellors) is against the extension. A total of six reports exist, some basing their results on others. The reports were conflicting with respect to the extent of the problem and about the solutions to be taken; depending on their position with respect to the issue, individuals engaged in the issue highlight the outstanding features of this or that report and the shortcomings of others. An open house and public meeting were organized to (a) provide opportunities for the residents and other citizens to peruse the reports, (b) for the report authors to talk about their re-

ports, (c) for residents and citizens to question the author on technical matters, and (d) for the public to make comments.

During the first part of the meeting, the different authors presented their reports. Throughout, moderator and the speakers engaged in rhetorical efforts to construct their legitimacy, listing titles (e.g., 'Mr. Yang has a masters of science degree') or position (e.g., 'chief scientist of health board'). All speakers also constructed the legitimacy of their reports as deriving from the adherence to scientific method, which in some cases was described as a way of supporting the conclusions of the report, but without explaining the meaning of the term 'scientific method'.

The subsequent question period pertaining to the technical matters showed that the citizens were not intimidated. Several residents engaged the scientists and in particular the author (Lowell) of one report, on the basis of which the politicians denied the watermain extension. The citizens' questions and the answers pertaining to the key report on the basis of which the municipality refuses to build the extension brought out the inconsistencies in scientific methodology, interpretation of data, and conclusions. In the following excerpt from the public meeting, Naught questions the hydro-geologist Lowell, whose report concludes that there are only minor aesthetic problems (chemical contamination) and that the wells at Saline Drive should therefore be individually treated. Other reports conducted by the health board and various consultants had shown that there are numerous problems, including a high chromium level.

Naught: Treatment of downstream water- Are you- Is that when- Is that your area of familiarity and expertise?
Lowell: I've worked with groundwater and water treatment for over twenty-five years.
Naught: So, so you, so you would consider yourself an expert in that area?
Lowell: Not in all aspects. An environmental engineer who's an expert in water treatment would know more about it than I do.
Naught: Would- Do you know, for example, whether chromium can be treated?
Lowell: Yes, yes I do.
Naught: Successfully?
Lowell: Yes, it can with ion exchange filtrate, a filter.
Naught: 'Kay.
Lowell: I phoned the manufacturers of certain systems and they assured me that that can be done.
Naught: And that's good enough for you?
Lowell: Well, I read it in publications as well.
Naught: Oh, there's a publication that we have here that says it has, that says there is no commercial uh treatment for chromium.
Bishop: Well, again Mr. Naught-

Lowell: Again there wasn't any concern for chromium identified. So I'm not sure what point you're making.

Naught: Well it seems to me that the report uh is relying, Mr. Magee's report is relying on very heavily on your information which would suggest that it doesn't matter what the problem is with water, it can be treated and uh, I would beg to differ on that.

The actions of scientists, engineers, and technicians in the everyday life of a community have consequences that often cannot be foreseen. The recent tragedy in the Walkerton (Ontario, Canada), where seven people died and thousands were infected by *E. coli* contaminated water, and the municipal water crises in many Canadian communities that all have been attributed to sampling and testing is but one example. In this interaction, Naught leads the scientific consultant first to admit that he is not the best expert on issues of treatment; the interaction with Lowell then brings to the open a contradiction between Lowell's claim that high chromium levels can be treated and the written information available at the open house and meeting that chromium levels cannot be treated. Bishop attempts to intervene at the very moment that Naught makes the contradiction salient. Lowell indicates that he missed the point Naught was trying to make, who then points to the link between the community decision, based on Magee's report, which in turn was based on Lowell's report.

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This episode shows that the participation of citizens in the questioning of science can raise questions and show that the science involved in a particular decision-making process was not infallible. The political decision-making could have consequences—especially during the dry season when well water levels are low, it is possible that Saline Drive residents are affected by chemical or biological contamination of their wells. In the present situation, the political process at least included the participation in a meeting where the reports and citizens' positions were publicly discussed. Not only was participation enabled but also many residents were present and took the opportunity to participate. In this case, Naught exhibited a level of literacy that allowed him to read the documentation on water treatments, and extract the impossibility to treat for chromium. More so, he exhibits competence to engage Lowell in a way that contradictions between the scientist's claims and the information at hand become evident. We believe that this is the kind of competence citizens need to cope in risk society.

Recently, if we take public protests and protest marches as a measure, there appears to be an increasing public awareness of the problems that evolve from many technological and scientific 'advances'. (Such protests are still more prevalent in Europe than in North America.) Mad cow disease (BSE), global

climate change, or the diffusion of genetically modified organisms are problems associated with what were previously hailed to be advances—high protein foods for cows from the carcasses of other cows, gas emissions from industry and cars, and genetic modification of plants. That is, the so-called scientific and technological advances entailed negative effects that were not and perhaps are impossible to foresee in principle. The introduction of new technologies therefore inherently poses risks, which has led some sociologists to talk about and theorize 'risk society' (e.g., Beck 1997a, 1997b, Giddens 1994). Over the past decades it has become increasingly evident that science and technology are not infallible and that the risks associated with innovation increase rather than decrease. There is an increasing sense—again more so in Europe than in North America—that scientists and engineers alone cannot and ought not make decisions about the implementation of new scientific knowledge and technological innovations and that all levels of society should contribute to sociotechnical decision-making processes (Rowe and Frewer 2000). The multi-faceted nature of the unpredictable problems arising in risk society requires citizens to participate more actively. That is, an important way to deal with the phenomenon of risk society are various participatory models that allow experts from non-techno-scientific domains and the general public, especially those most affected by any changes, to have their input (Roth et al. in press). The meeting about the water available to Saline Drive residents is an example of interaction between techno-scientific experts, political administrators and the public, where competent citizens were able to enter a critical dialogue with the experts in order to solve a problem in the local community. For us, the concern for educating a competent public immediately raises three important questions: 'What are the competencies required in a risk society?', 'How do young people acquire the required competencies?' and 'What competencies do teachers need to prepare students for risk society?'

