The impact of I(C)T in spatial planning education, 25 years of blended e-learning

Knaap, W.G.M. van der

This is a "Post-Print" accepted manuscript, which has been published in Proceedings of the EDULEARN14".

THE IMPACT OF ICT IN SPATIAL PLANNING EDUCATION

25 YEARS OF BLENDED E-LEARNING

Dr ir Wim van der Knaap

Wageningen University, Land Use Planning group (The Netherlands)
e-mail: wim.vanderknaap@wur.nl

PAPER IN PROGRESS *(ask author before quoting)*

Abstract

The Wageningen spatial planning education curriculum is based on a mix of decision-oriented and design-oriented approaches. It is also intertwined with a wide range of E-learning options. The E-learning environment consists of a spectrum of applications such as model studies, spatial analysis using GIS, scenario studies, imaging results or support in the educational and the planning process. At the end of the 1980's already divers applications were intertwined in the training of planning students at Wageningen University. What has changed over more than 25 years in spatial planning, in computer applications, and in its related curriculum structure? This paper wants to address these experiences. Several courses on spatial planning at Wageningen University are used as examples, some courses from the end of the 1980's and some recent courses. An overview is presented based on experiences during this 25 years of education in spatial planning and the role IT (the computer) has had in this process. Developments in IT went fast, but also the way we deal with planning issues has been in transition. Looking back, the spatial planning process itself changed from a technocratic to a more sociocratic approach, from top-down and sectoral to co-creation planning, from only an economical (profit) rural focus towards including people and planet aspects in a growing metropolitan environment. In the mean while computational possibilities for supporting different planning related aspects grew enormously. Software is much more advanced (from simple raster data calculations to 3D or 4D representations, often applied in many forms of Planning Support Systems); the handling has much improved (offering sometimes too much functionality for class circumstances); the storage capacity and speed of processing increased enormously (creating also enormous data overflow); the digital accessibility of articles, reports, books and journals took a huge step (creating questions what to choose for references; information overflow); new instruments to replace 'paper or analogue oriented' processes into digital processing were implemented (eg. Touch tables and serious gaming). And new IT developments are knocking on the educational door, such as VR (virtual reality) and AR (augmented reality) in combination with MOOC (massive open online courses). Until now all these IT related changes also transform the planning education itself. It requires a constant refocus on instrument training in combination with the changing planning process focus. It also requires a shift and an intensification in knowledge, cognitive and attitude skills for the students, to deal with more complex options and reflective approaches of both the spatial planning process as the supportive instruments.

Keywords: Technology change; Spatial Planning education; E-learning; dynamics in spatial planning.

1 INTRODUCTION

This paper discusses several developments over the last twenty-five years in supportive E-learning activities when applying different ICT components within the spatial planning curriculum at Wageningen University[1]. The spatial planning paradigm (be it theory or practice related) has gone through major changes. It went from a technocratic "blue print" planning (until the eighties) via sociocratic "deliberative/communicative" planning towards currently a more community based planning or also typified as co-creation (see e.g.[1] [2]). Dutch spatial planning was formerly focussed on the growth assumptions, now stabilisation or even diminishing / shrinkage are important issues. Large integral projects are more or less banned, because they do not have the expected impact, were too expensive and take too long to show results. The planning focus shifts towards small scale initiatives, like neighbour-

[1] The name of the University and of the spatial planning program also changed several times during this period.

hood energy communities, urban agricultural developments, ecological self-management and local development (crowd)funding.

Also Information and Computer Technology (ICT) experienced enormous developments. Processing became much faster, many options and new applications became available and were implemented, hardware devices became much smaller and sophisticated. People worldwide got connected with all kind of small hand held devices, such as smart phones and tablets, having more power than the early massive computer systems. The basic concept, however, stayed the same, the binary processing of 0 or 1. The feel and look show many new and different appearances. Much more variances in simulating reality became available (from 2D GIS to 3D GIS – Geographic Information Systems, PSS – Planning Support Systems, Virtual Reality and Augmented Reality applications) (see e.g.[3], [4], [5]). Many of these possibilities are also applied in an educational setting. Information technology gives a boost to the mutual connection between groups and users in the new planning process and it creates a new kind of community sense [6]. But as Batty ([5], p357) mentions we've a long way to go, "*Computer interaction is still extremely primitive and the task of translating relatively abstract ideas into a form that enables much wider interactive use is a major issue. In fact the challenge is not one of hardware or technology or even of the tools that we now have at our disposal, but one of enabling the translation into a form that is useful to a wide range of users who are somewhat different in their expertise and interest from those who are charged with driving the formal planning process.*"

