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ABSTRACT

The key question in the research reported is whether a high investment in the design of written materials for use in distance education is worth the effort. Specifically, the study investigated the actual use of embedded support devices (ESDs) by 25 students at the Open University of the Netherlands in a distance education governmental law course. Students did use ESDs, with 60 to 80% of students using nearly all the ESDs. Women were more likely to use planning ESDs, orienting ESDs, and processing ESDs on a deeper level than men. Students with higher prior education also seemed to use ESDs on a deeper level, as did students with less prior knowledge of governmental law and those using study guidance. No interrelations were found between cognitive student characteristics and the use of ESDs. High investment in the design of written materials seems worth the effort, but student characteristics should be taken into account in writing the materials. Six tables present study data, and three appendixes provide supporting information. (Contains 14 references.) (SLD)

The actual use of embedded support devices in self-study materials by students in a distance education setting

Research results

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OTIC research Report 54

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The main objectives are in the field of flexible organisation of support, incorporation of support into learning materials, optimizing the link between prior knowledge state and the support needs, and the development of more flexible (and automated) approaches towards guidance oriented evaluation.
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Centre for Educational Technology and Innovation
Open University

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Het feitelijk gebruik van ingebouwde begeleidingscomponenten in schriftelijk leermateriaal voor afstandsonderwijs

Nederlandstalige samenvatting OTIC-onderzoeksrapport 54

Inleiding

In dit rapport wordt verslag gedaan van de empirische fase van een onderzoek naar het gebruik van ingebouwde begeleidingscomponenten in schriftelijk afstandsonderwijs door studenten van de Open universiteit. Na een literatuurstudie en theoretische uitwerking (Valcke e.a, 1991; Valcke en Martens, 1992) werden meer dan veertig verschillende ingebouwde begeleidingscomponenten onderscheiden (nader te noemen: ESD, Embedded Support Devices). Een groot gedeelte van deze begeleidingscomponenten wordt momenteel bij de uitwerking van Ou-cursusmateriaal gebruikt (bijv. inhoudspagina's, structuurpagina's, advance organizers, voorvragen, voorbeeldtoetsen, illustraties, margeteksten, schema's, opdrachten etc.).

Uit de literatuur blijkt dat de theoretische onderbouwing voor het aanwenden van deze ESD slechts beperkt of niet bestaande is. Aan de ESD worden functies en effecten toegeschreven die niet ondersteund worden door onderzoeksbevindingen. Bijkomende bezwaren bij vroeger onderzoek zijn ook dat dit niet is uitgevoerd in de context van afstandsonderwijs en dat eerder naar produkteffecten dan proceseffecten is gekeken.
Ondanks de gebrekkige theoretische en empirische onderbouwing wordt er aan de Open universiteit veel geïnvesteerd in het implementeren van ESD in schriftelijk studiemateriaal.

De *hoofdvraag* van dit onderzoek is dan ook of deze investering effectief is, waarbij we voor het beantwoorden van deze vraag uitgaan van de afgeleide vraag : "Hoe gaan studenten om met de ingebouwde begeleidingscomponenten ?".
Na een selectie van onderzoeksmethoden (Valcke en Martens, 1992) is gekozen voor de interviewmethode, in combinatie met een schriftelijke vragenlijst.

Nul-hypothesen

De volgende nulhypothesen werden naar voor geschoven :
- Studenten gebruiken geen ESD (kwantitatief gebruik)
- Er is geen verschil tussen het aantal studenten dat ESD oppervlakkig of op een diepgaande manier gebruikt (kwalitatief gebruik).
- Er is geen verband tussen algemene studentkenmerken (zoals intrinsieke motivatie, geslacht, algemene motivatie en locus of control) en het gebruik van ESD.
- Er is geen verband tussen cognitieve studentkenmerken (zoals algemene studeerstrategie, gebruik van externe begeleidingsvormen, ervaring met afstandsonderwijs) en het gebruik van ESD.

Op basis van de verzamelde onderzoeksgegevens konden twee extra hypothesen gecheckt worden :
- Het gebruik van ESD heeft geen effect op studiesucces (tentamenscore en aantal tentamenpogingen).
- Er is geen verschil tussen de theoretisch verwachte functies/effecten van ESd en de functies en effecten die studenten spontaan aan de ESD toeschrijven.

Procedure

De onderzoekspopulatie bestond uit 25 rechtenstudenten die de cursus 'Inleiding tot het bestuursrecht' van de Open universiteit bestudeerden en in de loop van het half jaar voor het interview aan het eindtentamen hebben deelgenomen.
Deze studenten komen uit een groep van 51 studenten die bereikbaar waren vanuit de studiecentra Sittard, Eindhoven en Venlo. Het profiel van de 25 studenten was representatief voor het type studenten dat de cursus 'Inleiding tot het bestuursrecht' bestudeert.

Het onderzoek was gebaseerd op een analyse van de antwoorden van studenten op gestructureerde interview-vragen. Alle interviews werden opgenomen op band. Daarnaast zijn tijdens het interview notities gemaakt en zijn de aantekeningen van studenten in hun cursusmateriaal op intensiteit van gebruik onderzocht (bijvoorbeeld: gebruik van kleurmarkeringen en onderstrepingen).
Omdat het interview sterk gestructureerd was konden de meeste antwoorden direct herleid worden tot specifieke antwoordcategorieën bij in het totaal 499 interviewvariabelen. Deze gegevens werden als ruwe data ingevoerd in een computerbestand. Vervolgens zijn de interviewvariabelen gerubriceerd, getransformeerd, bewerkt en herleid tot 191 onderzoeksvariabelen. Ten aanzien van ESD-gebruik werden in het onderzoek 23 ESD nader onderzocht. Het gebruik voor elke ESD afzonderlijk werd onderzocht en van clusters binnen deze ESD (verwerkende, toetsende, oriënterende en plannende ESD).
Met behulp van het statistisch pakket SPSS^{pc+} zijn de data verder geanalyseerd.