The purpose of this article is to suggest a possible answer to the complex of questions. Our answer will rest on the concept of *allgemeine Bildung* or *Allgemeinbildung* (Klafki 2000), that is, a broad and general, liberal education for all. We begin our essay with a description of risk society and proceed to articulate some of the required competencies that citizens need to bring in order to participate in collective decision-making processes. *Allgemeinbildung* is comprised of just those competencies. We provide the case of a Danish third-grade curriculum, where children were in the process of acquiring these competencies.

Risk Society

Watching the nightly news allows us to understand that the institutions of our post-industrial society are coming face to face with the negative effects of industrial production on environment, human health, and human social or socio-economic situation. Although hailed as advances, many techno-scientific innovations embody unforeseeable and often uncontrollable risks, which makes this a 'risk society' (Beck 1994). Many products of science and technology introduced as advantages to society turn out to be the opposite or at least questionable in terms of the actual beneficiaries. This includes production of electrical energy based on fossil and atomic fuels, the so called 'green revolution' of increasing food supplies in developing countries, the processing of pesticides in industries and the distribution of the products in agriculture and private gardens, the production of plastics of different kinds and for a great variety of applications, the discovery of blood composition to help patients with deficiency disorders. In all of these examples, there have been unforeseen side effects or backlashes, which society has to deal with, and society would include science institutions and science education.

There are two different stages of risk society with respect to a particular problem: (a) the problems are only latently present but have not yet been recognized and articulated (e.g., long term evolutionary and ecological impacts of genetically modified organisms) and (b) the public has acknowledged, defined, and diagnosed a problem but not necessarily resolved it (e.g., environmental impact of fish farming). It is a significant feature of risk society that any choices and decisions among different solutions have to be made on the basis of incomplete and uncertain information. Even after long deliberations, the possibility remains that a society finds itself on a road without being able to return to a previous branch to take another road—the one not taken as the famous Robert Frost poem states. To control the risk assessments and unforeseen side effects, political choices must be made. The problem with water supply on Saline Drive can be regarded as an example of the effects of risk society. The increasing use of the valuable water resource for industrial reasons are draining the supply for the resource as drinking water—an unintended side effect, which caused the citizens some immediate trouble, but which has caused more fatal effects in other communities.

Risk society can be characterised in terms of opposite movements associated with the way power and control are maintained and exerted. New forms of power struggles exist—traditional democratic institutions are increasingly pushed into the defence, partly by centralised and monopolised financial and

productive companies and partly by alternative movements on or near the two extremes of the political spectrum. There are two major directions in the struggle over power (Beck 1994): (a) increased centralisation and (b) increased decentralisation and individuality. So centralised and decentralised tendencies are two dialectically related movements, which can partially be interpreted as the result of each other. We provide examples for each of these two characteristics that influence educational circumstances.

Dialectic of Centralisation and Decentralisation

Indications of an increased centralisation can be observed in different contexts throughout education broadly and science education specifically. For example, in many industrialised nations there are increasing levels of interest and participation in international assessments of scientific achievement such as TIMSS or PISA. One effect such participation has is increased attention to educational needs; another effect is the increased attention given to the examination of assessment implications on policy development (OECD 2000). We already know that the tests influence not only top-level policy but migrate through and align actions down from national to provincial and local levels.

The TIMSS and PISA studies have had important impact on participant countries, resulting in national analyses of the contents and organisation of science education. The international efforts lead to national coordination of curriculum development, which in turn lead to regional and local adaptations and alignments of the curriculum (OECD 2000). Assuming that coherence exists between objectives, means and content of education, there is then a risk that international tests lead to a standardisation of curricula within and between the participating countries. The standardisation will be catalysed by the influence of natural scientists on the curricula, because they have a tendency to request a curriculum that focuses too much on specific content and very little on relevance to the students (Aikenhead 2002, Fensham 2002). That is, one effect of international tests is an increasing uniformity of national curricula brought about by organisation at a super-national level—an example of centralization.

Similar trends towards centralisation can be seen in the increasing concentration of the textbook publishing market leading to increasingly homogeneous texts, and in the adoption of a small number of software and hardware. That is, centralisation is a major characteristic of risk society, where governments and

increasingly multinational companies wrestle for the control over the results of industrial production and markets as well as cultural features.[1]

Together with centralisation, risk society exhibits tendencies to decentralisation and individualisation. Decentralisation tendencies can be observed in educational settings, when, for example, schools are organised into smaller units, schools within schools, which gradually replace the traditional hierarchical organisation (Bell and Gilbert 1996, Hargreaves 1994). On a private level, life in risk society means not only that a person has available more information, knowledge, and choices but also that a person has to make an increasing number of decisions. Whereas pre-industrial and industrial society offered relative certainty within groups and social classes and offered relative certainty with respect to knowledge, a person in risk society constantly faces public knowledge expansion and the uncertainty whether accessed information is actually the best and most relevant. Associated with each decision, a person often has to deal with multiple competing and contradictory representations of the same issues. A person left to his or her own judgement about which option to choose may experience ambivalence, a constituent part of our existence in risk society. Instead of trying to eliminate it, citizens of risk society need to learn to live with ambivalence (Baumann 1991). The Saline Drive example shows one person (Naught), who takes charge of his own decision-making, and interacts with experts and his fellow citizens about the action to be taken concerning an important problem for the community. But Naught also has other competencies that are required to cope in a rapidly changing risk society. Naught participates constructively, in effect assisting to establish the limitations of the tests conducted by the hydrogeologist. Furthermore, Naught participates in the process not only for himself, but also for all the residents living on Saline Drive; he exhibits competency for solidarity with others who, for one reason or another, cannot or do not want to fend for themselves regarding the water issue.

