The role of project-based learning in the “Political and Social Sciences of the Environment” curriculum at Nijmegen University

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Abstract Since the end of 1996, teachers at the Faculty of Policy Sciences at Nijmegen University, The Netherlands, have been working on a new educational programme called “Political and Social Sciences of the Environment” (PSSE). In fact, the PSSE curriculum builds on the Environmental Policy Sciences curriculum that had existed since 1989, and which from 1998 onwards integrated the former programme (Social Sciences and Environmental Studies). The (re)designing of the PSSE curriculum has been inspired by innovative ideas in education, in which project training plays an important role. This paper discusses the educational background of the new curriculum, its main structure and the goals and functioning of project training therein. We relate our efforts to the goals of pursuing sustainability in higher education, and conclude by summarising the specific profile and features of the curriculum.

1. Educational background
The development of a new curriculum creates possibilities for rethinking the existing teaching theory and for using a didactic approach when deciding how an educational programme should look. By developing the new curriculum in Political and Social Sciences of the Environment at Nijmegen University from 1996 onwards, attention has been particularly paid to the coherence between the different modules and to the co-ordination of the various implemented teaching activities. The curriculum model employed at Aalborg University, Denmark offers an inspiring point of departure in this regard (Kjersdam and Enemark, 1994). Therefore, we sketch some of its main features here, indicating on which points, and for what reasons, we opted for a slightly different curriculum design at Nijmegen University.

At Aalborg University, the educational system that has been set up expresses an educational philosophy that involves projects organised around problem-based instruction. During each semester of their study, students are continually working on an extensive project of great length and scope. These projects focus

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on the analysis and the designing of solutions for real-life problems, which stem from the world of professional employment. This real-life content of the projects, including their presentation to the societal “stakeholders” and the discussion with them on conclusions and implications, turn out to be a motivational power of high order.

At Aalborg University, students take a three-year bachelor’s programme and nearly all of them continue their university education in a two-year Master’s programme. Aalborg University has adopted a semester system, each of which contains a project. As a result, students usually complete ten projects during their studies. On average they spend about 50 per cent of their time in project work, while the other 50 per cent is devoted to courses. Each semester has its own theme, and projects and courses are closely inter-related by the strategic choice of these semester themes. Students have quite substantial degrees of freedom in elaborating their projects, though of course they consult their tutor or other specialists.

The courses resemble “classical” university classes at other universities. Groups differ in size between 30 to 100 students and they are generally teacher centred. Nevertheless, students ask many questions and take every opportunity to discuss matters related to their topics. Cross-fertilisation between the project and the courses is evident, due again to the strategic choice of the semester themes: whereas projects reflect the real world relevance of the issues, the courses are assumed to provide the theoretical and methodological tools and skills to come to grips with these issues. Therefore, students in general are motivated to participate in coursework, in order to discover answers to questions still unresolved. In addition, the simultaneity of project and courses contributes to the conceptual richness of the ten projects, as it changes students’ attitudes to the content of their discipline.

The importance of the latter should not be underestimated. Teachers are often disappointed about the short-term character of many learning activities of students. After an examination, much of what students learned and acquired is forgotten because of its lack of meaning for their real lives. Projects create, clarify and demonstrate this meaning and as such are very helpful in the development of knowledge. In addition, students are trained to actively search for the answers to the questions that are raised during the successive projects. This experience reinforces their critical attitude towards knowledge and strengthens their thinking abilities. In brief, the designing of the curriculum, particularly its combination of projects and courses devoted to well-chosen common themes, steers the learning process and promotes a better relationship between scientific theory, occupational practice and education. Learning has a goal that is also referred to as “situated learning”.

The model used at Aalborg University stems from the pragmatic thought which prevailed at the start of the twentieth century. The social purpose of education was of foremost importance. The idea was transferred to educational methodology by the American pragmatist, Dewey. In the early 1920s he developed the “problem method of teaching”, a forerunner of problem-based
instruction. Dewey saw this type of instruction as having been derived from the way people learn from everyday life.

