PROSA
A Computer Program as Instructional Environment for Supporting the Learning of Legal Case Solving

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Abstract

Legal case solving is a central activity of legal practitioners. This may account for the fact that legal case solving has a place within legal education. However, students experience difficulties learning to solve legal cases and teachers find it difficult to teach it. To offer students support with the learning of legal case solving the computer program PROSA[1] has been constructed. PROSA is an instructional environment for supporting the learning of legal case solving. This paper describes the major design decisions for the construction of the computer program PROSA and the computer program itself.

1 Introduction

The city council of Amsterdam decides in a letter dated January 15, 1998, to close all swimming pools in Amsterdam on Sundays. Is this an order in the meaning of the General Administrative Law Act?[2]

Presented here is a legal problem situation, a legal case. This legal case is used in a graduate course on administrative law at the Faculty of Law at the University of Amsterdam. Many authors stress the importance of legal case solving being part of legal education (see, for instance, Crombag and Van Tuyll van Serooskerken 1970; Van Gunsteren 1974; Scholten 1974; Franken 1979; Abas 1985b; Teich 1986; Fernhout, Otto, Span and Van Rijthoven 1988; Henket and Van den Hoven 1990; Algra, Ten Berge and Sleurink 1991; Tunkel 1992; Wessels 1992).

> Solving legal cases is a central skill of legal practitioners, training students in solving legal cases is a main task for legal education (Crombag *et al.* 1971, p. 1).
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> One of the most important activities of legal practitioners or jurists is solving problems, or legal cases. The law study in which this skill is not dealt with fails. Exactly at the beginning of the studies it is important that students are confronted with this aspect of

1 PROSA stands for PROblem Situations in Administrative law.
2 In Dutch: de Algemene wet bestuursrecht (Awb).

> the activities of legal practitioners. Later during the studies the student may benefit from the fact that she has learned to solve a legal problem taking a systematic approach (Abas 1985b, p. 6, 7).

However, both teachers and students experience difficulties with legal case solving. Teachers have difficulties teaching legal case solving and students have difficulties learning to solve legal cases.

2 What causes these difficulties?

Research has been carried out by Crombag *et al.* (1970, 1971, 1972, 1977) to find a cause for these difficulties. They state that the main cause for the difficulties with learning legal case solving is the lack of a method for legal case solving that can be used in instruction. Because there was no such method available Crombag *et al.* (1970, 1971, 1972, 1977) constructed a method for legal case solving. The method was the basis for the design of instructional material for supporting the learning of legal case solving.

Although no proper evaluation of the instructional material was carried out, experiences with the instruction were not overall positive. The outcomes of students working with the instructional material did not differ much from the outcomes of students not working with the instructional material. Teachers in turn were complaining about flatness of the method.

Why was this approach for supporting the learning of legal case solving not as successful as expected? Reasons that may account for this are:

a) The main difficulties with legal case solving are not caused solely or mainly by a lack of method.
b) The method constructed by Crombag *et al.* (1970, 1971, 1972, 1977) is not correct.
c) The instructional material is no good.

Crombag *et al.* (1970, 1971, 1972, 1977) assume that the difficulties with legal case solving are caused by the lack of an explicit method for legal case solving. To find out whether the difficulties experienced by students are caused solely or mainly by the lack of a method, research was carried out in which law students and experts were asked to solve legal cases while thinking aloud (Muntjewerff 1993). Experts were asked to solve legal cases to be able to show that their expert case solving capabilities were based on the use of a legal case solving method. That is, a comparison of student and expert protocols would show a difference in performance because experts used a method and students did not.