Analyses

Met behulp van descriptieve gegevens (percentages en gemiddelden) is in kaart gebracht door hoeveel studenten ESD gebruikt worden en hoe ze gebruikt worden.
Geconcludeerd werd dat:

- ESD veel gebruikt worden,
- ESD overwegend op een diepgaande manier gebruikt worden,

Met behulp van loglineaire analysetechnieken is nagegaan welke verbanden er bestaan tussen het gebruik van ESD (kwantitatief en kwalitatief) (2*23 variabelen) en algemene en cognitieve studentkenmerken (30 variabelen). Er is gebruik gemaakt van de SPSS^{pc} HILOG procedure om modellen te toetsen. Modellen werden gescreend met behulp van hiërarchische loglineaire analyse (backwards stepwise).
Geconcludeerd werd dat er duidelijke verbanden zijn tussen algemene studentkenmerken en (diepgaand) gebruik van ESD: geslacht, opleidingsniveau, voorkennis van bestuursrecht en gebruik van studiebegeleiding. Vooral hoogopgeleide, intrinsiek gemotiveerde vrouwelijke studenten met veel studie-ervaring gebruiken ESD meer op een diepgaande manier.
Er was een negatief verband tussen voorkennis en het gebruik van 'toetsende ESD'.
Er werd geen relatie gevonden tussen cognitieve studentkenmerken en het gebruik van ESD.
Opgemerkt moet worden dat de proefpersonen groep sterk homogeen was (met betrekking tot ESD-gebruik), hetgeen de kans op het vinden van significante verschillen mogelijk verkleind heeft.
In een volgende reeks loglineaire analyses is nagegaan hoe de tentamenuitslag en het aantal tentamenpogingen zich verhouden tot ESD gebruik. Er is vastgesteld dat zowel de tentamenuitslag als het aantal tentamenpogingen samenhangen met de algemene studeerstrategie. Een diepgaand ESD gebruik hangt samen met hogere tentamenuitslagen en minder tentamenpogingen. Er zijn ook verbanden met onder andere het opleidingsniveau en ervaring met afstandsonderwijs.

In een laatste reeks analyses is onderzocht wat het verband is tussen theoretisch verwachte functies en effecten en spontaan door studenten genoemde functies en effecten van ESD. Om dit na te gaan werd bij de vragen die handelden over het specifieke gebruik van ESD altijd eerst een zeer open en niet-sturende vraag gesteld ("Wat vindt u van dit soort informatie?").
Op deze manier wilden we voorkomen dat antwoorden in een bepaalde richting gestuurd zouden worden. Aansluitend werden meer gerichte vragen gesteld waarin wel de functies van ESD werden genoemd ("Heeft de inhoudspagina u geholpen bij het oriënteren in het cursusmateriaal ?").
Onderzocht is of de spontaan gegeven antwoorden overeenkomen met theoretische verwachtingen, gebaseerd op het model dat is uitgewerkt in Valcke en Martens, 1992.
Er bleek een duidelijke discrepantie te zijn tussen de theoretisch verwachte functies en effecten en de spontaan genoemde functies en effecten van ESD. Studenten schreven niet bepaalde functies en effecten toe aan ESD terwijl dat op grond van de theorie wel verwacht werd. Ook noemden zij andere functies en effecten van ESD die niet verwacht werden op basis van de theorie.

Een mogelijke verklaring hiervoor is dat het niet te verwachten is dat studenten in staat zijn om spontaan alle mogelijk effecten van ESD te noemen. Ook is het mogelijk dat studenten zich niet bewust zijn van de mogelijke functies van ESD. Een andere interpretatielijn zou kunnen zijn dat studenten wel in staat zijn functies en effecten toe te schrijven aan ESD, maar dit doen binnen hun eigen momentane studiebenadering en -strategie. Deze verschillen van student tot student.

Conclusies ten aanzien van de nul-hypthesen

De volgende nulhypothesen kunnen worden verworpen:

- Studenten gebruiken geen ESD (kwantitatief gebruik)
- Er is geen verschil tussen het aantal studenten dat ESD oppervlakkig of op een diepgaande manier gebruikt (kwalitatief gebruik)
- Er is geen verband tussen algemene studentkenmerken (zoals intrinsieke motivatie, geslacht, algemene motivatie en locus of control) en het gebruik van ESD

De volgende hypothese kan niet verworpen worden :

- Er is geen verband tussen cognitieve studentkenmerken (zoals het gebruik van externe begeleidingsvormen, ervaring met afstandsonderwijs, etc.) en het gebruik van ESD.

Discussie, extrapolatie van de onderzoeksresultaten en vervolgonderzoek

De uitgangsvraag : "Loont de uitgebreide didactische uitwerking van Ou-cursussen op basis van he gebruik van ingebouwde begeleidingscomponenten, de moeite ?" kan naar onze mening positief beantwoord worden. De onderzoeksresultaten geven echter aan dat bij deze uitwerking meer rekening kan/moet gehouden worden met het 'type' student dat men voor ogen heeft. Blijkbaar hebben niet alle studenten dezelfde behoeften aan ESD als andere. Daarbij komt de vaststelling dat het toeschrijven van functies en effecten van ESD tussen door studenten vesrchilt van wat theoretisch verwacht wordt.

Dit laatste, gecombineerd met de eerste vaststelling leidt ons inziens tot een argumentatie voor een flexibele cursusproduktie enerzijds en een flexibel doorlopen van de Ou-cursussen door een student anderzijds. In concreto zou dit kunnen inhouden dat bijv. verschillende versies ontwikkeld worden van éénzelfde Ou-cursus, afhankelijk van het soort gebruikers dat men voor ogen heeft (bijv. diplomastudenten versus professionaliseringsgerichte gebruikers). In een ander perspectief kan gedacht worden aan een geautomatiseerde leeromgeving die geënt is op een Ou-cursus. Een student zou deze leeromgeving kunnen gebruiken om tijdens de eerste fase van het bestuderen van de cursus keuzes te maken in verband met de inhoud en de begeleidingscomponenten. Pas dan zou een - aangepaste - Ou-cursus afgedrukt worden. Een andere extrapolatie van de onderzoeksgegevens kan inhouden dat studenten getraind worden in het gericht gebruik van ESD.

Een relativering t.a.v. de gevonden onderzoeksresultaten is hier op zijn plaats. De karakteristieken van de onderzoeksgroep, de aard van de cursus die in het onderzoek werd betrokken en de gevolgde onderzoeksmethode (interview) kunnen de onderzoeksgegevens beïnvloed hebben. Hierdoor is een directe generaliseerbaarheid van de bevindingen niet gepast.

Toch kunnen we stellen dat de gevonden resultaten betekenisvol zijn en blijven. De gevonden resultaten stemmen bijvoorbeeld overeen met resultaten vroeger onderzoek dat door het onderzoeksteam opgezet werd bij dezelfde rechtencursus. Nog belangrijker is dat de gevonden kwantitatieve en kwalitatieve gegevens m.b.t ESD gebruik en de samenhang met bepaalde studentkenmerken ook bevestigd worden door onderzoeksresultaten bij een ruimere Ou-populatie (cf. de jaarlijkse JOO-onderzoeken). Meer onderzoek blijft echter wenselijk. Bij dit vervolgonderzoek zouden alternatieve onderzoeksmethoden moeten gebruikt worden. Daarnaast is ook onderzoek bij andere cursussen, inhoudsdomeinen en studentenpopulaties wenselijk.