The ideas of these pragmatists, prevailing at the start of our century, are echoed in the current educational literature on project teaching. Van Woerden (1991) describes project teaching as a form of teaching that begins with a problem where it is not at first apparent which knowledge, insight and skills are going to be required in order to find a solution. He considers it to be important that these problems are lifelike and that they have not been construed. Project teaching differs from problem-based learning in various ways (Gerritsen and Meijssen, 1997; Van den Bosch, 1997a, b). We restrict to two differences here. First, in PBL (problem-based learning) students work on several fictitious and stylised problems, which have to be tackled within a set time and in a step-by-step programme. More so even, because the problem that serves as a starting point in project teaching is much more extensive, more true-to-life and therefore more complex, making it much less obvious in advance in PBL to see which knowledge is required in order to solve the problem. In project teaching, students follow their own “path of learning” and in this way they learn to distinguish which knowledge is required in order to find solutions to the problem. And second, in project teaching, the application of knowledge receives more attention than it does in PBL, where the emphasis is directed more towards acquiring knowledge (Adderley et al., 1975; SISWO, 1981).

Nevertheless, PBL and project teaching share the same focus on problems. In this respect they also have, fundamentally, the same view on the role of knowledge. This is how van Woerden (1991) sees project teaching as a form of situated learning, which he subsequently, just as Dewey, equivocates with problem-based learning. By working on a problem, students are able to structure and to activate their previous knowledge and they learn how to use previously acquired skills (methods and techniques) within a new context. Moreover, he typifies project teaching as a form of group teaching which stimulates students to work together on one task, a skill that is indispensable in occupational practice. Finally, van Woerden refers to project teaching as a good example of what is known, in current educational jargon, as student centred teaching: the teacher no longer fulfils the role of the one who transfers knowledge, but of the one who guides the learning process.

It is precisely because of these origins, stemming from a pragmatic, scholarly view, that project teaching, if it is presented in this way, holds a danger, in that students are taught a unilateral instrumentalist view towards knowledge. Or in the words of an educational supervisor at Aalborg University: “We are not educating ‘scientists’ but ‘craftsmen’”. By this, knowledge is meant to appear useful only if it directly contributes to finding solutions to problems. However, learning objectives such as “knowledge for the pure sake of knowledge” or for the sake of general development, learning from the texts of others and “the wonder” of how reality fits together should all be reflected in education. Because knowledge from various professional fields plays a multiple role, situational
learning is not by definition problem-based learning. Moreover, for students who are constantly working on solving problems, it might appear that all problems could be solved, as long as there is sufficient knowledge available. Scepticism and the stimulation of a critical perspective in regard to such a scholarly approach are, however, an important part of an academic education in quite possibly all studies, but in any case certainly for those who study political and social sciences. The latter is particularly true, we believe, when it comes to environmental issues. Elsewhere we discussed the risk of instrumentalising the social and political sciences of the environment in more detail (Leroy, 1995, 1996b).

These latter considerations explain some of the dissimilarities between the curriculum of Political and Social Sciences of the Environment at Nijmegen University and the “original” model at Aalborg University. The contribution of projects in our Nijmegen curriculum is smaller (about 20 per cent), mainly since we needed time and space for reflection and deepening theoretical matters.

This view on the role of knowledge in society and, therefore, in training has been incorporated into the educational design of the Political and Social Sciences of the Environment programme at Nijmegen University and it is reflected in the way training and research skills are approached. The programme focuses on the analysis and the interpretation, from a social sciences perspective, of environmental problems and on the design, development and implementation, from a social and political sciences perspective again, of finding solutions for these problems. In addition, the curriculum emphasises critical academic reflection and evaluation of the analyses, interpretations and solutions that have been brought forward, be it by stakeholders, other scholars or the students themselves. In brief, the curriculum contributes to a synthesis of the skills of analysing, explanation, designing, implementing and reflecting. In Dutch: *een Synthese van Analyse, Verklaring, Ontwerp, Interventie en Reflectie*, a sequence of learning goals to which for convenience’s sake has been given the acronym SAVOIR, the French word meaning “to know”. Since the curriculum, as will be discussed hereafter, more or less consecutively emphasises these learning goals, we conceived the curriculum as a “SAVOIR cycle”. This cycle steers the content and the design of the curriculum of the Political and Social Sciences of the Environment, in that the emphasis during the study gradually shifts from the more analytical and explanatory theory and research skills, to more contemporary social change strategies and intervention skills. Moreover, in each phase, attention is paid to critically evaluating both the explanatory analysis and the strategies of change.