Thirty law students in the last year of their university studies were asked to solve a legal case in the domain of administrative procedural law. All students had followed the graduate course on administrative law. The students were also asked to solve a case in the domain of civil law. Four administrative procedural law experts were asked to solve the same cases as the law students. A first analysis of the protocols shows that experts have no difficulties with solving the case in their field of expertise. However, the experts do experience difficulties with the civil law case. The experts use expressions as “oh … that is a long time ago” and “I do not have that knowledge ready right now” and similar expressions. What does this tell us? If using a method is essential for successful legal case solving, the experts could and would also have used the method in solving the legal case outside their domain of expertise. It is possible to conclude that to use a method is

not enough to be able to solve a legal case. Although a method does play a role, it appears that the knowledge of the specific legal domain plays a more central role. Without the knowledge of the specific domain at hand the experts do not use a legal case solving method to arrive at a solution. The method follows the knowledge so to speak. A method does not seem to play the role stated by Crombag *et al.* (1970, 1971, 1972, 1977). However, a method does play a role when the domain knowledge is available. Therefore it is important to include a method in the instructional design for supporting the learning of legal case solving. However, in addition to a method, the instructional design should offer support for availability of domain knowledge.

Is the method constructed by Crombag *et al.* (1970, 1971, 1972, 1977) correct? To be able to answer this question, the task of legal case solving as described in legal literature was analyzed. This was followed by an analysis of the task of automated legal case solving as described in literature on artificial intelligence and law. To be able to compare both analyses, an attempt was made to express the structures in the same language. A first comparison shows a large overlap between the described task models. We may conclude that the legal case solving task model constructed by Crombag *et al.* (1970, 1971, 1972, 1977) is correct.

On the basis of this analysis and comparison it was concluded that the method constructed by Crombag *et al.* (1970, 1971, 1972, 1977) could be used as a method for supporting the learning of legal case solving in the instructional environment to be designed.

What about the instructional material used to support the law students in learning to solve legal cases? A general problem with the instructional material developed on the basis of Crombag *et al.* (1970, 1971, 1972, 1977) is the lack of an explicit description of the instructional design approach taken. This makes it almost impossible to evaluate the instructional design.

In designing instruction, task related design decisions have to be made, as well as more general instructional design decisions. The task related design requirements result from an analysis of the task of legal case solving and an inventory of difficulties of students with this task. The general instructional design decisions should be made based on a global theory of learning and instruction. Such a principled approach may result in a coherent and consistent instructional model. Choices made in the instructional design process are then well-founded, and difficulties and mistakes may be accounted for (Warries and Pieters 1994).

The instructional material that is developed on the basis of the research by Crombag *et al.* (1970, 1971, 1972, 1977) (see, for instance, Giltay Veth 1974) consists of a set of legal case descriptions and related question that have to be answered using the constructed method for legal case solving. The ideal situation is that a teacher is available for every student, monitoring the student during legal case solving and providing support where and when necessary. However, this being infeasible, computer-assisted support[3] might be a way to offer the student the possibility of practicing legal case

3 Projects in computer assisted legal instruction on legal case solving are, for instance, Fernhout**,** Cohen, Crombag, Pinckaers and Temme (1987), Fernhout, Otto, Span, Rijthoven van (1988), Temme and Willigenburg van (1988) and Span (1992). A project in computer-assisted instruction on case based argumentation is that of Aleven (1997). The main difference between these projects and PROSA is that in PROSA the design of computer assisted instruction for legal case solving is regarded as instructional design. A principled design approach is described in detail.

solving combined with immediate feedback. A computer program as the instructional environment can meet the requirements of individualized instruction. A computer program can offer immediate feedback and information management support.

The first decisions made in the process of designing the computer program for supporting the learning of legal case solving were:

a) The instruction of a method is not enough; domain specific knowledge support has to be incorporated as well.
b) The method of Crombag *et al.* (1970, 1971, 1972, 1977) can be used as the legal case solving method.
c) The instructional design should be based on a theory on learning and instruction to be able to justify design decisions and to account for difficulties and problems.

3 Learning and instruction theory

To be able to select a global theory for an explicit and consistent design of the instruction the selected theory should encompass:

a) An explicit description of learning
b) An explicit description of the relation between learning and instruction
c) An explicit description of how to arrange instruction to enhance and support learning
d) An explicit description of the relation between motivational issues and learning
e) An explicit description of how to arrange conditions in the instruction in such a way that motivational issues are taken into account.

In *The Conditions of Learning* by Gagné (1965, 1985) the purpose of instruction is to support effective and efficient learning. Instructional design should therefore be based on a model of learning. Gagné (1965, 1985) explicitly describes a view on learning, a view on the relation between learning and instruction and a general view on how to arrange instruction in such a way that effective an efficient learning may occur.