CONTENTS

The actual use of embedded support devices in self-study materials by students in a distance education setting

ABSTRACT

The key question dealt with in the research reported here can be stated as follows : "Is the high investment in the design of written study materials for use in the distance education setting, worth the effort ?". The written study materials, used at the Dutch open university (Ou) imply a high investment in the didactical elaboration of the study texts by embedding a large variety of support devices. The actual use of these embedded support devices (ESD) is questioned in this study. To answer the question, our research focuses on quantitative and qualitative aspects of ESD use.

The following scientific hypotheses were specified:

Quantitative hypothesis:

1. Students make no use of ESD. To check this hypothesis descriptive statistical techniques are used.

Qualitative hypotheses:

2. There is no difference in the number of students making surface level or deep level use of the ESD. Checking this hypothesis implies descriptive statistical techniques.

3. There is no interrelation between general student characteristics and the use of ESD.

4. There is no interrelation between cognitive student characteristics and the use of ESD.

These last two hypotheses are checked using a multi-way frequency analysis.

The information gathered, is also helpful to focus on two other hypotheses :

5. Student study success is not related to ESD use.

6. There is no difference between theoretical expected and spontaneously mentioned functions and effects of ESD.

The research setup was based on an in-depth analysis of responses to structured interviews. The research sample consisted of 25 Ou-law students who attended the final examination in 1991 for the course "Introduction to governmental law".

Analysis of the research data indicate that hypotheses 1 and two can be rejected. Students make use of ESD; nearly all ESD are used by more than 60% to 80% of the students. Furthermore students make deep level use of the ESD.

Also the third hypothesis can be rejected. Interrelations between general student characteristics and the use of ESD are also found. Women seem to be more likely to use planning ESD, orientating ESD and processing ESD at a deep level. Students with higher prior education levels seem to use ESD at deep level to a higher extent. Students with less prior knowledge of governmental law and students using study guidance use testing ESD more at a deep level.

The fourth hypothesis cannot be rejected; there are no interrelations found between cognitive student characteristics and the use of ESD.

To get a better view of the 'type' of students using ESD, the interrelations between general student characteristics have been analyzed. Especially higher educated (and intrinsic motivated) female students with a lot of study experience and less prior knowledge make deep level use of ESD.

When linking the use of ESD to study success (hypothesis 5) the following picture arises : Students using ESD at a deep level are not only more likely to have a higher score on the examination, they also need less examination attempts.

Looking at the results of the comparison of theoretical and spontaneously mentioned functions and effects of ESD (hypothesis 6), the results reveal that students indicate functions that are not theoretically expected. Students seem to ascribe their own functions and effects to ESD.

The main conclusion of this research is that the high investment in the design of written study materials is worth the effort, but that it is important to take account of student characteristics when implementing ESD in course materials. It can for instance be argued to incorporate into the materials a 'training' about the use of the ESD. Moreover, these results link up with the growing tendency to develop more flexible Ou-courses that are adaptable to individual student needs. The latter implies that the production of written versions of the study materials is to be redirected towards the development of automated interactive learning environments.

1. INTRODUCTION

In an earlier OTIC research report (Valcke & Martens, 1992), the theoretical base and an overview of research approaches was discussed in relation to the SIG-project "Support by Individual Guidance". The SIG-project is set up by researchers of the Centre of Educational Technology and Innovation (OTIC) of the Dutch open university.

The Dutch open university (Ou) organizes and supports university level education at a distance. This implies that the way learning and instruction is organized is adapted to particularities of this setting. Of outstanding importance in this perspective is the production of high quality study materials. Up to now, these materials are still mainly text-based. The SIG-project focuses on the quality of these written study materials.
A key question of this project is : "Is the high investment in the design and elaboration of written study materials for use in a distance education setting, worth the effort ?". Is the elaboration of the study text with a high amount of embedded support devices (structure pages, content pages, indexes, questions, tasks, schemes, examples, etc.) a functional and necessary elaboration that meets the demands of the Ou-students (Embedded Support Devices will from now on be abbreviated as ESD).

To answer this question, we first specified a theory about the potential functions and effects of embedded support devices in written study materials. This theoretical, hypothetical construct is considered as the starting point from where to look at the actual use of these ESD (embedded support devices) by students when they study the course materials. This point of view is helpful to obtain :

- *quantitative* information about the question whether or not ESD are used and to what extent;
- *qualitative* information about the extent the ESD are used by students (e.g. deep level or surface level). In which way(s) use students the ESD ? Related to the latter, a close look at variations in use of the ESD in relation to personal characteristics of the students is extremely helpful. In this way we obtain details about the necessity to vary the elaboration of ESD and study materials according to individual differences. This information is a necessary source to make study materials flexible and adapted to individual needs. We further question whether the actual use of the ESD reflects the theoretical, hypothetical functions and effects of ESD ? Finally wecan also link the use of ESD to study success.

This research report starts with a short summary of the theoretical base and background of our research in order to describe the research hypotheses and research variables. Chapter 3 focuses on the description of the research setup. Attention is paid to the selection of the research sample, the analysis of the Ou-course "Introduction to governmental law" to define an operational subset of ESD, the interview and the interview procedure. An analysis of the research data based on descriptive statistics to draw conclusions at the quantitative level is supplied in chapter 4. Chapter 5 contains a multi-way frequency analysis of the research data to deduce conclusions at the qualitative level. In chapter 6 we discuss the students score on the examination and the number of attempts to pass the examination in relation to the use of ESD. Chapter 7 we confront the functions and effects of ESD as reported by the students with the theoretically expected functions and effects of ESD.
Chapter 4 and 5 each comprise a discussion of the research results. Chapter 8 goes beyond a local discussion of the results by positioning the research findings against results of other research. At the same time the relevance of the results to (re)direct educational practice at the Open university are debated and directions for future research are derived. We end this report with a concluding discussion in chapter 8.

2. RESEARCH BACKGROUND, HYPOTHESES, AND VARIABLES

2.1 Theoretical base and background of the study

As stated in the introduction, our research focuses on quantitative and qualitative aspects of the use of embedded support devices in distance education study materials.

To summarize in a short the theoretical base and background for this research, we repeat the following :

- Embedded support devices (ESD) are defined as formal and/or content-related add-ons, extensions and elaborations of the learning content in the written study materials (objectives, prior knowledge state tests, structure pages, content pages, indexes, questions, tasks, examples, illustrations, typography, etc.). They aim at scaffolding the learning process by supporting orientation, planning, processing and testing aspects of the individual learning process.
- From earlier research in relation to ESD we learn that this research can be criticized since there are important theoretical and methodological weaknesses. This is especially true iif the results of this research body is to be used in the context of distance education study materials.
- A theoretical base has been elaborated for our research that is founded on a cognitive processing approach taking account of the learning process, the reading process, the task environment and characteristics of the study materials.
- The theoretical base has been used to describe potential functions/effects of all types of ESD.
- After reviewing methods to research the use of ESD by students in a distance education setting, we decided to opt for the use of an approach based on the use of structured interviews.