2. The structure of the PSSE curriculum
Besides the educational aspects mentioned in the previous section, the structure and content of the Political and Social Sciences of the Environment (PSSE) curriculum are also determined by its attainment targets (Leroy, 1996a). Much attention has been paid to the methodical and communicative skills concerned with obtaining these attainment targets. The cognitive attainment targets
essentially relate to the ability to apply relevant concepts and theories from the social sciences “sensu lato” on to environmental problems, to the social scientific explanation of these problems and to the possible strategies for change and interventions.

A particular feature of the PSSE curriculum, that we will not discuss here in detail, is its multidisciplinary character. Not only does it cover the wide field of social sciences, from psychology to public management and from sociology to law, but it also includes administrative sciences. Moreover, there is an introductory module on the scientific aspects of environmental problems and, more particularly, there are two modules that are common with the twin curriculum of the Natural Sciences of the Environment. The latter is a curriculum within the Faculty of Sciences at Nijmegen University. We discussed this unique situation at Nijmegen University elsewhere, including an elaboration of how we deal with the issues of multi- and interdisciplinarity within those common courses (Leroy, 1996b, 1998).

Inspired by the Aalborg example, we attempted to promote the coherence of the content and the synchronisation of teaching methods into the curriculum by determining overall themes and more specific subjects and issues for each semester. We will discuss these themes and their relation to the SAVOIR cycle in more detail in the next section. Both the curriculum development and the instruction took place in the form of team teaching, which in itself promotes also the coherence of the programme. Each semester has a co-ordinating theme (Van den Bosch, 1997c). The semester themes in the first part of the study (after the propaedeutic year – the doctoral phase, in other words) refer to various paradigmatic and disciplinary lines of approach in the social sciences. In the second part, the themes refer to clustered professional practices. The idea behind this is that first, an education is required in disciplinary lines of approach, so that afterwards the professional practice can be seen from various perspectives. The doctoral semesters one to three (DS1-DS3) respectively cover the themes “environmental studies: objectives and core concepts”, “social sciences and the environment” and “environment, policy and society”. The professional fields are reflected in the four specialised variants that start from semester four onwards (DS4-DS6): “environment, policy and space”, “environment and industry”, “environment and development” and “environment and social change” (see Figure 1). These variants are partially rendered by developments in the Dutch job market.

As stated before, the content of the educational programme is guided by these general themes and based on the SAVOIR cycle. As in Aalborg, each semester has a learning project in which students work together in project groups. The issues dealt with within these projects also relate to the overall semester theme. The extensiveness of these projects, which comprise 20 per cent of the semester, ensures that the students, to a large degree, determine their own path of learning. Working in project groups is seen as an important professional skill. Along with theme-focused teaching and the project, there is a limited amount of time available for studying supportive subjects such as law
in DS3, organised as auxiliary modules. Within each semester, the methodological teaching also relates to the research skills that are practised during the project. In brief, within each semester, a balance is sought between the acquisition of new knowledge, on the one hand, and the integration and the application of that knowledge, on the other. As Figure 2 suggests, the volume and importance of the courses decreases as the semester progresses, whereas the project gradually demands more time and attention.