Gagné (1985) selects the information processing model of learning and links his instructional approach to it.

> The information processing model of learning and memory is of great significance for the planning and design of instruction in educational programs (Gagné 1985, p. 69).

Gagné states that in the end learning is concerned with five different kinds of things one has to know, or that one must be able to do (capabilities). Gagné distinguishes five types of learned capabilities: verbal information, intellectual skills, motor skills, attitudes and cognitive strategies. These categories of learned capabilities differ in the human performances they make possible, and the internal and external conditions favorable for their learning. The internal conditions see to the cognitive processing required and the presence of required prerequisite knowledge and skills. The external conditions are the environmental stimuli that support the learner's cognitive processing. The content of external conditions depends on the desired learning outcome and the internal conditions.

When designing instruction both types of conditions should be specified as completely as possible, to produce the desired learning outcome(s).

> Proper usage of principles of learning to achieve effectiveness of outcomes requires first that the class of learning outcome be identified for any specific learning task that the learner undertakes. Once this is done, steps can be taken to discover what internal conditions are applicable to the learning task, and further to arrange the external conditions so that the expected outcome will be achieved (Gagné 1985, p. 258).

However, what is missing in the approach of Gagné is a more specific, fine-tuned, description of how to arrange instruction to support learning.
An explicit description of the relation between motivation, and learning and an explicit description of ways to arrange the instruction to enhance and maintain motivation, is also missing. It is therefor necessary to turn to other research.

Merrill (1983) presents a refinement of the theory of Gagné on the arrangement of instruction at the micro level in his Component Display Theory (CDT).

> CDT is founded on the same assumptions as Gagnés work – namely that there are different categories of outcomes and that these categories require a different procedure for assessing achievement and a different procedure for promoting the capability represented by the category (Merrill 1983, p. 284).

Merrill (1983) attempts to formulate a more presentation-oriented description.

> CDT defines several categories of objectives using a two dimensional classification system with performance level as one dimension and content type as the other dimension. CDT also defines a set of primary and secondary presentation forms. The theory postulates that for each type of objective there is a unique combinations of primary and secondary presentation forms that will most effectively promote acquisition of that type of objective (Merrill 1983, p. 283).

The primary presentation forms are the vehicles of instruction. All subject matter can be represented on two dimensions: level of specificity and level of responsive expectation for the student.

The secondary presentation forms can be characterized as elaborations of the primary presentation forms. The secondary presentation forms support and facilitate the students processing of information.

Neither Gagné (1985) nor Merrill (1983) offers an explicit description of the relation between motivational issues and learning. Strategies on evoking and sustaining motivation within instruction are not explicitly described either. The research by Keller and Suzuki (1988) incorporates motivational issues into the approach of Gagné. Theories of motivation based on the information processing model of learning and memory (see, for instance, Lepper 1983; Lepper and Malone 1987; Keller and Suzuki 1988; Pintrich and Schunk 1996) see motivational processes from a cognitive perspective. Motivation is defined as the process whereby goal-directed behavior is instigated and sustained. Motivation, as with learning, is not observed directly, but inferred from verbalizations, task choices, effort expenditure and persistence. Motivation[4] plays an important role in learning in the

4 Motivation can be extrinsic or intrinsic. When people are intrinsically motivated they engage in an activity as an end in itself. Intrinsic reasons for working on the task are internal to the task. The reward comes from working on the task. The task is both the means and the end. Rewards for intrinsic motivation may be feelings of competence and control, →

sense that a motivated student engages in activities that facilitate learning, activities such as attend, rehearse, relate information to previously acquired knowledge, ask questions. Keller and Suzuki (1988) describe a systematic approach to designing motivational aspects of instructional computer programs to make the instruction appealing, efficient and instructionally effective.

The model they developed is called the ARCS model. This model is based on the model of learning and instruction of Gagné (1985). The ARCS model:

a) postulates that there are four factors in the motivation to learn
b) includes subcategories of motivational characteristics (issues)
c) includes examples of motivational strategies
d) is used in conjunction with a systematic instructional design process.