Science and Risk Society

Science and technology not only created the problems implicit in techno-scientific innovations that enter society, but also constitute a pool of expertise that decision-makers draw upon when it comes to finding solutions. That is, policy makers are drawing upon expertise that embodies the same ideology, the

[1] In Canada, for example, the effect of free trade agreements with the USA lead to increased sales of books and magazines produced for the American market, displacing culturally very different Canadian products.

same kinds of conceptual blind spots that have led to the development of the techno-scientific innovation and the ensuing problem in the first place. There is an increasing recognition that scientists cannot be left alone with trying to find solutions; new forms of solutions are required that require 'thinking-outside-the-box' (Roth et al. in press).

Initiatives concerning political decisions of scientific and technological issues are the outcomes of an increasing public interrogation of their governments' abilities to manage risk situations and problems. Advisory organs are established as part of the effort of political leaders and administration to regain public trust (Davies 1998). Other centralised measures to control risk—situations include international or multinational institutions for approving chemical substances, conducting analysis of climate change and health-related issues, or managing pollution. As in the earlier described case of international testing in science education, the rationale for the international approach is that a global problem should lead to a global solution and accordingly adapting national legislation and administration, and beyond doubt the efforts will lead to international results in controlling risk factors. The question is, however, if these initiatives are sufficient.

The gradual public awareness of the uncertainty of decisions concerning matters with scientific content has among other initiatives resulted in formation of ministerial councils in many nations, with the object of providing a balanced foundation for decision makers in complicated matters. For example, in Canada it is recommended that the advisors should be elected so that the particular council is 'balanced to reflect the diversity of scientific opinions and to counter potential biases' and 'include[s] at least some experts from other, not necessarily scientific, disciplines' (Industry Canada 1999). Canada decided to establish the *Council of Science and Technology Advisors* after a report had been published that acknowledged the concept of risk, and the potential 'eroding' of public confidence in the ability of the politicians to react to large-scale public concerns (Davies 1998, Metha 1997). Many nations have declared policy intentions to be as open as possible about decision-making, and some countries have techno-scientific non-experts or lay people as members of the advisory councils (The Danish Council of Ethics 2000).

Risk Society Requires Increased Citizen Participation

The increasing involvement of the public with techno-scientific expertise comes about as a reaction to what is perceived as the inability to deal with the unforeseen effects of risk society by the established channels of decision-making, which mainly relied on techno-scientific expertise and non-participatory deci-

sion-making methods. Knowledge from fields other than techno-science gain recognition and the ongoing public discourses now involve everyday experiences parallel to techno-scientific discourse. This phenomenon, whereby political dialogue and actions involve individuals and members of groups not belonging to traditionally organised political systems, has been called 'sub-politics' (Beck 1994). Within the logics of 'sub-politics', society is formed bottom-up, a process characterised by an emergent order, rather than top-down, a process characterised by planned order. Among the new forms of organisations are peace-, environmental- and anti-nuclear movements, characterised by flexible and dynamic structures and objectives, which are much more responsive to emergent problems characteristic of risk society than traditional hierarchically organised (bureaucratic) institutions. These new organisations develop new and alternative strategies and solutions to techno-scientific problems in society, which embody very different and heterogeneous ideologies—it is a form of 'thinking outside of the box [of science]'.

In many countries, particularly northern Europe, a range of public participation methods have been used and evaluated that inherently draw on different forms of expertise, including the local knowledge of ordinary citizens (Rowe and Frewer 2000). The idea of local knowledge, however, runs against the grain of conventional science education, which has spent considerable efforts to characterise alternative forms of knowledge as inconsistent with techno-scientific (Pfundt & Duit 1994). Science educators have treated these alternative forms from deficit perspectives calling them 'misconceptions', 'alternative conceptions', 'naïve conceptions', 'everyday knowledge', 'folk knowledge', and so forth. Many science educators have declared as their explicit goal the eradication of these forms of everyday knowledge and replace them with the scientifically correct knowledge. On the other hand, some scholars predict that the parallel knowledge domains will continue to exist and experience-based forms of knowledge will continue to pose challenges to established techno-scientific knowledge (e.g., Beck 1994). Because both kinds of knowledge are contextually influenced and produced and thereby of limited value, they can prosper from mutual acceptance and interactive dialogue—this will allow the emergence of a new, more democratic science (Roth and Lee 2002). Participation in collective decision-making requires competencies not only to make decisions for oneself, but also, and more importantly, competencies for participating in collective decision-making processes and for enacting solidarity for those who are unable to fully control their lives. These competencies are part of the broader concept of *Allgemeinbildung*, a concept that we develop in the next section.

What Education for Risk Society?: Toward *Allgemeinbildung*

We have described thus far the concept of risk society and how the concept can be used to analyse the role of science in such a society. In this section, we outline our suggestions for the link between the description of present society as being a risk society and appropriate competencies for future citizens in this kind of society. The term 'appropriate' presupposes clarification regarding our underlying educational goals and values, which we therefore articulate and explicate.

Assuming our description of risk society is viable, educators and educational institutions have to make choices about how education should respond to societal developments. Based on the work of Beck (1997b), Giddens (1999) and Rasmussen (1996), we identified three basic choices for educational systems), leading them to take a *fundamentalist*, *re-traditionalizing*, or *democratic* direction. First, the fundamentalist route involves top-down organisation whereby a hierarchical state, religion, or other institutional form hold the central power. The object of such educational systems is to obey the expectations of the institutionalized power; the goal of education is the development of obedient citizens (i.e., compliant assembly-line workers). Second, the re-traditionalizing route involves holding on to or reinvigorating traditions ('Back to the basics!') and societal structures characteristic of the industrial age. Educational systems on this route transfer the goals from the past, industrial age, onto those of the future, the age of risk society. Education thereby continues to train students in the tools and practices appropriate for an industrial age (they teach 'the sabre-toothed tiger curriculum [that] will never be able to stand in the 21st century' [Scott 2001: 3]) socialize students into the historically valid but perhaps outdated structures of society (i.e. the 'sabre-toothed tiger curriculum'), including social classes, roles of employment, and traditional family roles. Third, educational systems can choose a democratic direction, which allows for self-expression, participatory action, and solidarity in a pluralistic society. The central object of the educational system is the enactment of a critical dialogue with the institutions of power to pursue a democratic project and ensure that it applies to all students so that they can develop into empowered citizens (Skovsmose 1998). In the following, we pursue our argument for a democratic education in a democratic society.[2]