In the PSSE curriculum, projects take less time than they do in Aalborg. The projects intentionally start from the very beginning of the semester, in order to retain their motivational purpose. The projects take a total of ten weeks at a minimum to complete. This minimal duration of the projects is, besides their motivational purpose, also of importance since students should not only gather their information from literature, but also should communicate with experts in the field and societal actors involved in the case that is being researched. The groups in which the students work on these projects are made up each semester. As said earlier, the workload of the projects is rather slight at the beginning of a semester, but gradually the project becomes more intense. The continuity of working on the project is stimulated by inserting interim assessments such as the evaluation of a work plan, a discussion on the appropriateness of a methodology, an assessment of the empirical evidence gathered, etc. The project assignment is such that it requires the application of newly acquired knowledge, either theoretical concepts or methodological skills.
The projects are research projects, which means that students are trained in the starting up and the execution (of different sorts) of scholarly research, partially guided by theory and partially practice oriented. According to the SAVOIR cycle, each of the consecutive semester projects emphasises the various basic goals of research, including the appropriate theoretical and methodological approaches. In DS1 the students make a general social scientific analysis of a certain environmental issue, whereas in DS2 they pursue a more theoretically grounded explanation of the issue. In DS3 the students are asked to generate options for strategies of change and intervention, if possible with participation of the societal actors involved. This design, we believe, creates the opportunity for students to become acquainted with a variety of research strategies and techniques, thereby gradually shifting from problem structuring, via theoretical explanation, towards the generating and the actual implementation of options for solution. During their research endeavours in the consecutive semester projects, students also gradually gain autonomy in their work in terms of the project assignment becoming less and less pre-structured, even though all learning projects are tutored by professional teachers who regularly give feedback regarding content as well as process. Finally, besides learning research skills, the projects also aim at training the students in communicative skills, not only by devoting themselves to writing reports, but also by giving presentations to their fellow students, to their teachers and to people from the professional field.

We will elaborate on the goals and issues of the consecutive projects in more detail in section 3 hereafter. We conclude this section by stating that, with all similarities in mind, it should be clear from the above that the Nijmegen projects differ on at least two points from their Aalborg examples. First, the projects in the PSSE curriculum do not emphasise the designing of solutions to real life problems, but stress the role of a well-elaborated social scientific analysis, particularly when it comes to environmental problems that have not yet been signalled as such. Second, explicit attention is paid to the comparing of concepts, paradigms and theories, in order to teach students to see how various theoretical viewpoints cast different views on reality: and indeed, the other way around – to what extent theoretical approaches differ in relevance, depending on specific research goals.

3. The semesters DS1 to DS3 and their projects in more detail
In this section we will discuss how the ideas mentioned above have been incorporated into the PSSE curriculum as a whole and into the projects in particular. For mere practical reasons, we restrict hereafter to the semesters DS1 to DS3 and their respective projects.

The doctoral semester 1 (DS1) has Environmental issues: subject and core concepts as its general theme. The courses aim at transferring basic knowledge concerning environmental issues, the way these issues are studied by various scientific disciplines, the development of these disciplines in view of the challenges of the environmental debate, and the theory and practice of multi-
and interdisciplinarity. As stated earlier, some interfaculty courses, given by teachers from a variety of disciplinary backgrounds and attended by students of our Faculty of Policy Sciences, of the Faculty of Social Sciences, as well as students from the Faculties of Sciences, for example Medicine, play a key role in this semester. In addition, PSSE students also attend a course on the scientific aspects of predominant environmental issues. The whole programme of DS1 first offers students a survey of the key concepts and theories that have been developed and used up until now in the approach and analysis of environmental issues by both social and natural sciences. On this basis, second, it is very obvious to them why environmental issues inevitably ask for a multidisciplinary approach, the various epistemological, theoretical and methodological problems of which are addressed in both the courses and the project (see below). According to the first stage of the SAVOIR cycle (analysis), the methodology in DS1 is focused on the designing of research, on the diverse definitions of the problems, including the various interpretations put forward by different disciplines, on some interdisciplinary approaches (e.g. environmental impact assessment, life cycle assessment), and on the opportunities and difficulties of the latter.

As with some of the courses, the learning project is carried out in co-operation between different faculties. The main learning objective is for students to experience the need, the opportunities and the difficulties of interdisciplinary co-operation. Therefore they undertake research on an authentic and complex environmental problem in multidisciplinary groups. Since some of them have a background in social sciences, others in medicine and others in natural sciences, they will gain insight into a wide variety of aspects, including the opportunities and problems of knowledge integration. Based on this experience, students should be capable of defining and realising a contribution to a multidisciplinary research project, rooted in their own disciplinary background, but taking into account the advantages and inconveniences of multidisciplinary co-operation.