The four factors of the ARCS model are:

1) Attention: arouse and sustain curiosity and attention
2) Relevance: connect instruction to important needs and motives
3) Confidence: develop confidence in success and generate positive expectancies
4) Satisfaction: manage reinforcement.

The design decisions made on the basis of these theoretical approaches resulted in design requirements for the instructional environment. These were combined with the decisions based on the analysis of the task of legal case solving and the difficulties with legal case solving. It is assumed that by offering the student the possibility to practice legal case solving the learning of legal case solving can be supported when these requirements are met. To mention a few:

a) A distinction is made between instruction and support.
b) The student is in control.
c) At the instructional level the student engages in legal case solving by constructing a legal solution for the legal problem situation presented.
d) During the legal case solving process the student is monitored by the computer program.
e) Both the solution construction process and the legal solution constructed are monitored by the computer program.
f) In monitoring the process the computer program uses the task activities and sequence as described in the research by Crombag *et al.* (1970, 1971, 1972, 1977).[5]

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self-satisfaction, task success and pride in ones work. Intrinsic motivation is to engage in an activity for its own sake, work on a task because the task is enjoyable, task participation is its own reward, does not depend on external constraints or explicit rewards. Extrinsic motivation involves an activity for reasons external to the task. The activity is a means to some end (an object, a grade, feedback or praise, or being able to engage in an other activity).

5 The legal case solving method of Crombag *et al.* (1970, 1971, 1972, 1977) consists of the following activities: structure legal case; translate legal case terms into legal rules terms; select a legal rule (act); select an article; select an article component; select a legal case fact; relate article component to legal case fact.

g) The computer program compares the activities of the student with the required activities (the most recommended route and the two possible routes[6]).
h) Domain knowledge is available in the computer program for constructing the legal solution.
i) Domain knowledge[7] support is available in the computer program.
j) The computer program compares the legal solution of the student with the correct legal solution.

4 The computer program PROSA

The aim of the computer program PROSA is to offer an instructional environment for supporting the learning of legal case solving. PROSA offers the student the opportunity to practice legal case solving. PROSA presents a legal case to the student, monitors the activities of the student during the process of constructing a legal solution and evaluates both the legal solution construction process and the legal solution constructed.

4.1 The user interface of PROSA

The content of the instruction and the way in which the instruction is arranged is described on the basis of the user interface of PROSA.