2.2 Deriving hypotheses

Since the key question of this project is : "Is the elaboration of the study text with a high amount of embedded support devices (structure pages, content pages, indexes, questions, tasks, schemes, examples, etc.) a functional and necessary elaboration that meets the demands of the Ou-students ?", we have to focus on quantitative and qualitative aspects of ESD-use in relation to student characteristics. The hypotheses we derive from this research question show a narrowing down from quantitative features of general ESD-use to qualitative features of ESD-use related to student characteristics. As such, two sets of hypotheses are defined :

Set 1 : quantitative hypothesis

- *1. Students make no use of ESD.*

Set 2 : qualitative hypotheses

- *2. There is no difference in the number of students making surface level or deep level use of the ESD.*
- *3. There is no interrelation between general student characteristics and the use of ESD.*
- *4. There is no interrelation between cognitive student characteristics and the use of ESD.*

The information gathered and the theoretical statements about functions and effects of ESD are also helpful to state additional hypotheses about ESD-use :

5. Student study success is not related to ESD use.

6. There is no difference between theoretically expected and spontaneously mentioned functions and effects of ESD.

2.3 Research variables

When stating the hypotheses in relation to our research question we already - implicitly - pre-defined sets of variables that have to be researched :

- variables in relation to **ESD-use**;
- variables that look at more detail to **quality features use of ESD-use**;
- variables that are helpful to describe **personal characteristics of the students** in our research sample;
- variables that are helpful to describe **general cognitive characteristics of the students** in the research sample.

A detailed overview of the **research** variables will be discussed in part 3.6. These variables are derived from the **interview** variables reviewed in part 3.4.

3. RESEARCH SETUP

3.1 General description

As argued in Valcke & Martens (1992), we opt for a research setup, based on the analysis of data inferred from interviews. Since we prefer a research set up with high ecological validity, we are well aware of the difficulties in controlling for a multitude of variables influencing the research data. Therefore, much attention was paid to the selection of the research population, the analysis of the course "Introduction to governmental law", the construction of the interview and the procedure to derive research variables from the interview. Nevertheless, we have to keep in mind, when deriving conclusions from our research results, that the research data can be biased due to the research procedure.

3.2 Research population

The SIG-project links its empirical research to courses in the law domain. For this research, we focused on students taking the course "Introduction to governmental law".
From the Open university data base about student enrolment and exams, we extracted the complete list of students who participated in the 1991 examinations for this course. We selected these students, to be sure that students really studied the course and used the course material. From this list we selected 51 students who live close to three specific study centres of the Open university (Sittard, Eindhoven, Venlo).

The selection of 'students taking examination' can question the representativeness of our research sample : Do we not omit students who do not take examinations due to shortcomings in the written study materials ? Earlier research at the Dutch open university reveals that 45% of students subscribing for introductory courses (the 'type' of students we focus at) do not or do not plan to participate in examinations. But, as to the rationales for not attending examinations, refined analysis reveals that not taking examinations is not related to the quality of the study materials (Kempkens, 1987, p.60). The findings of more recent research with Dutch Ou-students confirm the results of Kempkens : Ou-students, independent of the fact whether they attained a certificate or not, highly appreciate the content and elaboration of the written study materials (Boon et al, 1991a, p. 12).
Kempkens (ibid, p. 20-25) also analysed drop out in relation to examination participation and study success at other open or distance education universities. She finds comparable conclusions, sustaining the hypothesis that examination participation is not related to or has certainly not a primary significant interrelation with quality features of study materials.

The students received a letter to describe the research project and to ask their participation in the research. Two weeks later all students were contacted by phone. A protocol was prepared to structure this phone call. This resulted in 25 students who were willing to participate. A letter was sent to these students, confirming the date and study centre location for the interview.

The final sample of 25 students consisted of 19 male and 6 female students, a ratio which is representative for the population participating at the law course "Introduction to governmental law".
The educational level of this students was rather high: only 1 student had a low educational level (elementary school); 12 students had a medium educational level (secondary school); 12 students had a high educational level (higher education).
The age level of the students was divided as follows:

18-30:	5
30-40:	9
40-50:	7
>50:	4

Further data about the student characteristics of the research sample are displayed in appendix 1. In general it can be stated that the research sample is a representative subset of the student population taking the course "Introduction to governmental law". Despite this fact, the selection of this research sample can influence the extent to which we can or might generalise our reserach conclusions. Are law student different from e.g. student taking social science courses or studying cultural topics ? We have not analysed our reserach sample in relation to the total Ou student population. Therefore, cation will be taken when generalising conclusions.

3.3 Analysing the course "Introduction to governmental law" : a subset of ESD

As stated earlier, we analyze study behaviour of students taking the course "Introduction to governmental law". This is a first level course designed for the law scientific diploma line.
Since we are interested in the actual use of ESD by students, this implies a detailed analysis of this course. Learning unit 20 of this course was selected to be used in the interview. This unit was selected since the course developers and tutors indicated this was considered as a difficult unit. Moreover, this unit comprises a large subset of the ESD we focus on. Each page of learning unit 20 was analyzed to detect where ESD were embedded. This selection was done making use of categories for ESD that are described in Valcke et al, 1991. Twenty one different ESD are embedded in learning unit 20. Of two of these ESD, two examples are used in the interview, totalling the number of ESD used in our research to 23. Table 1 presents a list of these ESD.

3.4 The interview and interview procedure

3.4.1 Interview elaboration and structure

Seven clusters of interview variables[1] were defined :

- *Personal student characteristics* : gender, age and educational level;
- *Motivation level* : for studying at the Open university, for studying law and studying this specific course;
- *Prior knowledge/experiences* : with studying at the Open university, studying law and studying the specific course "introduction to governmental law";
- *Task environment* variables : use of specific support provisions;
- *Learning strategy* : general learning strategy, learning strategy in relation to specific course, learning strategy learning unit 20, use of the 23 ESD;
- *Metacognitive variables* : use and development of metacognitive strategies;
- *Time structuring* : time used to study, time planning;

A first version of the interview was composed and discussed with a team of OTIC-researchers. Also a try-out with colleagues provided materials for further discussion. Especially the length of the interview posed problems. Therefore, it was decided to split up the interview into two parts. Some questions were excluded due to the time-constraints.

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[1] It was not necessary to define interview variables in relation to all research variables since we could rely on information already present in the Open university student data base (e.g. number of examination attempts, examination score, etc.).