In the early years of the computer use the ICT applications were very supportive for and well in line with the "blue print" planning approaches. Different software models and applications could support the "predefined paths of planning". About twenty-five years ago not much was available for the educational planning setting, only a few applications, such as spreadsheets and text processing combined with mainly raster GIS. Also some research oriented models were embedded during classes, either showing options or a first glance to use it. Students should get familiar with these possibilities of course, the ideas behind the models and its options and how it functions; it should not stay a black box for university students. An e-learning environment was in progress, but only bits and parts were available. The worldwide internet was not even graphical, only text oriented. Within the planning courses these new ICT options were recognised and teachers started to apply these options, mixing it with classical educational principles and tools. We created a kind of blended e-learning environment. Blended learning in this paper is to be understood as learning activities in a classroom setting mixing it with computer technology (cf [7]). Tools and media are mixed in an e-learning environment, combining it with different didactic strategies. Also distance learning could be part of it. Blended learning is always a combination of technology, instruction typologies, didactic principles and strategies.The terms "blended," "hybrid," "technology-mediated instruction," "web-enhanced instruction," and "mixed-mode instruction" are often used interchangeably in current research literature (see e.g. [8]). E-learning is this paper is any learning activity using a computer network for distribution, communication and facilitation; it contains an electronic component. Often e-learning is linked to distance learning. In this paper this distance aspect is not important, I will focus on a campus setting with group oriented courses. A third term to clarify is the use of the acronym IT or ICT. IT means for me only the hardware, the computers (or better the devices in all different forms) and its related infrastructure. ICT is in this paper to be understood as using Information Technology via software for any purpose by people having some sort of Communication.

The aim of this paper is to discuss changes that took place in spatial planning and its education when intertwining it with ICT options. Some of the related questions are: Do changes in planning paradigm and in ICT developments influence the curriculum and the approach of students? Does more software options also mean a better didactic approach? Are the required competences of the students met with these new options? Did ICT increase or complicated the learning curve and changed the didactics? Is the logistics of a course improved or altered? Are more didactic options available? What kind of core competences do planning students need and how can ICT support this training? Does social media increase or diminish the relevant options?

In this paper first the spatial planning background and its changes are clarified, followed by approaches to include in spatial planning education. In the next section the use of ICT in planning classes is illustrated, first 25 years ago, followed by a description of current approach. The paper will end with a discussion about a comparison and concluding remarks related to the aim of the paper.

2 SPATIAL PLANNING AND ITS TRAINING PROCESS

2.1 Changes in spatial planning

Within the current Wageningen approach of Spatial Planning the object of study is the metropolitan landscape ([9], [10]). Spatial Planning deals with landscape processes, balancing natural processes (physical, ecological) and human perspectives (societal, policies) and its mutual interactions ([4], [11]). The landscape encloses the reflection of these interactions, including its limitations, and specific internal and external dynamics. Spatial planners try to facilitate the changes taking place in this interaction area. Aside from facts, values matters too. Normative approaches are important; we're dealing with humans, whose behaviours are driven by norms, values and convictions ([12], [13]). De Roo *et al*. [14] describe it as "*Spatial planners create bridges between 'what is' and 'what could be', 'what should be' and 'what is desired'*." In other words, they try to connect and combine past, present and future for each aspect and (planned or autonomous) development including different time-scales and values. Timmermans ([15], p24) affirm the time scale when stating that history matter and time is irreversible, but he also mentions that "*initial conditions are highly important for further developments*", both natural and societal conditions. But the future is by definition uncertain and we have to deal with this somehow ([2], [16]). Both individual and public interests are supposed to be combined. The societal and natural environment should be matched and its conditions should be met as best as possible. Especially in the Dutch landscape it is a challenge to carefully combine competing claims (e.g. from water, nature, food production, urban developments, infrastructure) in order to create for people and planet a sustainable and coherent environment. A regional approach of planning is important as is resilient thinking to understand conflicting situations within social-ecological systems, and especially where decision-making over how to achieve sustainability is concerned [13]. Decision-making will require the facilitation of a fair amount of learning, participation, negotiation and cooperation amongst competing interests and the parties or actors that represent them.

The (Dutch) Spatial Planning practice has become much more complex, with a large diversity of rules and laws, many governmental layers (from UN and EU to local representatives), many different stakeholders (public and private) and changing arguments (food production, environmental quality, sustainability, energy supply). Spatial Planning has two faces: a content side and a process side. Content is about the spatial organisation and design in a landscape for specific (mix of) land uses; it is more about the natural side of planning. The process side deals with how the steering of the spatial organisation and procedures should be managed [17]; it is more about the social side of planning. These two sides could also be identified in the approaches of spatial planning as design-oriented planning or as decision-oriented planning (see [10]).

Spatial Planning in various different European countries shifts from a top-down institutionalised approach ('blue-print'; technocratic process) to a bottom-up collaborative process with different accents of participation, from informative to co-decisive and organic planning (via a sociocratic process) (see e.g.[1], [18], [19]). Also responsibilities are moving within this process from national to a more regional and local level, using a network approach. Long-term visions are mixed with short-term developments to adjust to societal needs (see also [20]). As a result of this process during the past twenty years a shift from content issues took place towards an overwhelming emphasis on processes of planning and the interaction of stakeholders within these processes. But in reality a mix of natural sciences combined with social sciences now seems the best option to support the new process in the "fuzzy middle" between the technical and communicative realms (see also[1], [15], [21], [22], [23]). Using a co-creation approach citizens, local and regional governments, and entrepreneurs start an exploration for a new desired situation, in which each partner can have more input but which also creates more responsibility. A greater diversity of routes and outcomes becomes possible, not just one solution, given the set of many opinions and values. How facilitating governments should or could be? Are current administrative borders still relevant and functional? Should also supra-regional or international aspects be considered? Are the local and regional representatives the only players? The decision moment seems to get more importance, when we're trying to deal with complexity and fuzziness. Time, uncertainty, non-linearity, development and progress over different levels are all combined in a process to find a new equilibrium ([1], [15], [24]). The spatial planner who used to be a creator and later a mediator, becomes a landscape transition manager. Agreements about ends and means are important elements in this process and lead to different styles in planning approaches (see table 1).