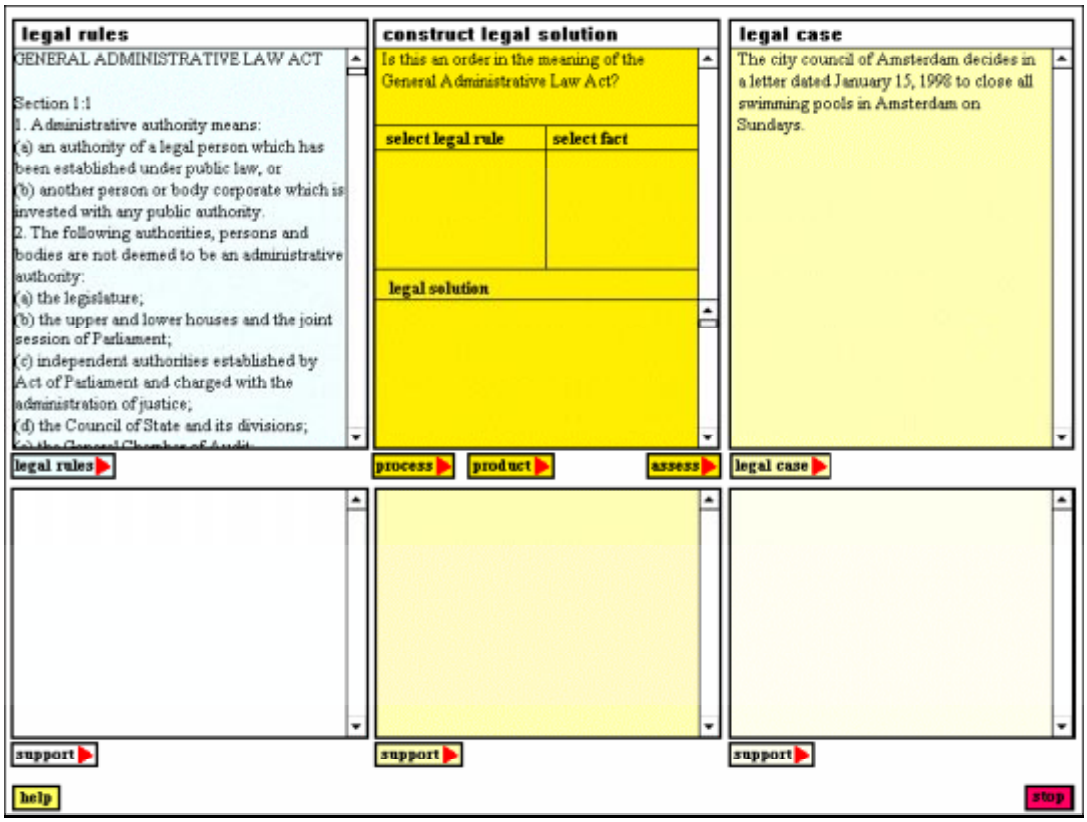

Figure 1. The PROSA interface

6 The most recommended route is a. select legal case; b. use process button to choose select, select legal rule; c. select law; d. select article; e. paste into legal solution part; f. select article component; g. select fact from legal case; h. relate article component to fact
7 Domain knowledge consists of the domain concepts and the legal rules.

The interface of PROSA consists of :

- Two separate layers (horizontal)

a) The upper layer where the instructional material is presented.
b) The lower layer where the support material is presented.

- Three separate parts per layer (vertical)

a) The legal case part, where all materials concerning the legal case is presented
b) The construct legal solution part, where all materials concerning the construction of the legal solution is presented
c) The legal rules part, where all materials concerning the legal rules is presented

The upper layer consists of, what Merrill (1983) calls, the primary presentation forms. Here the subject matter is represented on two dimensions: level of specificity and level of responsive expectation for the student.

In PROSA, legal case solving is divided into three separate parts: the legal case part, the construct legal solution part, and the legal rules part. These three parts are the basic elements of legal case solving. Confronted with a specific legal case (a problem situation that requires a legal solution) the legal case solver has to construct a legal solution using the legal rules as problem solving devices. The material is presented in the form of a legal case. The responsive expectation for the student is to construct the legal solution.

4.2 The legal case part

In PROSA legal case solving starts with the presentation of a legal case in the legal case part of the upper layer (see figure 1). The legal case is selected by the student from the set of legal cases present in PROSA. In some specific situations PROSA selects a legal case for the student.[8]

The legal cases present in PROSA are constructed in such a way that all the data necessary to be able to construct the legal solution are present in the legal case. The student does not have to gather or prove data and facts.

The legal cases in PROSA are arranged by topic. Within each topic the legal cases are arranged by level of difficulty.[9] The student selects a legal case using the legal case button at the bottom of the legal case part in the upper layer of the screen.

8 For instance, PROSA suggests the selection of a legal case of a certain topic and/ or difficulty level if the student keeps selecting legal cases she already masters. On the basis of the evaluation of the legal case solving activities of the student (process) and the constructed legal solution (product) four different situations can be distinguished (for example the situation: process correct, product correct). On the basis of these situations PROSA monitors the student's next choices of legal cases. Some choices are recommended, some are advised against, based on the specific situation.

9 The topics are: interested party, order, administrative authority, appeal and objection. These topics are the main topics in the domain of administrative procedural law. The difficulty levels are: very easy, easy, moderate, difficult and very difficult. On the basis of the complexity of the legal case solving process and the complexity of the legal solution (the product) a legal case is marked.

4.3 The construct legal solution part

When the legal case has been selected and is presented in the legal case part, the related question automatically is presented at the top of the construct legal solution part of the upper layer of the screen. In PROSA every legal case has a related question. The formulation of a question is not part of the legal case solving activities in PROSA. The question is the starting point of the construct legal solution process. The question states the goal of the legal case solving process.