Part I was sent to the students a week before the interview appointment in the study centres. The students were expected to fill in this part at home. This part consisted of questions related to the first four clusters of variables explicitated above.
Part II was elaborated as a very rigid protocol in which the focus is on the variables related to the three last clusters of variables. Each question in the protocol is unambiguously connected to one particular variable. Along this interview protocol, the focus of the discussion is continuously narrowed down from the general individual learning strategy of the student to his/her specific use/approach of ESD when studying learning unit 20 of the course. In relation to each single ESD of learning unit 20, a double strategy was observed. First we provoked spontaneous reactions of the students that indicated their opinion about and use of the specific ESD. Next, we faced them with questions/statements that reflect hypothetical functions/effects we derived from our theory. They could indicate whether or not they agreed with these questions/statements.

3.4.2 Interview procedure

- The students were expected, as stated above, to fill in part I of the interview at home.
- During the interview, which was all set up during a period of 2 weeks, the focus was on the questions of part II. The students were invited individually for this interview session in a study centre. They were asked to bring their own study materials with them. Each interview lasted about 90 to 120 minutes. The interviews were recorded on audio tape. The researchers took note of key words during the interview.
- The introduction to the interview stressed the non-evaluative nature of the interview, although this was already mentioned in the letter and the phone call preceding the actual interview session.
- According to the interview protocol, students were allowed or demanded to go through (specific parts of) the study materials before answering a new set of questions.

The first set of questions was about the study approach of the course "Introduction to governmental law". The students got the opportunity to go through the course during about 5 minutes to refresh their knowledge. The interviewers suggested that the structure page and the introduction could be very helpful.

The second set of questions dealed with the study approach of a learning unit the students themselves could chose. The students could go also through this learning unit.

The last set of questions was about learning unit 20. The study approach of this learning unit and the use of ESD when studying this learning unit was questioned. Beforehand the students got also the opportunity to go through this learning unit.

The interviewers went through the personal study materials of the students during the interview and used a separate checklist to gather information about the way students had 'personalised' their written course materials (marking, underlining, arrows, renumbering, written summaries, symbols, etc.).

3.5 From interview variables to research variables

Since the interview was based on a rigid protocol and structure, the researchers could relatively easily assemble the variety of answers for each question in order to structure the information. A codebook (176 pages) was compiled that described how the individual student answers were to be coded in an unambiguous way. The complete interview resulted in a data set of 499 interview variables. This data set was entered into the computer to be processed with the SPSS^{pc} statistical package.

The 499 interview variables were in a next step reduced to 191 research variables by combining, regrouping and recoding. We give an example : students were asked three questions whether or not they had experience with (1) studying at a distance 'AFSTERVA'(= AFSTandsonderwijs ERVAring: the dutch shortening of experience with distance education) (2) studying at the Dutch Open university 'OUERVA'(= OU ERVAring: Dutch for experience with studying at the Open university) and (3) the number of Ou-courses they already studied 'NCURSUS'(= N CURSUSsen: Dutch for number of courses). The answers to these three questions were recoded in order to compute the variable 'experience' :

recode afsterva ouerva (1=1) (2=0) (9=sysmis)/ ncursus (9=0).
compute experience = afsterva + ouerva + ncursus.

The number of categories for this new variable was 7. Analysis of the frequency table for this new variable helped to reduce the 7 categories to 3 by the following rule :
recode experience (0=1) (1=1) (2=1) (3=2) (4=2) (6=3) (7=3).
These new values are labelled : 1=low, 2=medium, 3=high.

To argument this recoding and computing process, the researchers have introduced - for some variables - rationales about the nature of cognitive functioning. Three of these rationales refer to concepts commonly found in literature about study regulation : surface level versus deep level studying (Marton & Säljö, 1984), external versus internal control (Simons & Vermunt, 1986) and deep versus elaborative processing (Schmeck, 1983).

To judge whether the study behaviour of a student is to be judged as *'Surface level' or 'Deep level* studying' a specific procedure was followed. During the interview, students had to respond to statements that describe the way one can study the course; e.g. :

I read first the complete text book.
I first read the text and the next time I mark parts of the text.
I first read the work book completely.
I start with the questions/tasks and next work step-by-step through the course.
I study daily a prefixed number of pages.
I read the learning objectives afterwards to control my learning process.
I continue and repeat reading the content of a learning unit until I master the content.
I explicitly adapt to all 'study guidelines' in the text.
...

The researchers discussed beforehand whether a behaviour was considered as an operational description of deep level versus surface level studying. The students indicated whether these statements did or did not reflect their own personal study behaviour. Agreeing with a 'surface level' operationalisation resulted in a '0' score. Agreeing with a 'deep level' operational description resulted in a '1' score. Summing the scores for the whole set of statements resulted in a new score for the new variable 'general learning strategy'[2]. The value for this new variables ranged from 6 to 25. Recoding resulted in three categories (6 thru 8 = 1; 9 thru 14 = 2; 15 thru 25 = 3). The 1-category refers to a rather surface level type of general learning strategy, 3 refers to a deep level approach and 2 refers to a combination of both approaches. One can find a detailed transformation procedure of this variable in appendix 2.

Judging whether a complex behaviour or orientation was *externally or internally controlled,* depended - comparable to the procedure outlined above - on the sum of scores for a set or subset of statements. Again, students could agree or disagree with these statements :

I make my own summaries.
I add my own schemes.
I underline text parts.
I test the mastery of the learning content myself.
I use especially my own annotations when studying.
I rather use the study guidelines in the workbook to direct my study process.

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[2] Care was taken to 'correct' scoring if students did not respond to a specific statement.

The answers to these questions were recoded in order to compute the variable 'INTERN'. The documented transformation procedure of this variable can also be find in appendix 2.

Deep versus elaborative processing refers to respectively making relations within the course material or between the course material and personal experiences. To construct this new variable the answers to the question which kind of relations the students make were recoded.

In recoding and computing the research variables, the number of categories for each variable were limited. Since we projected to use multi-way frequency analysis, the number of categories for each variable had to remain restricted, taking account of the small sample size. In a limited number of cases, too many missing values made the use of certain variables irrelevant. They were excluded from the further analysis. One can find additional examples of variable transformations in appendix 2. The complete reduction and recoding procedure has been fully documented and more information can be obtained from the authors.

3.6 Research variables

In relation to each research variable we provide - between brackets - key words referring to the categories. We repeat that the categorisation is based on a recoding and computing process that result in new variables. Frequency analysis of the scores for the new variable is used to look for relevant criteria to split up the scores in e.g. low, medium or high categories.