[2] Most educational systems around the world follow a re-traditionalistic direction in their efforts to maintain a school organization consistent with the industrial age, seeking to adjust the structure and the content in accordance with concerns related to production

Democracy means diversity of cultural expressions, beliefs, values, knowledge and actions to seek mutually acceptable solutions concerning problems between people. In other words, 'democracy is a political system of government which embodies, in a variety of institutions and mechanisms, the ideal of political power based on the will of the people. Democratization is a process which leads to a more open, more participatory, less authoritarian society' (IDEA 2000: 5). Once educators choose democracy as a process and product of their work, they have to make pedagogical choices. It has been argued that a basic requirement for making such choices and for teaching toward democratic citizenship is *allgemeine Bildung* or *Allgemeinbildung* (Klafki 2000), a term that can approximately be translated as general citizenry or general literacy.[3] *Allgemeinbildung* involves competence for self-determination, constructive participation in society, and solidarity towards persons limited in the competence of self-determination and participation. Revisiting our Saline Drive case: resident Naught exhibited exactly these three competencies that constitute *Allgemeinbildung*; this case study also shows that *Allgemeinbildung* includes the competence for participation in critical dialogue of currently important matters irrespective of how many scientific facts he can recite. Most importantly for us as educators and educational theorists, the prefix *allgemein-* connotes 'general', a general education, and 'all', an education for all.

In contemporary society, a person with *Allgemeinbildung* should be able to participate in democratic decision-making processes about issues concerning peace keeping and conflicts, environmental problems, problems associated with inequality, problems concerning management of technology, and problems that focus on the subject at the expense of social considerations (Klafki 2000). (De-

(Quicke 1997). Even teachers' jobs are defined in industrial terms: 'Teachers are now becoming increasingly accountable in crude cost-benefit terms as managers of the human and financial resources in their schools, while performing decreasingly professionally-valued instructional activities' (Harris 1998: 174). But the danger of fundamentalism still exists, exemplified (a) in the efforts to centralize political and financial power, (b) by fundamentalist religious movements that have tremendous impact on what and how it can be taught (e.g., the theory of evolution in the US, theocracies of the Middle East), or the increasing support for xenophobic ultra-right ideas that sweeps several European countries and the US at the time of this writing (2002).

[3] Westbury (2000) uses the expression *formation* for 'Bildung', which is the direct translation of the German word, and as such is a better substitution compared to *citizenry* or *literacy*, which both signals end products, whereas 'Bildung' and *formation* also emphasizes the process.

pending on the local context, there are other problems that provide appropriate contexts for an evolving *Allgemeinbildung*.) Conflict and conflicts of interests are inherent in this formulation of curricular content; curricula will have to include analysis of these forms of conflicts and the opportunities they pose for taking action. *Allgemeinbildung* and participation in democratic processes imply competence. The residents of Saline Drive showed the kind of competence that might be appropriate, for the public to interact with experts to pursue a democratic solution to problems. But what do we mean by the concept of competence?

Competence exhibited in a particular, concrete situation can be analyzed in terms of three forms of knowing that have already been discussed by the ancient Greek—knowing that, knowing how, and knowing why (Gustavsson 2001). Knowing how and knowing why include not only aspects that can be articulated but also what has come to be known as tacit and value-related knowledge.

Knowing that, *episteme*, encompasses the processes and products of the sciences, and the diffusion of the processes and products into society. This means that also non-professional use of episteme occurs through the participation of citizens in their process of enculturation to society (Gustavsson 2001). The educational system has formerly been dominated by *episteme*, which culturally has been considered more important and distinguished than the practical forms of knowing. *Episteme* is the way a scientist argues with colleagues to prove a science statement or test a hypothesis, and the way laymen argues as opposed to statements about faith or belief.

Knowing how, *techne*, is about knowing with the aim of creating something, where knowing is to be understood as the means of reaching the end product. Understanding develops through action, and the viability of the knowing is ascertained in praxis (Gustavsson 2001). This kind of knowing has formerly been associated with qualifications in practical labour or crafts, but has gained increasing general interest from theories like situated learning (Lave and Wenger 1991). Although knowing how develops in praxis, reflection on action is a means to develop and enhance this form of knowing (e.g. Schön 1987).

Knowing why, *phronesis*, has ethical and political backgrounds or effects and is therefore neither neutral nor objective. Values and normative influences are part of *phronesis*, which therefore constitutes a social phenomenon (Gustavsson 2001). *Phronesis* implies prudence, because the action chosen has to be based upon good judgement with regard to rational reasoning. Development of *phronesis* requires experiences from participation in everyday out-of school situations, because formal schooling in the traditional sense is separated from society.

We will therefore understand *Allgemeinbildung* as a competence for self-determination, constructive participation in society, and solidarity towards persons limited in the competence of self-determination and participation, where the competence develops through the knowing what, the knowing how and the knowing why of a particular situation or problem.

How should teaching be organised so that the understanding of competence development through a situated, inductive and constructivist approach can be pursued, on one hand, and centrally established goals for learning are respected, on the other? Part of the answer to this question is to work towards formulation of goals of learning in very broad terms—a development that takes time and involves all levels of practitioners and policy makers. An example of a relatively successful effort (Fensham 2002) in this direction (few and general, broadly stated goals) exists in 'natur/teknik' (Nature/Technology), a general science course introduced to the Danish curriculum in 1994 (Andersen and Sørensen 1995). A focus on competence is consistent with democratic ideals, because the student is the central subject of development, where his or her former experiences are the point of entry to new learning and where the student is participating in planning, execution and evaluation of the development of a competence (Velde 1999). The relevance and individual meaning to each student of educational goals are therefore a prerequisite for any development of a competence in science education.

Allgemeinbildung and Risk Society: What are the Consequences for School as Institution?