The DS1 project is to a large extent pre-structured because, notwithstanding the project teaching in the foundation year, it is the first research project in the PSSE programme. Therefore the research problem and the procedure are more or less stipulated. The students also receive an integrative framework analysis and a case that has been pre-selected. The project requires three products: a research planning and methodological approach, a comprehensive problem analysis, and a list of considerations to be given attention to when designing possible solutions to the issue involved. Empirical evidence is gathered both from new research and from a secondary analysis of material that the teachers have compiled to make a project library. In addition to a group paper, students are required to write an individual essay at the end of the semester. Besides learning the skill of working together, students should also elaborate on the specific position and contribution of their basic discipline. The latter is what they are asked to develop within their individual essay.
Doctoral semester 2 (DS2) is labelled *Social sciences and the environment*. Students become acquainted with approaches stemming from various social sciences relevant to the interpretation of environmental problems. This is where psychology comes into play, with concepts and theories on human behaviour and the environment, on rational choice theory and other approaches. The pedagogical perspective addresses the role of learning processes, be it individually or in groups, including communication theories, the role of information on both the micro and macro levels, etc. Also anthropological and sociological perspectives are discussed, such as the social dilemmas approach, the common goods perspective, the risk society concept, etc. In brief, doctoral semester 2 emphasises the theoretical and empirical interpretation and explanation of the social causes of environmental problems, their social impacts and the social responses to them. The methodology courses, with their emphasis on both inductive statistics and qualitative research methods, support all of this.

According to the overall themes and goals of this semester, the DS2 research project focuses on the social scientific interpretation of a (local or regional) environmental problem, including its position within a more global and long-term context. Students learn how to apply the social scientific concepts and paradigms that have been told to them earlier to an empirical problem. The tutors now restrict themselves to introducing the problem, whereas the students have to structure, to analyse and to explain that problem based on the theoretical insights they judge to be the most useful, and applying the methodological approach they assess to be the most fruitful. The latter implies, among other things, the development of a data gathering instrument (e.g. a questionnaire), the organisation of a survey or a series of interviews, their analysis and their interpretation based on the theoretical starting points. Designing, implementing and managing a research strategy, including the relationship between the research objectives, the problem definition, the theoretical framework and the methodology are the important underlying goals of the project.

As its general theme, *Environment, policy and society* reflects environmental politics and policies are the key issues in doctoral semester 3 (DS3). It deals basically with the analysis and interpretation of environmental policy that is initiated and carried out by different players (government agencies, industries, environmental action groups and civilians) at different political levels. Environmental politics and policies are not only looked on as well-thought strategic interventions, to be evaluated in terms of effectiveness and efficiency, and to be analysed in terms of steering, governance, management etc; they also have to be regarded within their societal context of changing relationships between the state, the market and civil society, within the context of processes of globalisation, individualisation, etc. (Van Tatenhove et al., 2000). The main concepts and paradigms here originate from political sciences and sociology, from law and economics, from international relations and public administration. The methodology in this semester goes across the policy cycle (from problem
structuring via scenario development, from policy instrumentation to *ex post* evaluation), initiating students in the variety of methods and techniques that can be used in the consecutive steps of a policy process.

In the DS3 project that parallels the courses just mentioned, students quite logically are asked to analyse a specific environmentally relevant policy field, varying from local public transport to international arrangements on biodiversity. The first aim is to analyse the policy developed and implemented hitherto, to explain its main characteristics as a result of the predominant problem definition, the power relations between the actors involved, recent changes in the overall political context, etc. Second, students are asked to assess those policies and to come up with suggestions for probably more effective alternative strategies, some of them feasible, others useful as contrasting and therefore thought-provoking scenarios. The project thus requires a policy-relevant structuring of the problem, a well-elaborated assessment of prevailing policies within their political context, the development of both likely and unlikely scenarios, the designing of alternative strategies, etc. Students therefore in each phase need both theoretical insights and methods of policy analysis. The results of the project, including the recommendations drawn from the research outcomes, are presented and discussed in a sort of public forum in which the stakeholders are invited to participate. The latter of course allows students to get feedback from the actors involved on their findings and proposals, thereby enhancing the real life character of the project. In some cases, students came up with proposals that, though modified, turned out to be more feasible and even more effective than the strategies the stakeholders themselves dared to imagine.