Current ICT developments can also be linked to the two sides of content and process, respectively for modelling options and communicative aspects. Because of the technical and social developments the social media is very rapidly gaining impact. The social media as participative instrument could best be

applied at the process side [27]. While the more calculating, modelling and evaluating approaches best fit at the content side. The graphical representation and visualisation ICT options are for both side very interesting, be it to discuss and promote ideas (more process side) or explore design options (more content side).

Table 1: Overview of differences in planning styles (based on [25] and [26])

		Certainty	*Uncertainty*
MEANS / FACTS / KNOWLEDGE	*Not (yet) know how to achieve*	*(Limited) options Create alternatives Debate about options Learning process Communicative planning*	*Search for order in chaos Self-organisation; Wicked problem Complexity and Co-creation*
	Know how to achieve	*Technical solution Rational planning*	*Bargaining process Political issue Deliberative planning*
		Agree on what is wanted	*Don't agree on what is wanted*
		ENDS / AIMS / VALUES	

2.2 Spatial planning education

As mentioned by Bertolini [16] *"Planning students must [..] learn to cope with this constant changing, intrinsically uncertain object that the future is. They must become "future proof" and, because the future is uncertain, they have to "learn how to learn", and "learn how to keep learning"*. " The way students learn and keep learning is very important. Spatial Planning is an academic discipline as well as it is practised as profession ([16], [23]). So at the university both theory (reflection on planning; the planning of planning) and the act of planning are important and should be part of the curriculum. For both planning styles descriptive and prescriptive approaches can be applied and should be trained. Within the act of planning the planner or the planning process is central and is direct, specific and contextualised in a local environment (first order planning) [23]. The planning of planning (second order planning) is concerned about organising very divers bottom-up inputs into a cohesive plan.

In this section some aspects will be highlighted related to learning processes in a spatial planning setting. The first subsection briefly discusses some learning steps to consider. The second subsection gives a background about problem based learning, a popular approach for spatial planning training. The last subsection deals with a short history of Planning Support Systems (PSS) as one of the drivers in spatial planning and its education.

2.2.1 Learning steps

Kemp and van den Bosch [28]) applied the learning-curve approach to explain and describe sustainable transition experiments. They distinguish three learning levels: instrumental, conceptual and social level. These levels could be well applied in learning about spatial planning.

- Instrumental learning encloses learning about instrumental tools, solving technical problems and the effectiveness of an instrument or action. It is also typified as first-order or single-loop learning. It is not about evaluating aims and existing activities, but about technical aspects.
- Conceptual learning includes the learning about a new concept (for instance system innovations, participatory developments or transition management).
- Social learning is societal oriented learning; it is about changes and developments in societal views and understanding, norms and values, responsibilities, new attention points and framing. You end up with defining a societal research question and task.

Within conceptual and social learning a reconsideration must take place of existing frames of references, basic assumptions and theories and is often identified as second-order or double-loop learning. The learning processes always occur in a societal environment with many different actors. The instrumental learning can be linked to the first-order process of planning, learning about the act of planning and the role of a planner. Also conceptual learning can be linked to this first-order process, but it could well be part of the second level of planning, when thinking about reframing or conceptual views on planning. The social learning process is also a mixture of first and second level, but with much more

focus on the second part. Students have to be trained in understanding and acting in society (as instrumental learning), but should be much more reflective about it.

Another learning approach has been introduced by Dreyfuss and Dreyfuss, already in 1986 (see [29], [30], [31]). It is about offering a rationale for human cognition and expertise and is about skill acquisition and transition from being a novice to an expert. The five stages are novice, advanced beginner, competent user, proficient user and expert. Geldof ([29], p 81) describes the three main levels as: "*All learners start at the level of the novice. Characteristic of this first level is learning rules that can be applied away from the context. Someone who is learning to drive a car will practise steering and shifting gears [..] knowledge important in both slow and heavy traffic. […] the level of competence requires a correct interpretation. Competent people can carry out complex tasks. They weigh different options against each other, depending on context, and take decisions. They still do this analytically, based on rules. Competent car drivers shift gear at the right time and choose the smartest route using the information handed to them. […] People who reach the highest level, the level of expert, no longer act exclusively analytically. They oversee 'the whole' and regularly take decisions using their intuition. They use their implicit knowledge. The experienced car driver shifts gear automatically and can prevent accidents in critical situations, [..he] can react alertly in unexpected situations.*" The other two levels, advanced beginner and proficient user, are in-between stages having aspects of both surrounding levels.

These three main actor levels can be associated to the three learning-curve levels. The novice level is related to instrumental learning. The competent level can be linked to conceptual learning, while the social learning requires expertise from different levels and angles, next to competent input.

We can also apply the learning levels to the different planning styles as presented in table 1. Learning about spatial planning, either as act of planning (planner-centred and planning-centred) or as reflection on planning, contains also divers stages each with a predominant impact (see table 2).