Acknowledging *Allgemeinbildung* as an appropriate aim for the school system in preparing future citizens for risk society will have major influence upon the content of education and organisation of the school as an institution (Bell and Gilbert 1996, Dale 2000, Hargreaves 1994). *Allgemeinbildung* implies the ability to engage in action concerning societal issues—action that is deliberate and based on experience and reflection (Klafki 2001). To develop the competence to take action the learner will need experiences from taking action in teaching situations, which requires the involvement of the teaching and learning in society. Based on the sociological analysis of Beck (1994), Klafki argues that the organisation of the traditional school in schedules, classes and subjects must be restructured to allow for continuous and problem-based learning and teaching.

Problem-based teaching can be described as constituted by four principles—the exemplary principle, method and action-oriented principles and the principle of integration between subject learning and social learning. The exem-

plary teaching means that the theme of teaching and the theory and methods integrated in the theme are valid beyond the situation itself. The students participating in the learning process develop knowledgeability (active knowing) and experiences that can be re-enacted in similar situations or problem areas (Hodson 1999). The principle of method can be explained by the fact that it is the responsibility of the teachers to introduce or otherwise arrange the use of adequate theories and procedures to investigate the problem, whereby 'adequacy' is contextually determined by problem type and level of student (Roth, 1995). The action-oriented perspective integrates the interests and motivation of the students, which means that the teacher should ascertain the interests of the students in dealing with the problem and in the actions in relation to it (Jensen and Schnack 1997). The combination of subject-related and social learning deals with the integration of the factual substance of the problem with the social and cultural meaning of the problem. The integration means investigating the problem in its societal complexity, and the consequence of that is the acknowledgement of the cultural influence on the problem and the cultural diversity of experiences and action possibilities of the students (Klafki 2001).

This form of problem-based teaching has as its aim the development of *Allgemeinbildung* and, in the process, increases students' competencies. Students engage in investigations of problems, supported by the just-in-time and as-needed help of the teacher, both with respect to theoretical and procedural issues. In this way, students develop knowledge for action concerning exemplary problems, their typical structures and content. Students thereby enhance their *knowing that.* In analysing the problems, they enact skills associated with the particular problem and with the search for information, and they will acquire experience by involving in action—they enhance their *knowing how.* In dealing with the problem in its cultural context, they will learn about the social impact of the problem in the local community and the action possibilities in terms of possible solutions of the problem. Based on their own judgement of the individual and social effects of the solutions, they will engage in action—they will have enhanced their *knowing why.*

Consequences for Science Education

Teaching for *Allgemeinbildung* poses an important problem to science educators: how should the content of the curriculum be chosen? In traditional school systems, the sciences have provided the structuring and progression of subject content; science teachers concentrate on how to adjust the content to the particular students (Westbury 2000). However, scientists and the sciences are not necessarily the best or sole sources for content in a contemporary and future

perception of the purpose of education (Fensham 2002). If teaching is problem based and therefore arises from the interaction between the student and society, then the content cannot be described a priori or predetermined by a book or a manual (Sjøberg 2002). The sciences represent a somewhat artificial or 'unnatural' (Sjøberg 1994) categorisation of the world and our knowledge of it, compared to the everyday life of people. However, the rejection of the sciences as the source of structure and content of science education in schools must not result in exclusion of the sciences in the school system, for they continue to be one of the resources (though not the sole) for solving the problems of risk society. Ultimately, science education must allow for the students to develop their science competencies—knowing what, how and why—in the context of problems that are personally interesting and that provide opportunities for investigating social implications to their surroundings. The problem should also allow for actions to be taken by the students so that they take part in the solution of the problem and through this participation change their participation in society, in other words, to learn how to solve problems (Roth 2002). So what kind of science education do we envision, one that begins where teachers are today and which can be developed progressively into forms increasingly well adapted to risk society, based on the concept of *Allgemeinbildung*? In the following section, we provide an example of a science unit from one of our studies in a Danish elementary school.

Case Study from a Third-Grade Classroom

We take the following case materials from a research project that the first author conducted during Spring 2000 as part of his dissertation research in a Danish public school. During this period of research in two third-grade classes, the students engaged in a two-month project of health issues. Prior to this, the students had not tried to work according to the principles of problem-based learning, and had no experience with the different phases and methods as described below. The two teachers worked together as a team in planning, coordinating and evaluating the project. They had decided the overarching theme of the project by calling it *Health and Cycling*; in the second step, they asked students about their associations and ideas concerning the theme. This resulted in a number of sub themes followed by the students choosing the sub theme, which they were most interested in. The pupils suggested sub-themes that they considered relevant to themselves, including the danger of being hit by motorised vehicles, the lack of cycle tracks and lanes along thoroughfares, and the apparent rampant practice of using illegal substances to win races such as the *Tour de France*.

The Problem

One group of students decided to investigate the question, 'Why do professional cyclists engage in doping to enhance their performance, when they know it is hazardous to their health?' The topic chosen by these students is highly relevant in today's risk society, because it is recognised as a problem by society and because it contains element typical for a substance whose future problems, at the time of the invention of it, could not be predicted.

Doping is a problem among athletes—both professionals and also amateurs. There is a long list of substances included in the definition of doping as it is decided by the International Olympic Committee (Council of Europe 2001, WADA 2002), and among these is *erythropoietin* (EPO), a glycopeptid hormone, mainly produced in the kidneys, which controls the formation of red blood cells (erythrocytes) in the stem cells of the bone marrow depending on oxygen requirements. In the 1980s, the pharmaceutical industry produced a synthetic form to increase the amount of red blood cells in patients suffering from kidney problems. The more red blood cells, the more oxygen can be transported. This, of course, is also the case for non-patients. The substance somehow spread from the health-care domain to sports. It is side effects, as some tragic deaths among cyclists so vividly illustrated (MacAuley 2000, Sciencenet 2002). The introduction, abundance and use of different substances have created the need for establishing legislation and administration to seek control of the abuse, which has evolved into a large bureaucracy (European Commission 2002). There are nevertheless some indications, that the actions taken against the abuse are not being implemented in total agreement within the organisations and institutions of the international sports world, and experts predict that an increasing amount of athletes will be attracted to doping and that research will continue to produce new drugs (Christensen 2000).