The final list of research variables can be structured as follows :

Descriptive variables about personal characteristics of the research sample
Gender (man, woman)
Age level (18-30, 30-40, 40-50, > 50)
Educational level (low, medium, high)

Variables related to the general orientation of students towards studying at the Open university
Experience with distance education materials (Low, Medium, High)
Locus of control (Extrinsic, Intrinsic)
Level of intrinsic motivation (Low, Medium, High)
Level of extrinsic motivation (Low, Medium, High)
Motivation level (Low, Medium, High)
Use of study guidance facilities (yes, no)
Reliance on external support (Low, Medium, High)

Variables in relation to studying law and the course "Introduction to governmental law"
Prior knowledge in relation to the law domain (Low, Medium, High)
Prior knowledge in relation to the course "Introduction to governmental law" (Low, Medium, High)

Variables specifying the nature of cognitive functioning of students
Orientation strategies at the start of the study (low, medium, high)
Evolution in study speed during long term study process (change, no change)
Development of metacognitive skills (yes, no)
General learning strategy (surface level, deep level, combination)
Self-controlled versus external controlled studying (external, internal, combination)
Insight in main purpose of the course (via ESD, via external support, other ways)
Average time spent studying (5-10, 12-19, 20-55 hours a week)
Regularity of study-time (regular, irregular)
Time planning (yes or no)
Time spent per learning unit (same time, variation in time)
Difficulties with switching between course materials (yes or no)
Annotations in study books (yes or no)
Problems with looking up (enough trained, not enough trained)
Source of overview (strongly, average ... not by means of ESD/external sources)

Self-testing by means of ESD (strongly, average or not)
Self-testing by means of external source (strongly, average or not)
Elaborative processing (deep versus elaborative processing)

Variables related to the performance of the students on the course exam
Final score for the examination (< 6, 6-7, 8-10)
Number of examination attempts (1, 2, > 2)

Variables in relation to the use of ESD
23 variables indicating the quantitative use of a specific ESD
23 variables indicating deep level or surface level use of a specific ESD
The evaluation of the deep or surface level use of the ESD was based on the categorisation of the functions and effects students attributed to each specific ESD :
Statements that were categorized as deep level or surface level were of course also used to score for the variable "use of ESD".

surface level use : "I did read it."
"I noticed it."
"I look at the indications for prior knowledge and take them for granted."
"I have only scanned that text for a few seconds."

deep level use : "I use this to look for other examples."
"I always solve the questions and control my answer by using the feedback information."
"This device helps me to understand the text."
"This information is helpful to get an overview."
"I have tried to answer that question."
"After reading the introduction I reread a part that was ambiguous to me."

Indications for 'no use' of a certain support device :
"I don't use or read that kind of information."
"I always skip the summaries."
"Is there a content page?!"

Additional research variables were created which indicated the use, deep level use and surface level use of ESD at a more general level. Four clusters of ESD were defined :
- orientating ESD (e.g. content page, introduction, ...)
- planning ESD (e.g. learning objectives, content page, ...)
- processing ESD (e.g. advance organizer, study guidelines, ...)
- testing ESD (e.g. learning objectives, examples, ...)

For each cluster the use, deep level use and surface level use was computed.

4. QUANTITATIVE ASPECTS OF ESD USE

4.1 Descriptive statistics

To check hypothesis 1 "Students make no use of ESD" and hypothesis 2 "There is no difference in the number of students making surface level or deep level use of the ESD" we used a descriptive statistics technique: the data in relation to the variables about the use and level of use of ESD are analyzed.

Table 1 gives an overview of the use and appreciation of the ESD embedded in learning unit 20 of the study text. The variables are given in an descending order of use.
The first column indicates the overall quantitative use of ESD; this is the proportion of students that indicate they use this specific ESD in one way or another.

The second and third column examin in more detail the use of ESD. Here a distinction is made between 'surface level' and 'deep-level' use[3]. In the cells the percentages of students are given that made at least one statement that was an indication for surface or deep-level use. Note that in this way it is possible that a student uses a support device in both ways.

Table 1 : The use of ESD

	1	2	3	4	5
ESD	% used by students	% surface use by students	% deep level use	used as meant (0-3)	appreciation
study guideline	100%				
example	100%	28%	96%	2,92	
scheme (1)	96%	25%	88%	2,44	
question (2)	96%	6%	96%	2,83	2,83
introduction	92%	48%	91%	2,43	
margin text	92%	4%	96%	2,79	
reference to other learning units	88%	6%	92%	2,75	
scheme (2)	88%	11%	83%	2,17	
title	84%	22%	83%	2,68	
task	84%	28%	77%	2,00	
example of correct answers (feedback)	84%	12%	79%	2,58	2,67
summary	84%	16%	80%	2,27	2,33
learning objective	80%	24%	65%	2,17	2,39
text paragraph	80%	0%	96%	2,68	
pre-question	80%	16%	81%	2,48	
question (1)	80%	19%	90%	2,14	
font types (italics)	80%	10%	76%	2,52	
advance organizer	80%	65%	70%	2,13	
additional remark	76%	41%	67%	2,33	
indications about prior knowledge	68%	37%	56%	2,13	2,65
small printed text	64%	47%	65%	2,30	1,82
content page	60%	25%	54%	1,73	
facultative activity	28%	24%	30%	1,60	

The fourth column gives an indication whether the students used the ESD in concordance with our theoretical assumptions. A score '3' means that all students use an ESD exactly as expected, a '1' score means that no subjects use the support device as expected. Here a correction was made for the total number of possible ways to use an ESD.

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3 Because one can only use or not use a 'study guideline', no further questions were asked about this support device. This means that the cells 2, 3 and 4 for this particular row are empty.

Without such correction the ESD that can be used in many ways are underestimated, since it is more likely that students do not use the ESD in al the possible ways.
The last column gives information about the appreciation of ESD. Due to time-constraints it was not possible to obtain information about the appreciation of all ESD during the interview. The scores vary from 1 to 3, reflecting a negative to a very positive appreciation of the ESD.

4.2 Discussion

The results in table 1 are, in our opinion, surprising. We did not envision such a high level of ESD use by the students. With the exception of 'facultative activity', all ESD are used by more than 60% of the students.
If we use this information to check the first main null hypothesis "Students make no use of ESD", we can easily reject this hypothesis.
When interpreting these results, we can wonder why ESD are so highly used. Several explanations can be put forward. It can be caused by the small sample size, the fact we selected law students, the specific course or the difficulty level of learning unit 20.
As a consequence we have to interpret the results with caution. Although we tried to set up an ecologically valid and reliable research setup and tried to detect the 'real use' of ESD by students, it remains plausible that the student responses are not reliable. Their perceived and reported use and level of use of ESD can still differ from what they actually do when studying.

If we focus on the 'level' of ESD use, it is striking that students mention especially kinds of uses that are to be qualified as 'deep level'. This can bring us to the conclusion that 'if students use specific ESD, they use it in a 'deep level' way'. This suggests that we might also reject the second main null hypothesis that states that there are no differences in deep level or surface use of ESD among students.