Table 2: Differences in planning styles combined with predominant learning levels

		Certainty	*Uncertainty*
MEANS / FACTS / KNOWLEDGE	*Not (yet) know how to achieve*	*(b) Limited options; Create alternatives* *Learning process; Debate about options* *Reflection on planning* *Conceptual learning /* *Competent actor*	*(d) Search for order in chaos; Wicked problem* *Self-organisation; Complexity and Co-creation* *Reflective and Reflexivity* *Social learning /* *Expert actor*
	Know how to achieve	*(a) Technical solution; Rational planning* *Act of planning (planner and process centred)* *Instrumental learning /* *Novice actor*	*(c) Bargaining process; Political issue* *Reflection on planning* *Conceptual learning /* *Competent actor*
		Agree on what is wanted	*Don't agree on what is wanted*
		ENDS / AIMS / VALUES	

Within the curriculum the students should preferably go from (a) to (b) or (c) [or the other way around or mixed], followed by (d) in the table, building up expertise and insight. In practice (work) the same routing will normally take place, building up expertise while doing the job.

2.2.2 Problem Based Learning

As noticed before spatial planning students should design and facilitate future developments and be receptive to unforeseen situations ([15], [16]). They have to deal with uncertainty and non-linearity in processes, especially when thinking about innovative approaches to support new developments and find solutions for specific local and regional issues. Applying a Problem Based Learning (PBL) envi-

ronment is very suitable to learn about spatial planning situations ([10], [16], [32]). Within a PBL ill-defined or wicked problems, which planning situations actually are (see also (d) in table 2), can be tackled. Before entering the PBL-ateliers students have to acquire certain basic knowledge and skills (the instrumental level). Using a rational planning approach is very suitable to make these first steps. A PBL-environment contains several aspects: it starts with a problem description, that should be recognised and interpreted (for instance which frames are applied or who has power). This problem can be a real life issue, such as described by Carsjens *et al.* [10] or an imaginative, constructed, issue (more of a laboratory setting). The students work in groups and search together for specific solutions or chances for change. "Out of the box thinking" should be no exception, especially because the future is uncertain and new ideas and approaches are often useful because the old ones most of the time didn't work. The students depend in this process on their basic training in skills and knowledge, but they also need their own attitude and strengths, being member of a group with a specific role. The student has to act as a planner (manager of change). When doing a PBL atelier at the end of the curriculum it will also have great resembles with social learning, especially when students cooperate with local people and their knowledge is used (see for some good examples of these kind of social learning environments, [10] and [32]). In earlier studios students can practice basic skills and build up conceptual ideas to prepare themselves.

2.2.3 Planning Support Systems

There are many common software products applied in an educational setting, such as a word processor, a spreadsheet, a statistical program or a supportive learning environment like Blackboard or Turnitin. Specific ICT tools are developed and applied for spatial planning practices, the so-called Planning Support Systems (PSS) (see eg. [3], [4], [5] and many others). PSS are also used in educational settings. Already in the sixties is was thought that the plan-making process could be totally automated, including to compare alternative possibilities, optimising it through iterative steps [5]. But soon this technical idea was rejected, because of required creativity and insight knowledge, that could not be offered by a computerised approach. The informative character of computer models however is still applied to generate and evaluate future plans. Next to a rational analysis instrument the systematic approach can also support a deliberative and participatory purpose. There are many different systems available, from large-scale one-off systems to more oriented on qualitative visualisation, analytical approaches and supportive dialogue techniques. As spatial planning also is very divers in the plan-making so are the PSS tools, following also the scales and topics to be covered. Also the type of processes influences the sort of PSS to be applied, from systematic procedural to intuitively and unconstrained activities. It depends on how well the problem is articulated, which actors are involved with what kind of interests. But should each of these PSS options be getting attention in the learning process? Or is a general knowledge sufficient and a more "black-box" approach could be applied?

3 SPATIAL PLANNING COURSES OVER THE YEARS

3.1 Courses at the end of the Eighties

The text of this paragraph is mainly based on my own (early) experiences, and the papers by Graumans *et al*. [33] that describes developments until 1987, and by van der Knaap and van de Veer ([34], [35]), describing ICT components in specific planning and design courses. In the eighties the educational use of a computer was started, mainly by pioneers. Several projects started at Wageningen University to look for ICT options and applications for an educational setting, either creating software models and applications or through Computer Assisted Instructions (CAI). Before that period the computer was used only to demonstrate the possibilities and some results (complex in those days, very simple now). The handling of a computer was a privilege for experts, creating punched cards and feeding it into a card-reader that translated it into machine-code. In (university) classes software products and models were analysed on their methods and procedures. No black-box situation should exist, the student should know how software functions and how results were calculated (and even were manipulated, mostly because of software limitations). Next to dissecting of and reflecting on software models and practising with these models, also tutorials, drill and practice exercises, dialogue and inquiry software and simulation and games started to become common practice in education. All these computer supportive environments were in the eighties rather primitive compared to current products. Special interface software had to be developed either using generic programming languages (like Fortran or Cobol) or specific educational authoring languages. Also introductions for specific tools (databases, CAD/CAM) and hardware (like a digitizer) were provided. The main learning goal was to

teach instrumental knowledge and a tiny bit of conceptual knowledge on how to apply the products and results in a planning process.