The pupils expressed concerns about the health of their sports idols when they use the substances, and about the future of cycling as a sport when drugs determined the outcome of the races. For example, Allan described, 'I saw him on TV after a trial, but I don't think he took it, because it is dangerous and you can die from it'. Many students previously had heard the word 'doping' in the news on TV and other media, and heard accusations against some of their idols. But what exactly was doping, and how serious was the problem?

The Unfolding Curriculum

The subsequent work was divided into three phases—envisioning, investigating and action-taking. Prior to each phase, the teachers planned the work to be done

together with this group (as with all other) and ascertained that the collectively defined goals were reachable. For example the teacher mediated the discussion, so it would result in the production of clear and workable tasks, and she assisted students in simultaneously reflecting on the goals concerning action competence—will students have possibilities for taking action? Are all in the group participating in planning and deciding?

The students conducted the actual investigations, with the teachers being present to consult if necessary. The phase of investigation and the phase of action typically consisted of alternating periods of contacts and meetings with persons in the local community and with work in the school area. They kept a log, which contained the program, decided by the group for the day, the results from the investigations and a sheet of evaluation, which was to be filled out at the end of the day. It included the following items: Indicate and explain how much have you in the group decided today—how much the teachers; indicate and explain if you think, today has been interesting; and indicate and explain what you have learned today.

Envisioning

The group working with the doping problem started off in the vision phase by explaining to each other, why they felt, that this issue was a problem—what it meant to them. They talked about doping being dangerous to the health, and that some professionals had died from taking it. The members of the group were also very concerned about the ethical implications of the use of doping, 'It is cheating, because doping makes you go faster and longer than the others'. They used some handouts from the teachers to establish an overview of whom to contact in order to gather information. The handouts consisted of scaffolds with the aim to help the students organize their thoughts and investigations. They created a poster from the scaffold, resembling a staircase, with the immediate and easily obtainable goals on the lower stairs and the ultimate goals on the top stairs. As an outcome of the phase of vision, they decided to work towards a result that would ensure a fair competition in sports. The group emphatically noted on its poster, 'We plan to be able to convince our friends, classmates and team members, that doping is dangerous to their health and on top of that—it is cheating'. To be able to explain the cause and effect of the problem to others, they decided that their investigation should deal with what doping was (which kind), the effect on achievement and on health (why athletes used it), and so on. At the end of this phase, the students presented the poster to the rest of the class.

Investigating

Their phase of investigation started up with the teachers and the students meeting again, and the students were working on a new sheet consisting of a scaffold of concentric circles. How could they gain information about doping and related problems? Some of the group members suggested going directly to the dealers and users of illicit doping substances and confronting them with the problem. Others explained instead that this would be a bad idea. Thus, Christina suggested, 'First of all it will be pretty difficult to find them, and I don't think they will admit it'. The group therefore agreed to use the handout from the teachers and the help they offered to organize the investigation phase. In the inner circle, they wrote their main problem. In the next circle, they drew or wrote the persons closest to themselves that might be assisting—parents, school nurse and physical education teachers. Erik commented, 'my father is a policeman, and we will ask him. I don't think he works with doping issues, but he might know somebody'.

The next circle consisted of so-called experts, but still within the local community, including doctors, local sports clubs and athletes. The outer circle was filled with resources like the ministry of sports, the national Olympic committee, the Internet and so on. The group thereafter made contact with medical experts and interviews of doctors as well as searched for and gathered information on the problem from various sources. They interviewed a local sports idol, and investigated his training schedules and amount to establish an understanding of how much was needed to be a top athlete. They interviewed him and others to get their opinion on, why some athletes choose to use doping.

Gabriel asked, 'We have read about how dangerous it can be, but we have talked to some doctors who explained us how many types there are and how much it is used. How is it controlled on the tracks? The athlete responded, 'after a match we sometimes have to urinate into a bottle, and the bottle is sent to a laboratory to be tested for substances. After a while the results are presented to the club—and the union, and then everybody knows'. Iris wanted to know more details of the procedure, 'What if you can't urinate when they want it?' The athlete explained, 'then they give you sodas to drink. There is no way that you can escape. But this is not the reason you should say no to doping. The real reason is that taking it is cheating compared to the real athletes who work hard – there are no shortcuts.'

Action Taking

The phase of action taking consisted of two parts. Students created posters featuring slogans such as 'Doping is cheating—*and* hazardous'; they explained

these slogans by adding further text beneath. They distributed the posters around the school and in local sports clubs and parks. Secondly they arranged a meeting for other students from the school to a presentation of the issue, which included questions to and answers from the local sports idol. As an introduction to this phase, the teachers presented a sheet to help the students organize their actions—more or less: who does what and when. The students decided the actual actions to be taken, which included approaching people in the local community. This, for many of the students, meant crossing lines of insecurity. But they expanded their idea of 'school' and learning by integrating the resources in the local community. One of the teachers recounted:

> There was this girl—she was shaking all over. 'I can't do it', she said. Five minutes passed. And then she returned, still shaking all over. 'But you know what—I did it, I talked to him'. In this way, I think that many of the pupils have a good experience—to be able to cross a lot of limits. That you dare cross the limit, and that you can benefit from it—even if you are just a school child.

Learning Outcomes

When the unit began, professional cyclists had been sports stars, whom the third-graders followed in their exploits by reading magazines and by following the TV-coverage of international events such as the *Tour de France*. The children had already bought t-shirts and other *Tour*-related merchandise to show their support. They were quite shocked discovering that some of the most prominent cyclists were actually proven guilty of enhancing their performance using, for example, erythropoietin. In this unit, many students may have realized for the first time that achievements in the world of sports can be based on illegitimate practices and that various substances are available for doing so. The availability includes not only the world famous athletes but also the local area of any student. The student thereby has to make a choice of his or her opinion on that matter—the ethics of the fact, that some sports stars might use those substances, and the ethics of he or she preparing for the situation some time in the future, where he or she will be met by the potential offer of the artificial improvement of their physical ability.