We will derive no conclusions from the fourth collum ('used as meant') although we already perceive that ESD are used as meant by the course developers. The only clear exceptions are 'content pages' and 'facultative activities' (these variables score less than 2). We postpone a more detailed discussion of this topic to chapter 7.

The last collum gives information about the appreciation of ESD. Unfortunately we only have information about 8 of the 23 ESD (due to time constrains). Nevertheless from these figures we can conclude that ESD are highly appreciated. The only exception concerns 'small print'.

A final remark in relation to both the use and level of use of ESD is needed before we continue : The actual use of the ESD can be influenced by the quality of the specific implementation of the ESD in the study text. If for instance 30% or 40% of the students do not use a specific ESD, is this because they consider this ESD as useless or is this an indication for a bad implementation of this distinctive ESD ? But it can also indicate that students never tend to use such an ESD, wether it is good or badly implemented. Analysis of the interviews showed for instance that 'the small printed text" was not used by most student but also not appreciated. Some students indicated that the used character font was too small to be readable. So it is quite possible that improving the font size would increase the use of this support device.

5. QUALITATIVE ASPECTS OF ESD USE

5.1 Analysis techniques

In part 3.6 we gave an overview (5 clusters) of the research variables. Four of these clusters describe individual student characteristics at a general (e.g. age, educational level, etc.) to a very specific level (motivation to study this course, specific study approach, etc.)[4]. Up to 30 variables can be used when evaluating the hypotheses about the interrelation between general personal and cognitive student characteristics and the use of ESD. Multi-way frequency analysis is used to explore these interrelations.

Interrelating 23 variables indicating the use of each specific ESD with 23 variables indicating the level of ESD use and 30 variables describing student characteristics, results in a matrix of 23 x 23 x 30 variables. To explore this large set of variables data multi-way frequency analysis was performed to develop hierarchical loglinear models. But, due to the restricted number of students interviewed (N=25), the number of dimensions to be included in the model construction is to remain restricted in order to prevent a too large number of empty cells in the contingency tables (the "rule of five")[5]. To protect against empty cells, three-way frequency analysis was chosen as the most save way to explore the data and to develop models. The SPSS^{pc} HILOG-procedure was used to evaluate the models. This procedure protects against violation of the rule of five by adding .5 to all observed cells. But still then, we have to remain cautious because observed and expected cell frequencies are small. The only solution left is to choose a severe, high criterion when judging the goodness-of-fit of models (e.g. $\alpha > .25$)[6].

Following the SPSS^{pc} HILOG-procedure, a backward stepping procedure was used, starting with the saturated model. This model implies a perfect fit of the observed and the expected frequencies. The term (simple or multiple) that is least helpful to the model is deleted first, followed by assessment of the remaining terms of the same order. In the SPSS^{pc}-procedure, partial effects of individual effects are reported. Effects are deleted if they are unambiguously non significant. Backward stepwise deletion continues until the criterion for significance of fit is reached and the results adapt to the rule of parsimony.

5.2 Results

5.2.1 Student characteristics and ESD use

Table 2 summarizes the results of the multi-way frequency analysis of the models where student characteristics are related to ESD use (each ESD seperately and next clusters of ESD). A remark to be made is that when we comprise the variables 'use of ESD' and 'deep level use of ESD' in one model, both variables interact to this extent that they suppress possible other interactions between the variables. This is not strange if we look at the results of table 1: an ESD which is used is almost always used at a deep level. Therefore, only 'deep level use of ESD' is incorporated in the models when the interrelations with student characteristics are explored.
The first column describes the variables entered in the saturated model. The second column shows the number of cells when combining the number of categories for each variable in the model. The third column indicates the significant, unambiguous effect(s) that remain in the model after stepwise deletion of ambiguous effects. The next columns shows the respective L^2 value, the degrees of freedom and significance level. The last column is a symbolic indication about the direction of the interrelation that is present in the significant effects. Take care, the table only contains information about models that result in 'significant' unambiguous interaction-effects.

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4 Quantitative information about these student characteristics can be found in appendix 1 of this text where we give an overview of frequency tables in relation to most research variables.

5 The "rule of five" states that cell frequencies in the table all are greater than 1 and that no more than 20% are less than 5.

6 Tabachnik & Fidell (1989, p.270) discuss in great detail the choice of a significance level when considering the sample size and the nature of the problem.

Table 2: Analysis of the hierarchical loglinear analysis

variables in model	dimen-sions	significant unambiguous effects	L^2	df	p-value	+/-
gender deep level use of self-test ESD deep level use of ESD for planning	2*3*3	gender * deep level use of planning ESD	12.1	12	.440	+
gender deep level use of orientating ESD deep level use of processing ESD	2*3*3	gendor * deep level use of orientating ESD gender * deep level use of processing ESD	6.9	8	.550	+ +
educational level motivation rating deep level use	3*3*3	educational level * deep level use	7.4	12	.828	+
prior knowledge of governmental law age deep level use of testing ESD	3*4*3	prior knowledge of governmental law * deep level use of testing ESD	9.5	18	.947	-
use of study guidance gonder deep level use of testing ESD	2*2*3	use of study guidance * deep level use of testing ESD	3.3	8	.913	+

When looking for individual student characteristics that are related to the deep level use of ESD, we find the following significant interaction effects :

The variable "gender" interacts significantly with :
- deep level use of planning ESD
- deep level use of orientating ESD
- deep level use of processing ESD

The variable "educational level" interacts significantly with:
- deep level use of ESD

The variable "prior knowledge of governmental law" interacts significantly with:
- deep level use of testing ESD

The variable "use of study guidance" interacts significantly with:
- deep level use of testing ESD

These results can be interpreted as:
- women are more likely to use planning, orientating and processing ESD at a deep level
- highly educated people are more likely to use ESD at a deep level
- students with low prior knowledge of governmental law are more likely to use testing ESD at a deep level
- students who use study guidance are more likely to use testing ESD at a deep level

Variables in the models that showed only *main*-effects are :
- motivation
- experience with distance education
- elaborative versus within processing
- evolution in study approach
- regularity in study time
- orientating
- development of metacognitive skills

Variables in models related to the use of ESD that showed *no* effects are :
- reliance on external support
- age
- overview by means of ESD
- overview by means of external source

- switching between three books in the course
- development of metacogniiive skills
- development of metacognitive skills (general/related to the law domain)
- prior knowledge of law

5.2.2 Looking for 'types' of students using ESD

In table 2 only interactions between use of ESD and general or cognitive student characteristics are displayed. We have also explored the interrelations wthin the cluster of general and cognitive student characteristics to get a more clear picture of the 'type(s)' of student which use ESD. In table 3 some significant results of this analysis are displayed.