The student has to construct a legal solution on the basis of facts selected from the legal case and legal rules selected from the set of legal rules. In the construct legal solution part the interaction between the case specific facts and the abstract legal rules takes place.

In PROSA legal case solving is divided in the legal case solving process and the legal solution.

The legal case solving process consists of the activities to be carried out to be able to construct a legal solution. The legal solution should not only contain the answer to the question, but also a justification. In PROSA this justification consists of the outcome per activity carried out in the legal case solving process.

The construct legal case solving part has three buttons (see figure 1). The process button, the product button and the assess (evaluate) button. The process button indicates the activities to be carried out to solve the legal case. These activities are: select, and relate article component to legal case fact. The product button contains options for constructing the legal solution. These options are: put selected text in solution (copy), cut, up, down, large screen and formulate answer.

The student can ask for an evaluation of either her legal case solving process or her legal solution at any moment during legal case solving by using the assess button. An evaluation of the process shows whether the student has carried out the correct activities in the correct order. PROSA has three sets of activities available to match the activities of the student to evaluate these activities. There is a most recommended route and there are two possible routes. An evaluation of the product shows if the student has the complete set of components of the solution in the correct order, followed by the right answer.

4.4 The legal rules part

After selecting a legal case the student can select a legal rule from the set of legal rules available in PROSA using the legal rules button (see figure 1). The legal rules are arranged by type of legal rule (laws, other regulations, case law). The laws are arranged by area of law.

The lower layer concsists of, what Merrill (1983) calls, the secondary presentation forms. These are the elaborations of the primary presentation forms, meant to support the student and to facilitate the students processing of information. In PROSA there are two types of support: elaborations and feedback.

To be able to solve legal cases the student must have certain knowledge available. Elaborations provide the opportunity to the student to consult this prerequisite knowledge in case the student is not quite sure, or in case she wants to check to be sure. The student is in control where eleborations are concerned. The use of the support button at the bottom of each part in the lower layer of the screen makes it possible to select specific elaborations.

Available elaborations in the legal case part are: case, structure case, translate case term, list of domain concepts and model of domain topics.

Available elaborations in the construct legal solution part are: question, process, product and legal case solving model.

Available elaborations in the legal rules part are: legal rules, search and read.

Feedback is provided by PROSA in reaction to what the student is doing. PROSA monitors the activities of the student (process) and the outcomes of these activities (product).

4.5 A legal case solving session with PROSA

A legal case solving session with PROSA is described in more detail to illustrate the way in which both instruction and support are arranged to support the learning of legal case solving.

The first screen after starting PROSA shows the PROSA logo and four buttons with the respective options:

start PROSA
a) explanation (information on how to work with PROSA)
b) info (general information about PROSA)
c) stop

After selecting the start option the next screen asks the student to enter personal data such as name and student number. These data are used to individualize the feedback and to register the student's progress. After selection of the ready button, PROSA presents the main screen (see figure 1, however, at first all parts in both layers are empty).

The student has to select a legal case using the legal case button at the bottom of the legal case part of the screen. The student selects a legal case of the topic *order*, with difficulty level *moderate*. PROSA presents the case in the legal case part of the upper layer (see figure 1).

> The city council of Amsterdam decides in a letter dated January 15, 1998 to close all swimming pools in Amsterdam on Sundays.[10]

At the same time the related question is presented in the construct legal solution part of the upper layer (see figure 1).

> Is this an order in the sense of the General Administrative Law Act?

The student starts the legal case solving process by using the process button at the bottom of the construct legal solution part. There are two activities to choose from within the process button: select, and relate article component to fact from the legal case. To be able to construct a legal solution, the first thing to do is to select the legal rules (the problem solving devices) and the facts from the legal case. After choosing the select option the construct legal solution part becomes more specific (see figure 1). The student can now copy a legal rule and facts from the legal case and paste these in the respective

10 Relevant parts in the legal case text are made active. The student can drag text parts to the legal solution part and drop it in the select fact part.

parts of the construct legal solution screen. The output of the activities can be copied and pasted to the legal solution part.