Ultimately, the unit allowed student to develop competencies in the context of a personally relevant problem. The doping investigation featured a group of students that engaged in the three facets of competencies that make *Allgemeinbildung*. These included knowing that about EPO and other doping substances, knowing how to engage in an inquiry to find out more about different dimen-

sions of doping substances, and knowing why (when, what for) or why not (when not, what not for) to use these substances.

The students' engagement in the doping research has the potential for far-reaching consequences. At present, various public and private groups are slow in responding to the phenomenon. These children may soon wonder whether the slowness means that some organisations partly approve of the athletes' use of performance-enhancing drugs. Further, they might begin to wonder about the abundance of these substances. As a result of these students (now or in the future) beginning to engage in action, the situation can change, perhaps leading to a rapid decrease in the popularity of doping substances. It lies in the nature of risk society that we cannot predict the direction and nature of these changes, but, of course, we hope these changes to be for the better of humanity.

Conclusion

Some sociologists theorize collective life as 'risk society', which is characterized by the unpredictability of the consequences that comes with decision-making processes regarding techno-scientific innovation and by the dialectic of centralisation-decentralisation. Risk society requires increased participation on the part of here-to-fore uninvolved citizens to be able to make decisions that meet collective, general needs. Using risk society as our starting point, and having a predilection for a democratic education in a democratic society, we argued that an *Allgemeinbildung* would allow citizens to increasingly participate in collective decision-making processes. *Allgemeinbildung* includes the competencies of determining ones own life, participating constructively in collective life, and enacting solidarity for those who cannot determine their life on their own. Each of these competencies includes three, not necessarily independent forms of knowing—knowing that, how, and why.

Allgemeinbildung allows individuals to make informed, responsible choices in an increasingly complex social ('risk society') and natural world, and adapt to the continuous changes that this world undergoes. But being competent to make individually relevant decisions is only one part that characterises *Allgemeinbildung*, and is also only one part of the requirements for collective life in a democracy. Being a citizen in risk society requires the competencies of constructive participation in collective decision-making *and* of solidarity. These latter competencies are much less developed in those industrialised societies that are currently characterised by rampant capitalism and excessive focus on the individual at the expense of collective life and the generalised other. In fact, rampant capitalism comes with the exploitation of the natural world and social world.

Allgemeinbildung includes not only solidarity in spirit (knowing that others are poor, knowing that there are greenhouse gases) but also solidarity as action, knowing for (actively contributing to the reduction of poverty, change of policies that currently allow industries to emit greenhouse gases).

The notion of risk society embodies that the currently experienced (environmental, social, etc.) problems will not only escalate but will escalate more rapidly and in even more unforeseeable ways. We suggest that citizens of tomorrow will need to be able to live in and modify this increasingly complex natural and social world. We argued here that *Allgemeinbildung,* with the implied competencies for solidarity and constructive participation in collective decision-making, is exactly what we want these future citizens to be able to enact. We want democratic citizens, including the third-grade students and the residents of Saline Drive, who can and are willing to engage with others in contentious issues and, through their participation, change the world for the better. Schools must provide students with opportunities to develop the *Allgemeinbildung* necessary to participate knowledgeably in such collective efforts of making this a better world.

Education in general and school science more specifically interested in developing *Allgemeinbildung*, arranges for students to deal with problems relating to and relevant in their lifeworld. Most importantly, students need to engage in knowing how and why, and the practical action and wisdom that these forms of knowing imply. Students, even as young as third graders, can enact knowing how and why in their community, participate in collective life, and therefore engage in citizen science for a better world. We envision that, students with *Allgemeinbildung* will increasingly participate, once adult citizens, in political processes involving the critical issues facing risk society today (GMOs, greenhouse gases, genetic manipulation of the human genome, chemicals in the food chain, etc.) and even more so in the future.

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References

AIKENHEAD, G. S. (2002) The educo-politics of curriculum development. *Canadian Journal of Science, Mathematics and Technology Education*, 2 (1), 49–55.

ANDERSEN, A. M. and SØRENSEN, H. (1995) Nature/technology: Science education at primary level in Denmark. In A. M. Andersen, K. Schnack and H. Sørensen (eds.), *Science-Natur/Teknik, Assessment and Learning*(Copenhagen: The Royal Danish School of Educational Studies), 5–26.

BAUMANN, Z. (1991) *Modernity and Ambivalence* (Cambridge: Polity Press).

BECK, U (1994) The reinvention of Politics: Towards a theory of reflexive modernization. In U. Beck, A. Giddens and S. Lash (eds.), *Reflexive Modernization* (Cambridge: Polity Press), 1–55.

BECK, U. (1997a) Global risk politics. In M. Jacobs (ed.), *Greening the Millennium* (Oxford: Blackwell Publishers), 18–33.

BECK, U. (1997b) *The Reinvention of Politics: Rethinking Modernity in the Global Social Order* (Cambridge, MA: Blackwell Publishers).

BELL, B. and GILBERT, J. (1996) *Teacher Development—A Model from Science Education* (London: Falmer Press).

CHRISTENSEN, D. (2000) Will new Olympic drug tests level the playing field?. MSNBC News [http://www.msnbc.com/news/] (Visited 5 September 2002)

COUNCIL OF EUROPE (2001) *Anti-Doping Convention*. (Strasbourg: The Council of Europe). [http://conventions.coe.int/Treaty/EN/Treaties/Html/] (Visited 25 June 2002)

DALE, E. L. (2000) *Etik og moral i uddannelsessystemet* [Ethics and Moral in the Educational System] (Århus: Klim).

DAVIES, T (1998) *Scientific Advice in Government Decision-Making* (Ottawa: Industry Canada).