### 4. The PSSE curriculum and the search for sustainability in higher education

Although the PSSE curriculum has been redesigned from 1996 onwards as depicted above, it builds on a much longer tradition and on former experiences. Nijmegen University had a four-year programme in Environmental Geography from the early 1980s onwards, a programme that directly inspired both the Environmental Policy Sciences programme initiated in 1989 and the PSSE curriculum discussed here. As a result, and from 1989 onwards, Nijmegen University lived the quite unique situation of having two full-time and four-year programmes in the environmental field: the programme of Environmental Studies within the Faculty of Sciences, and the programme of Environmental Policy Sciences within the Faculty of Policy Sciences. They both started in 1989-1990. The former programme, quite obviously, primarily focused on the natural sciences perspective, the latter on the social and political sciences perspective. But right from their start, they had some common courses in which, among other things, the inevitable need for a multi- and interdisciplinary approach of the environmental issue was at stake, as we indicated above.
With this tradition, one can argue, the environmental sciences curricula at Nijmegen University anticipated the increasing attention paid to the environmental issues that emerged in the late 1980s and the 1990s, including the very successful launch of “sustainability” and related concepts. Even before they were so successful internationally, these concepts, their theoretical and normative backgrounds, their operational relevance and their limitations have been discussed in a variety of courses: and they still are discussed. Apart from the interdisciplinarity issue, the educational coverage of which has already been discussed above, and restricting ourselves to the PSSE programme here, we discuss sustainability from different perspectives in different courses: we analyse the successful emergence of the concept, and the advantages and risks of that success; we discuss the ecological, the economic, the social and political dimensions of the concept, and the uneven way these dimensions can be and actually are used in practice. We discuss its implications for environmental policy making, both on local (LA21), national and global levels, including the impact the sustainability concept has had on transnational negotiations and agreements. And as we have discussed above, the PSSE programme as a whole stresses the social change character of the idea of sustainable development, including the need for social learning, for political capacity building, for self-governance, etc. We thereby pay a lot of attention to the possible, albeit limited role of politics and policy as conveyors of strategic social change. But we also stress social and political inequality, on both local and global levels, as major threats to whatever efforts towards sustainability.

Without pretension, we think Nijmegen University has a pioneers position in environmental education. That is, however, not to say Nijmegen University meets the goals and standards set in the pursuing of sustainability in higher education. Not really surprisingly, having two, four-year programmes in environmental education may even hinder further efforts on that track. Nijmegen University underwrote the Copernicus Charter and appointed a person responsible for its local implementation. Within the Dutch context of a highly professionalised environmental labour market and within the local context of a university having two full-time programmes dedicated to environmental issues and including sustainability issues, some tend to regard the issue as being sufficiently covered and to consider further efforts as superfluous. Having said that, though, we believe Nijmegen University is in an excellent position – in both experience and expertise – to further invest in different sorts of education on the environment, on sustainability and adjacent issues.

5. Conclusions
The redesigning of the PSSE programme was based, first, on about 15 years of experience in environmental education from a social sciences and multidisciplinarity perspective and, second, on a critical survey of currently dominating trends in teaching theory, particularly the concept of “situationed
learning”. Though the latter idea of learning through confrontation with real world problems was inspiring, we still stood some distance from what we regard as an instrumental view on knowledge in problem-based learning. Therefore, learning projects with concrete and real world cases are paralleled not only with courses and training in methodology. Techniques and skills are practised in the context of courses on different theories, confronting students with the pluralistic world of paradigms and concepts.

The SAVOIR cycle first of all reflects our view on the different roles of science and knowledge, *vis-à-vis* real-world problems, in particular environmental issues: an interplay of analysis, explanation, design, implementation and evaluation, preceded and followed by reflection. Second, this same SAVOIR cycle formed the basis for the designing of the consecutive semesters, each of which focuses on one of these roles of scientific knowledge, paying due attention to a comprehensive set of theoretical concepts, linked with a specific set of methodological skills and trained in a well-thought out project.

Although we deliberately restricted this analysis to the first half of the programme (semester 1-3) in this paper, we hope that it is clear how it contributes to the main objectives of the PSSE programme as a whole: giving students insight in the possible and actual role of the social and political sciences in the environment and enabling them to fully deploy and use that role in a variety of professional roles, be it in the environmental or adjacent fields.

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