To select a legal rule the student has to choose the legal rules button at the bottom of the legal rules part. The student selects the General Administrative Law Act (GALA). PROSA presents the full text of the act in the legal rules part of the upper layer (see figure 1). The student can copy an article from the act and paste it in the select legal rule part of the construct legal solution part. The student can also paste the selected article in the legal solution part of the construct legal solution screen. Suppose the student copies and pastes article 1:3 from the GALA to the select legal rule part. Because the article is phrased in general terms and the legal case is phrased in specific terms it is impossible to relate the two at this stage of the process.

The next thing to do is to analyze the article, that is, to select the successive article components within the article, and to see whether these components can be related to facts from the legal case.

PROSA provides feedback whenever the student departs from the most recommended route, or one of the two possible routes. If, for instance, the student relates article 1:3 to a certain selected fact from the legal case PROSA will tell the student to decompose the article into components. At any time during legal case solving the student can ask for an evaluation of both process and product (using the assess button at the bottom of the construct legal solution part). When the student wants support in finding a legal rule the support button at the bottom of the legal rules part of the lower layer offers search support (using an alphabetical index or an index on article number).

When the student wants to stop she can select the stop button. The stop screen shows buttons with the options: start again, explanation, information, results and stop. The student can ask for her results. PROSA records which cases the student has selected and how the student performed per legal case. This performance is recorded both on process and product.

4.6 The realization of PROSA

The program Authorware is used for implementing the specification of the design of the instructional program.[11] Authorware is an authoring environment for creating and publishing interactive information and can be used for the construction of interactive learning and training applications. Authorware has many evaluation functions that make it possible to handle all kinds of input. Authorware makes it possible to incorporate digital movies, sound, animation, graphics and text in the application to be constructed.

The program Authorware has been chosen for the realization of PROSA on the basis of these specific Authorware aspects: interactivity and evaluation of input.

The domain of law is very text rich, all activities of legal practitioners involve many texts. The legal application PROSA is therefor also heavily text-based. In the process of constructing the application for supporting the learning of legal case solving it became clear that using text in a computer

11 Authorware 4 copyright 1997 Macromedia, Inc. San Francisco, California, USA. The University of Amsterdam has a campus license for Authorware. Financial support by the Ministry of Education and Science made it possible to appoint a programmer. Jolanda Groothuismink is the programmer in the PROSA project. The project period is September 1997 - December 1998.

program is a problem. It is not necessarily an Authorware problem, but a more general problem in using computer programs for instruction in almost solely text based domains. The tools available in Authorware to create and implement digital movies, pictures and graphics are not used in this particular application, because there is no function for them in the application for supporting the learning of legal case solving.

4.7 The architecture of PROSA

As Authorware is an icon-based authoring tool, a program is made by assembling icons on a flow line. Different types of icons contain different types of objects like text, graphics or a set of instructions and herewith the content of a program. The way in which these icons are arranged on the flow line forms the architecture.

In figure 2 the top level of the architecture of PROSA is shown.[12] The icons on the main flow line are visible at this level.

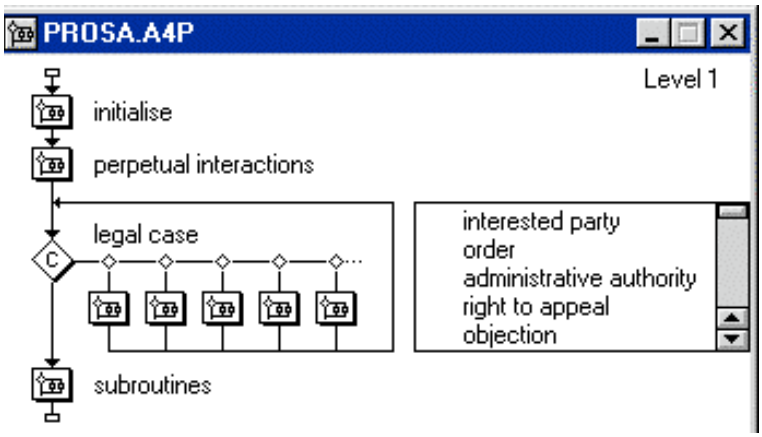

Figure 2. The top level of the PROSA architecture[13]

When PROSA is run, Authorware executes the icons from top to bottom along the flow line.