EUROPEAN COMMISSION (2002) Joining forces against doping - What is doping?' European Communities, 1995-2002. [http://europa.eu.int/comm/sport/key_files/doping/] (Visited 25 June 2002).

FENSHAM, P (2002) Time to change drivers for scientific literacy. *Canadian Journal of Science, Mathematics and Technology Education*, 2 (1), 9–24.

GIDDENS, A. (1994) *Beyond Left and Right: The Future of Radical Politics* (Cambridge: Polity Press).

GIDDENS, A. (1999) *Runaway World: How Globalisation is Reshaping our Lives* (London: Profile Books).

GUSTAVSSON, B. (2001) *Vidensfilosofi* [Philosophy of Knowing] (Århus: Klim).

HARGREAVES, A. (1994) *Changing Teachers, Changing Times* (London: Cassell).

HARRIS, K. (1998) Mathematics teachers as democratic agents. *International Reviews on Mathematical Education*, 30 (6), 174–181.

Hodson, D. (1999) Going beyond cultural pluralism: Science education for sociopolitical action. *Science Education,* 83 (6), 775–796.

INDUSTRY CANADA (1999) *Science Advice for Government Effectiveness* (Ottawa: Industry Canada).

International Institute for Democracy an Electoral Assistance (IDEA) (2000) *Democracy and Global Co-operation at the United Nations* 1–14 (Stockholm: IDEA). http://www.idea.int/publications/democracy_and_global_cooperation/democracy_and_global_cooperation.pdf (visited September 2002).

JENSEN, B. B. and SCHNACK, K. (1997) The action competence approach in environmental education. *Environmental Education Research*, 3 (2), 162–178.

KLAFKI, W. (2000) The significance of classical theories of bildung for a contemporary concept of allgemeinbildung. In I. Westbury, S. Hopmann, K. Riquarts (eds.), *Teaching as a Reflective Practice—The German Didaktik Tradition* (Mahwah, NJ: Lawrence Erlbaum Associates), 85–107.

KLAFKI, W. (2001) *Dannelsesteori og didaktik – nye studier* [Bildung-theory and Didactic] (Århus: Klim).

LAVE, J. and WENGER, E. (1991) *Situated Learning: Legitimate Peripheral Participation* (Cambridge: Cambridge University Press).

MACAULEY, D (2000) *Will drugs Ruin Sport?* [http://www.netdoctor.co.uk/editors_voice/] (Visited 25 June 2002).

MEHTA, M. (1997) Re-licensing of nuclear facilities in Canada: The 'risk society' in action. *Electronic Journal of Sociology:* 3 [http://www.icaap.org/]

OECD/Programme for International Student Assessment—*PISA* (2000) *Measuring Student Knowledge and Skills: The PISA 2000 Assessment of Reading, Mathematical and Scientific Literacy* (Paris: OECD).

PFUNDT, H. and DUIT, H. (1994). *Students' Alternative Frameworks and Science Education. Bibliography* (Kiel: IPN).

QUICKE, J. (1997) Reflexivity, community and education for the learning society. *Curriculum Studies*, 5 (2), 139–162.

RASMUSSEN, J. (1996) *Socialisering og læring i det refleksivt moderne* [Socialisation and learning in the reflexive modernity] (København: Unge Pædagoger).

ROTH, W.-M. (1995) *Authentic School Science: Knowing and Learning in Open-Inquiry Laboratories* (Dordrecht, The Netherlands: Kluwer).

ROTH, W.-M. (2002) Taking science education beyond schooling. *Canadian Journal of Science, Mathematics, and Technology Education, 2* (1), 37–48.

ROTH, W.-M. and LEE, S. (2002) Scientific literacy as collective praxis. *Public Understanding of Science*, 11 (1), 33–56.

ROTH, W.-M., RIECKEN, J., POZZER, L. L., MCMILLAN, R., STORR, B., TAIT, D., BRADSHAW, G., & PAULUTH PENNER, T. (in press) Those who get hurt aren't always being heard: scientist-resident interactions over community water. *Science, Technology, & Human Values.*

ROWE, G. and FREWER, L. J. (2000) Public participation methods: A framework for evaluation. *Science, Technology, & Human Values*, 25 (1), 3–29.

SCHÖN, D. A. (1987) *Educating the Reflective Practitioner* (San Francisco: Jossey-Bass).

SCIENCENET (2002) What is the point of blood doping for athletes [http://www.sciencenet.org.uk/database/Biology/0005/b00780d.html] (Visited 25 June 2002).

SCOTT, P. C. (2001, Fall) Accountability: A prospective. *Southern Leadership*, 1 (1), 1–3, 5.

SJØBERG, S. (2002) Science and technology education current challenges and possible solutions. In E. Jenkins (ed), *Innovations in Science and Technology Education Vol. VIII* (Paris: UNESCO).

SJØBERG, S. (1994) Naturvitenskap, demokrati og dannelse [*Science, democracy and Bildung*]
In K. Schnack (ed.), *Fagdidaktik og Dannelse – i et demokratisk perspektiv* (København: Danmarks Lærerhøjskole), 5–56.

SKOVSMOSE, O. (1998) Linking mathematics education and democracy: Citizenship, mathematical archaeology, mathemacy and deliberative interaction. *International Reviews on Mathematical Education,* 30 (6), 195–204.

THE DANISH COUNCIL OF ETHICS (2000) *The Danish Council of Ethics—2000 Annual Report* (Copenhagen: The Danish Council of Ethics).

VELDE, C. (1999) An alternative conception of competence: Implications for vocational education. *International Journal of Vocational Education and Training*, 51 (3), 437–447.

WADA (2002) List of prohibited substances and methods. World Anti Doping Agency, Montreal. http://www.wada-ama.org/asiakas/003/wada_english.nsf (Visited September 2002)

WESTBURY, I. (2000) Teaching as a reflective practice: What might didaktik teach curriculum? In I. Westbury, S. Hopmann and K. Richarts (eds.) *Teaching as a Reflective Practice* (Mahwah, NJ: Lawrence Erlbaum Associates), 15–54.