An example in which a predecessor of a PBL class is simulated showed the straight instrumental learning approach, based on technological knowledge over soil, water, agricultural demands, birds and vegetation impacts, combining different software models [35]. Going through 10 assessment steps the student was guided towards an optimal end map. The basic system used for storage and processing was a raster based Geographic Information System (GIS) in combination with a spreadsheet for the hydrological model and a vegetation analysis model. University students had to understand each step and how each applied model operated and "communicated". This required some conceptual knowledge, but the main focus was on how each model functioned and how to feed results into the next step. The analytical character of the course was important and an automation of the linear process seems the optimal tool.

Other agricultural related optimisation models were also applied in other courses. A training program around hydrological principles was developed using an authoring language. The computer and the applied models were supposed to be the supporting instrument in the process of planning and decision making. Politics and society should provide the required criteria and restrictions to be implemented by the experienced designer/planner in different scenario's, after which politicians should make a decision. However, because of little to none experience with a (large) computer and supporting software models, the attention of students was merely on handling the machine and its software to fulfil the required tasks instead of focussing on the process itself. Also the available machines and network connections created extra problems, often the connection was not stable or one of the computer machine crashed. Also not enough computer terminals were available for the growing number of students. This created annoyance and delays. Staff to develop new applications was not appointed. Often just one pioneer was active, while actually you need a content expert, an educational expert and an ICT expert. Time to develop new and stable educational products was underestimated immensely. For one hour of computer supported education up to 300 hours should be invested; especially thinking about the different screens, their layouts, and the handling of many different error options was a enormous job. The offered software in those days to develop CAI was either user friendly but not flexible or flexible but not user friendly enough. New hardware and software updates also required constant device and content attention of the staff involved. Technical knowledge is essential for the staff or otherwise a technical assistant is a necessity. But nevertheless, the students appreciated the multifunctional and "modern" approaches of their planning and design classes. They got a better insight in the complexity of spatial planning and design and were enthusiastic about trying to find new solutions, because they could perform the required calculations in less time. Some students however forgot to study the theoretical aspects and just hit the keyboard without actually knowing what they were doing. Starting with a theoretical exam reduced this problem. The success of applying CAI or related products depended also heavily on available (and working) computer facilities.

3.2 Courses around the millennium

After these early pioneering years of educational ICT applications, changes in software and hardware were regular business and somehow integrated in each (new) course. Developments in hard- and software generated new possibilities, more memory and calculation power became available for smaller machines, older software and hardware products were no longer supported and had to be replaced. After the central computer systems, like the DEC or VAX machines we used, personal computers and stand alone specialized machines become trendy. ICT and course management also changes accordingly. This meant a constant (almost yearly) change in course material, new set-ups related to documents and processing of steps, also related to new software releases. New possibilities and options were opened up. The internet was not only text oriented anymore, but much more graphical oriented. Scientific and daily popular information through reports, journals, articles and papers are available for everyone. Large databases with enormous amount of data can be consulted. Software becomes more sophisticated and smoother. Specific geographical software, like ArcInfo, becomes a standard. Students apply the digital options in class and for their individual thesis work. Word processing is a normal activity. The spatial planning domain is growing from only straight forward instrumental towards a more communicative and complex oriented field. Text itself is not enough anymore, graphical and mapping options become the new standards for planners ([36], [37]). New (planning) support systems are developed, like the electronic meeting system or a group decision room, combined with interactive GIS with three dimensional options, and sometime time as a fourth dimension is also added. Students get training in different tools and the focus on purely instrumental is moved towards more conceptual. Also basic training in using a computer and related software is becoming

obsolete. However, theoretical knowledge about spatial planning and design processes still needs attention and can be supported and illustrated by applying modeling options. Also getting familiar with the internet possibilities is a growing new phenomenon. The conceptual learning activities are more prominent on the educational agenda.

3.3 Courses in 2014

Over the years the relationship between spatial planning and (Geo-)ICT has weakened [38]. Both worlds have developed themselves in a different direction. Within spatial planning participation and communication are the magic words. Civilians, policymakers and scientists are going through different learning stages to support and shape this new process. Geo-ICT actually offers only more available data and more sophisticated software instead of new options and insights in the complex interactive landscape and societal processes. There is also an overload of information available through the internet, with many articles, blogs and opinions, and the huge data bases. Google maps and other interactive spatial systems are common goods. Data, images and results are collectively shared and modified by using clouds, wiki's and drop-boxes. On different moments in the planning process new or other information and support is needed, either qualitative or quantitative. The whole information train should be applied more scattered instead of straight forward. No linear process should be trained, but more a fusion strategy of different approaches and information, also dealing with different frames of participants in the planning and design process. This has consequences for the curriculum of planning students. The instrumental learning approach still is basic, but quickly overruled by conceptual learning and even the first steps of social learning. The current courses focus more on an overview of a variety of methods, model analyses and information overload or support the students how to handle, interpret and apply different sources. There is also an integrating educational learning environment offered using the Blackboard Environment combined with Turnitin software to check for (scientific) plagiarism of the produced reports. Furthermore, to get familiar with the social learning process an exchange from a practical situation and with practitioners is important. Several of these new options were described, integrating science and practice in a Problem Based Learning Environment (PBL) ([10], [32]). In these real life environments students can safely experiment with the skills to be required. They are also encouraged to come up with out-of-the-box solutions, especially to inspire practitioners who are somehow caught in their daily approach.