The first icon that is executed is the *map icon* 'initialise'. This map icon contains a number of *display icons* that contain the first screen.

Furthermore the variables used in PROSA are defined and initialised in a *calculation icon*. These variables are used to keep track of the students' actions and to store and use general PROSA information like available items for the menu buttons. And finally the 'initialise' icon contains *display icons* which contain the standard PROSA screen with the two layers and three parts (see figure 1). This 'initialise' icon is executed only once per session.

The second icon 'perpetual interactions' (see figure 2) contains two kinds of so-called *perpetual interactions*. An interaction is an *interaction icon* with different types of response type symbols attached to it. These response type symbols tell the interaction icon whether to display a button, a menu, a text-field or some other element. An interaction monitors the actions of the student and sends that information to the response type symbols attached to it. If Authorware encounters a perpetual interaction it activates the in-

12 When building files in Authorware one is encouraged to structure a piece using so called *map icons* because there is no scroll bar in the Design window. As a result a piece, and this is also true for PROSA, consists of several levels.

13 The concepts used are translated from Dutch for the purpose of this article.

teraction and continues down the flow line.[14] This is used in PROSA because the student is given personal control in learning to solve legal cases. The first perpetual interaction displays the menu buttons available for the six different parts and defines the reaction of PROSA when the student uses the buttons. These buttons can be used by the student throughout the whole session of solving a legal case.

The second perpetual interaction defines the responses of PROSA to the students activities regarding the construction of a legal solution in the sub parts select rule, select fact and legal solution part in the construct legal solution part of the screen. An example of such a student activity is pasting an article in the 'select rule' subpart of the construct legal solution part.

After the perpetual interactions the main loop of the program occurs, the so-called *decision icon* 'legal case' with *map icons* for every case topic attached to it. Within each case topic map a similar *decision icon* for the different levels of difficulty is used.

When Authorware encounters a decision icon it branches to a path according to certain criteria. In PROSA these criteria are the choices the student makes.

The student uses the menu button legal case and the choices she makes are stored in the two variables caseTopic and caseDifficultylevel.

On the basis of these variables Authorware first branches to the *map icon* of the chosen case topic and then to the *map icon* of the chosen difficulty level. A difficulty level *map icon* contains (1) *display icons* which contain the legal case text and the accessory question, (2) a *calculation icon* in which the correct legal solution is stored in a variable, (3) an *interaction icon* to monitor the students activities specific to the chosen case.

In the architecture a specific legal case and the accessory question are considered to be the basic element, because it is the current problem to be solved by the student and in this way PROSA is able to give case- and student specific feedback. Also many student characteristics can be recorded per case, like, for instance, the sequence of the students activities in solving the legal case, the legal solution the student constructs and the cases the student selects. These student characteristics are an example of characteristics that are recorded and maintained during all sessions of the student working with PROSA. In this way a student history is built to be able to adapt to the individual students activities and to evaluate the individual student.

The last icon at the top level flow line is the *map icon* 'subroutines' and Authorware never automatically encounters it. This icon contains a number of subroutines implemented as *map icons* attached to *framework icons*. These subroutines appear only once in PROSA, but are called many times by various parts of the program. An example of a subroutine is adding a student activity to the list that is used to keep track of the series of activities the student carries out to construct a legal case solution.

Because of the way the main loop in PROSA is structured, new legal cases of the existing topics and difficulty levels can be added easily. Furthermore, legal cases of new topics and difficulty levels can be added. For each new case topic and difficulty level a new *map icon* containing the case specific *display, calculation* and *interaction* icons has to be added. The same

14 Perpetual indicates that the interaction remains available during an entire legal case solving session in PROSA.

structure can also easily be used for a different domain if the problems to be solved can be divided in a hierarchy of topics and difficulty levels.

5 Further work

PROSA is an instructional environment for supporting the learning of legal case solving. The major decisions for the design of the computer program PROSA were described, followed by a description of the realization and the architecture of PROSA. PROSA contains three legal cases on three different topics, each with difficulty level moderate. The set of available legal cases will be extended to be able to evaluate PROSA.

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