Modeling and statistical analyses, combined with divers supporting ICT tools are trained and applied, like mapping software or Indesign to create images of new plan-situations. Students learn how to deal with tools like a touch table or an agent based model. They also have to deal with the information overload through the internet, to make distinctions between scientific and popular sources. Students create their own Wiki environment, combine it with clouds and blogs using their own laptops, and communicate in groups with their smart phones. Blackboard is offered by the university for a general educational setting. Presentation and discussion skills have become important elements as a result of the changes in spatial planning practice. New ICT technology offers options that are capable of approaching the real world, using for instance Virtual Reality (VR) or Augmented Reality (AR) settings. However, ICT cannot (yet?) simulate real life situations. The costs to create such an environment, comparable to movie-qualities, are also gigantic for just a few moments of education. Next to the practical link a scientific reflection has to be trained. Students have to reflect on the planning process itself and their role in it as a planner. They have to develop a more reflexive attitude, becoming a more competent actor to be able to function in practice. Knowledge and experience with ICT planning oriented tools stay important basic elements in this process. ICT can partly support this learning process, next to exchange interaction experiences and communicative capabilities. The management part still requires a growing attention, new software updates but also website addresses change regularly and too often, creating unexpected situations. For planners this is actually an unintentional learning environment, because they have to learn how to deal with sudden new situations. In this respect the regular ICT-changes are perfect illustrations of unexpected situations. There is no cooking recipe, the students must know about the ingredients and their impact, but have to prepare the meal themselves in cooperation with other participants, from a quick snack to an extensive high quality dinner.

4 DISCUSSION AND CONCLUSIONS COMPUTERISED SPATIAL PLANNING

In the introduction several questions were put forward about the changing role of ICT in spatial planning education. In this section I want to give answers to these questions and draw some conclusions.

4.1 Discussion

In the eighties, at the start of implementing ICT in classes it was a privilege for experts. Changes in ICT developments moved the expertise towards a more proficient or even a competent user, partly because of daily usage and a more user friendly working environment. The changes in the planning paradigm requires other skills to be developed. The curriculum of the spatial planning program had to be more adapted to these new planning skills. ICT developments, such as the internet or VR, support this process more adequately. On the other hand more ICT options in software did not enlarge the didactic approaches, it made it more complicated, as from an instrumental point of view. How can you tackle the information overload or the 'big data' issue? Modeling options grew enormously because of increasing calculation power, creating immense models that are too complicated and difficult to dissect and understand in a short period of available classroom time. Do we actually need more options or sophisticated software such as VR and AR to reach more landscape reality? Does it restrict or increase creativity to produce 'out of the box' solutions? At least it requires a new reflective approach on how to operate in a more extensive automated environment and the didactics has to be altered.

The changes in spatial planning approaches, towards a "manager of change", also requires new personal competences (related to attitude, knowledge and skills) to be trained. ICT tools can help the students to gain and support this expertise, but then much more extra time should be invested in tailor made products (as it was already in the early days with CAI). You cannot simply apply a software product like an off-the-shelf product for a production environment, especially when it is a once-a-year product. The ICT developments complicated more the learning curve, because more attention has to be paid to the handling of the menus and options. Also the logistics of a course had to be altered because of the new options. The impact of social media is not yet directly visible, but as a societal phenomenon it should be part of the spatial planning curriculum and how it might influence and support the planning process.

The supervisor/teacher needs to know more about software and hardware options, in order to implement it successfully in courses. How much does (s)he need to be a ICT-product specialist and are regular updates necessary to require new in-depth knowledge related to research and study? And how about a Blackboard learning environment? It can stream the information process and offers a platform to exchange information with students. Support should be adequate by professionals who can understand the teachers needs and wishes; it should not be a technocratic nerd. Also software updates should depend on specific quality improvements, a stable working environment (with a stable feel and look) for a few years is required for courses that are provided only once a year to prevent too much maintenance work to be done by teachers. This is also related to the changes in general software products and web-links. Not all updates are needed. New ICT products are often created by IT-specialists and the market, but take relatively too much time to implement each year. We have to think about its educational use and not every new product is useful. The new Massive Open On-line Courses (MOOC's) are not an option for spatial planning courses in a PBL setting. MOOC's are useful only for large group instruction and explanations; real interaction is quite difficult. The direct (face-to-face) interaction between students and with practitioners is an important element in PBL. Other digital instruments can better support (the preparation of) this interaction.

Another question that can be put forward is how many tools and approaches can be explored in a few weeks by the students, without having a 'system overkill' and still having a reconnaissance of the impact and knowledge gained? Do we need to train in academia tool specialists (menu-driven knowledge) or is awareness of options enough? The overload through the web in the data and information jungle can be tackled through specific moments intertwined in a PBL setting. Students have to understand what is scientific agreed upon and useful information and what is garbage. Within the PBL setting societal and practical experiences can be experienced, confronting and discussing scientific models, analyses and graphical output with the 'outsiders' of the classroom. This creates a productive and reflective learning environment.

Looking back we can observe that over the last twenty-five years we moved from instrumental learning through conceptual learning and reflection towards social learning. This last stage seems to require also enough reflexivity from students, being more of an expert actor instead of just a competent actor. To support and train this new applications should be developed.

4.2 Conclusions

The developments in ICT and the Spatial Planning paradigm show growing options and growing complexity. This requires adequate competences to be interwoven in planning education: focus on com-

plexity and reflexivity together with e-learning tools and learning environment. Students have to be aware of the constant changes in planning paradigm as about developments of software and unexpected situations during a planning process; they have to learn and keep on learning to deal with these uncertainties (as a general planners objective). Using the constantly changing software and hardware offer also options to put this changing aspect on the students agenda. ICT maintenance and updates (or even downgrades – not working operating systems like XP or vanishing websites require constant attention of teachers and students. Do (ICT-)managers working at universities also need educational background and training for insights in the process? Do teachers need to know more about ICT and its options? Balancing these questions will always be important and should feed the communication process between these groups.

The new ICT options and extensions created growing complexity in the practice of teaching spatial planning, either content related, competence oriented, skills enlargement or practical maintenance. The spatial planner today changed from applying top-down steps towards a manager of changes. The spatial planning educator changed from instructing how to master top-down steps and straight forward theory towards managing and balancing ICT-tools combined with new planning competences. Can you support and practice planning of landscape and society developments with e-learning tools? Yes, but with prudence combined with acknowledgement of sufficient time input from teachers and managers.

5 HOW TO CONTINUE

New changes in computer use are knocking at the educational doors or already made an entrance. These concern tablets, smart phones, interactive (distance) learning, dealing with own devices, supportive software and course related group work. New competence skills in negotiation and group processes are offered, next to ongoing insights in content and processes. Also PSS developments become focussed more on interactive planning. Or as Batty [5] states: "*But so far, the idea of a process of planning entirely supported in the online world remains fanciful. However, information technologies are now available to generate truly interactive problem solving and analysis. This is part of 'doing science interactively in silico rather than in vitro', which has been mooted for the last 50 years, but it has now arrived with a vengeance and increasingly not only models but data will be embedded in the web, in the 'cloud' as it is now being called [….] The other key question is that if planning becomes truly interactive and open to a much wider set of constituencies than anything hitherto, then the time required to invest in such processes is a major hurdle. Widespread participation takes time and costs money in terms of the opportunity cost of engaging in the process. Traditional participation is often stymied by our inability to find the time and space to engage in public problem solving. As soon as the door is opened to this interactive world, participation can become central to the planning process and it is likely that this will change the very nature of the problems that are addressed [...] This is almost inevitable given the flood of possible applications that we are now confronted with and the speed at which these are being explored. Everything from new forms of data to new types of problem over different time periods and at different scales is continually appearing in the broad planning domain and what we urgently need is some sense of this terrain and what are the most important problems to address."*

Applying new developments in a PBL setting will create new opportunities and new ways to address real world problems from a practical background. To find solutions it will require innovative ideas to integrate digital technology with education on planning for a natural and human environment. Exploratory research and training in this PBL setting can reveal new and unexpected solutions.

REFERENCES

[1] de Roo G., 2012; Spatial Planning, *Complexity and a World 'Out of Equilibrium': Outline of a Non-linear Approach to Planning.* Chapter 6 in Complexity and Planning; Systems, Assemblages and Simulations (eds. G. de Roo, J. Hillier and J. Van Wezemael). Ashgate , pp 141-175

[2] van Assche K., Beunen R., Duineveld M. and de Jong H., 2012. *Co-evolutions of planning and design: Risks and benefits of design perspectives in planning systems*. In: Planning Theory 12(2), pp. 177–198

[3] Geertman S. and Stillwell J., 2009; *Planning support systems; best practice and new methods*. Springer Media.

[4] Carsjens G.J., 2009. *Supporting strategic spatial planning; planning support systems for the spatial planning of metropolitan landscapes.* PhD Thesis Wageningen University;

[5] Batty M., 2012. *Integrated tools for planning support in an online world*. Chapter 17 in The future of cities and regions. (eds: L. Bazzanella et al.). Springer Media. pp 349-358

[6] Jaar van de Ruimte, 2014. Website: http://www.wiemaaktnederland.nl/over/ visited 27 March 2014

[7] Oliver M. and Trigwell K., 2005. *Can 'Blended Learning' Be Redeemed?* In: E-Learning 2(1)

[8] Martyn M., 2003. *The hybrid online model: Good practice.* Educause Quarterly: 18–23

[9] van den Brink A., van der Valk A. and van Dijk T., 2006. *Planning and the challenges of the metropolitan landscape: Innovation in the Netherlands*. In: International Planning Studies 3–4, pp.147–165
[10] Carsjens G.J., van Nieuwenhuize J. and Kleinrensink G., 2013. *Regional Learning: Integrating the Science and Practice of Strategic Spatial Planning.* In: Conference proceedings *Landscape and Imagination*; towards a new baseline for education in a changing world (eds. Newman C., Nussaume Y. and Pedroli B.) Paris 2-4 May 2013; pp 639-644.
[11] Kleefmann, F., 2005. *Planning in perspectief*. Wageningen, Landbouw Universiteit
[12] Neuvel J.M.M. and van der Knaap W., 2010. *A Spatial Planning Perspective for Measures Concerning Flood Risk Management*. In: International Journal of Water Resources Development, 26(2), pp. 283 — 296
[13] Peter C. and Swilling M., 2014. *Linking Complexity and Sustainability Theories: Implications for Modelling Sustainability Transitions*. In: Sustainability 6, pp. 1594-1622.
[14] de Roo G., Hillier J. and Van Wezemael J., 2012. *Complexity and Planning; Systems, Assemblages and Simulations*. Ashgate.
[15] Timmermans W., 2012. *Planning by surprise: innovative land use and green planning in relation to complexity*. PhD Thesis, Universidade de Santiago de Compostela
[16] Bertolini L., 2012. *Introduction: Time to Think. Planning Education: Time to Think, Time to Act*. In: Planning Theory & Practice, 13(3), 465–467
[17] Hidding M., 2006. *Planning voor stad en land*. Coutinho
[18] van der Valk A., 2002. *The Dutch planning experience*. In: Landscape and Urban Planning 58. pp 201–210
[19] Immink I., 2007. Beyond the standard of risk: new relations between space, water and risk. PhD thesis Wageningen University
[20] Albrechts L., 2004 *Strategic (spatial) planning reexamined*. In: Environment and Planning B 31 pp. 743-758.
[21] Haynes P., 2008. *Complexity Theory and Evaluation* in Public Management. In: Public Management Review, 10(3), pp .401-419
[22] Edelenbos J., Klijn H.E. and Kort M., 2009. *Managing complex process systems: surviving at the edge of chaos*. Chapter 10 in Managing complex governance systems; dynamics, self-organisation and coevolution in public investments (eds. G. Teisman, A. van Buuren and L. Gerrits). Routledge pp172-192
[23] Chettiparamb A., 2014. *Complexity theory and planning: Examining 'fractals' for organising policy domains in planning practice.* In: Planning Theory, 13(1) 5–25
[24] Teisman GR.. and Klijn E.H. , 2008. *Complexity Theory and Public Management*. In: Public Management Review, 10(3), pp. 287-297
[25] Van Wezemael J., 2012. *Transformative practice as an exploration of possibility spaces*. Chapter 4 in Complexity and Planning; Systems, Assemblages and Simulations (eds. G. de Roo, J. Hillier and J. Van Wezemael). Ashgate. pp 93-113
[26] van der Knaap W., Stobbelaar D., Spijker J. and van Groningen E., 2014. *Planning in a bio-based economy landscape development; cascading from different directions*. Paper for conference AESOP 2014, Utrecht
[27] During R. en Willemse R., 2013 *Beleid met sociale media: sturen met sociaal kapitaal op maatschappelijke energie*
[28] Kemp R. and van den Bosch S., 2006. *Transitie-experimenten; praktijkexperimenten met de potentie om bij te dragen aan transities*. 01 Kenniscentrum voor duurzame systeeminnovaties en transities. Delft/Rotterdam..
[29] Geldof G.D., 2005. *Coping with complexity in integrated water management; On the road to Interactive Implementation*. Tauw Deventer.
[30] West Burns R., 2012. *Five Stages of Acquiring Expertise - Novice to Expert*. Website: http://www.rebeccawestburns.com/ Retrieved 2-5-2014
[31] Garmston R.J. and Zimmerman D.P., 2013. *The novice to expert journey*. Chapter 1 in Lemons to lemonade. Sage.
[32] Timmermans W., Cilliers J., Garcia A., Koolen A., Woudstra A. and van Dijk T., 2014. *Learning by Practice, High-Pressure Student Ateliers.* Chapter 11 in R. Roggema (ed.), The Design Charrette: Ways to Envision Sustainable Futures. Springer Science+Business Media Dordrecht
[33] Graumans A.J.M., Pompe J.C.A.M. and van der Knaap W.G.M., 1987. *Computer Ondersteund Onderwijs: ervaringen op de vakgroepen Landbouwtechniek en Cultuurtechniek*. In: Voordrachten VIAS symposium, 1987; Informatica-toepassingen in de Agrarische Sector. (eds: H.A. Arendse, H.F.C.J. Paulissen) Pages 5-1 t/m 5-11
[34] van der Knaap W.G.M. and van de Veer J.L., 1990. *De computer als hulpmiddel bij de voorbereiding van een landinrichtingsproject: een vernieuwde onderwijsaanpak* In: Voordrachten VIAS-symposium 1990, Informatica toepassingen in de Agrarische Sector. (eds: W.H.G.J Hennen, J.C. Oudkerk, M.N.A. Ruijs) pp 143-152; Agro-informatica reeks nr 4
[35] van der Knaap W.G.M and van de Veer J.L.,1991. *Computergebruik in het landinrichtingsonderwijs*. In: Journal Landinrichting Volume 31 (3) Pages 17-22
[36] van der Knaap W.G.M., 2003. *Digital Spatial Planning? Some Dutch Experiences*. In: Les Figures du projet territorial (eds B. Debardieux, S. Lardon). 133-142 ; L'Aube, Datar.
[37] de Wit A., van der Knaap W.G.M. and Romijn E., 2008. *Planning futures: De Geo-ICT'er is deelnemer aan het ruimtelijk planproces!* In: Conference GIN/RGI symposium 27 november 2008 "Met het oog op de geo-toekomst"
[38] van der Knaap W. and Sterk B., 2009. *Geo-ICT as bargaining instrument within the planning process*. In: AESOP Liverpool congress "Why can't the future be more like the past?" 15-18 July 2009