Table 3: Analysis of the hierarchical loglinear analysis between general and cognitive student characteristics

variables in model	dimensions	significant unambiguous effects	L^2	df	p-value	+/-
locus of control (internal) gender educational level	3*2*3	gender * locus of control (internal)	7.2	10	.705	+
gender use of study guidance prior knowledge of governmental law	2*3*3	gender * use of study guidance	4.7	6	.575	-
intrinsic motivation prior knowledge of law prior knowledge of governmental law	3*3*3	prior knowledge of law * intrinsic motivation prior knowledge of governmental law * intrinsic motivation	8.0	12	.788	+ +
general learning strategy (deep) prior knowledge of law prior knowledge of governmental law	3*3*3	prior knowledge of law * general learning strategy	10.5	16	.842	+
annotations (observed by the student) general learning strategy (deep) use of study guidance	2*3*3	annotations (observed by the student) * use of study guidance	2.6	6	.863	+
annotations (observed by the student) annotations (observed by the interviewer) general learning strategy (deep)	2*3*3	annotations (observed by the student) * annotations (observed by interviewer)	9.1	10	.521	+
age prior knowledge of law prior knowledge of governmental law	4*3*3	prior knowledge of law * prior knowledge of governmental law	11.7	18	.864	+

When looking at the general student characteristics we find the following interesting interactions in table 3:
The variable "gender" interacts significantly with:
- locus of control
- use of study guidance

The variable "prior knowledge of law" interacts significantly with:
- intrinsic motivation
- general learning strategy

The variable "prior knowledge of governmental law" interacts significantly with:
- intrinsic motivation

The variable "annotations (observed by the student)" interacts significantly with:
- use of study guidance

This last interaction isn't surprising, because students are trained during study guidance meetings in making annotations.
The last two interactions:
- annotations (observed by the student) by annotations (observed by interviewer)
- prior knowledge of law by prior knowledge of governmental law

are not interesting for our research questions, but they can be regarded as a control on our interview.

5.3 Discussion

Before we discuss the results we should make the remark that we have not explored all possible interactions because of the vast amount of variables in our investigation. So the interactions that are presented here should be seen as a minimal set of possible interrelations.

On the base of the results of the hierarchical log-linear analysis we can test the hypotheses:
1) There is no interaction between general student characteristics and the use of ESD.
2) There is no interaction between cognitive student characteristics and the use of ESD.

The first null hypothesis can be rejected: there are interrelations between general student characteristics and the use of ESD :
- gender and deep level use of planning ESD
- gender and deep level use of orientating ESD
- gender and deep level use of processing ESD
- educational level and deep level use of ESD
- prior knowledge of governmental law and deep level use of testing ESD
- use of study guidance and deep level use of testing ESD

The second null hypothesis cannot be rejected. This means that no cognitive student characteristics are retained in the models.

Our findings are in line with and enrich earlier findings of Boon et al (1991b, p.17) when they analysed the interrelation between student characteristics and course characteristics with a more general Ou-population (N=1661). Their analysis revealed (1) that 79% of the students use structuring elements of the course[7] regularily or very often and (2) that student characteristics such as 'lower educational level', 'having no study plan outside the Ou-context', etc.. are related to making more use of structuring course elements.

We can question why only "gender", "educational level", "prior knowledge of governmental law" and "use of study guidance" are retained as having an interaction effect with the use of ESD in the models evaluated? First, we can question our research setup. The restricted number of students inhibits reaching significant effects. If we review the data in the frequency tables of appendix 1, we find that in general the 25 students in our sample are not extremely different in relation to for instance motivation level, prior experiences with distance education, prior experiences with the law domain, reliance on external support, general learning approach, orientating, etc. The characteristics of our sample influence as a result the extent to which differences pertain in study behaviour and the resulting use of ESD.
Second, the fact that all students use the ESD to a high extent makes it - a priori - difficult to find differences in use of the ESD.

To get a more clear picture of the kind of students which use ESD it is worth looking at the results of the multi-way frequency analysis of the models about 'types' of students. We find for instance interactions between gender and prior knowledge of governmental law on the one hand and other personal characteristics on the other hand : gender interacts with locus of control (intern) and use of study guidance; prior knowledge of governmental law interacts with intrinsic motivation. We didn't find interactions between educational level and other personal or cognitive characteristics. Looking at the crosstabs (Appendix 3) shows anyhow that there is a positive relation between educational level and prior knowledge of law, prior knowledge of governmental law, intrinsic motivation and general learning approach. From these four variables prior knowledge of law and prior knowledge of governmental law are most related to educational level. Prior knowledge of law itself interacts with intrinsic motivation and a deep level learning strategy.
So when considering the cluster of general and cognitive student characteristics which interact we get the following picture: especially highly educated (and intrinsic motivated) students with many study experience and little prior knowledge make deep level use of ESD.

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[7] They distinguished 8 structuring elements : structure pages, learning objectives, questions and feedback to tyhe questions, example examination, specifal requirements, supoort facilities outside the course and media add-ons.

6. STUDY SUCCESS IN RELATION TO USE OF ESD

6.1 Building models

We also gathered information about study success : final examination scores (score) and number of examination attempts (attempts). We can use this information to build additional models that are helpful to describe/explain ESD use. Table 4 contains the results of the multi-frequency analysis of the models where study success is related to the use of ESD and other student characteristics.
The first column describes the variables in the saturated model. The second column shows the number of cells when combining the number of categories for each variable in the model. The third column shows the significant, unambiguous effects that remain in the model after stepwise deletion of ambiguous effects. The next columns shows the respective L^2 value, the degrees of freedom and significance level. The last column is a symbolic indication about the direction of the interrelation that is present in the significant effects.

Table 4: performance of students in relation to the use of ESD and student characteristics

variables in model	dimensions	significant unambiguous effects	L^2	df	p-value	+/-
development of metacognitive skills score deep level use of ESD	2*3*3	score * deep level use of ESD	4	8	.858	+
attempts reliance on external support deep level use of ESD	3*3*3	attempts * deep level use of ESD	14.8	18	.678	-
attempts score development of metacognitive skills	3*3*2	attempts * score	7.8	8	.450	-
educational level prior knowledge of governmental law attempts	3*3*3	attempts * educational level	9.4	16	.895	-
educational level score prior knowledge of governmental law	3*3*3	educational level * score	12.3	16	.720	+
experience with distance education score prior knowledge of law	3*3*3	experience with distance education * score	19.5	18	.360	+
orientating score prior knowledge of law	3*3*3	orientating * score	18.8	18	.405	+
switching between course materials score prior knowledge of law	2*3*3	switching between course materials * score	15.4	18	.633	+

Study succes versus use of ESD :
The variable "score on the examination" interacts significantly with
- deep level use of ESD

The variable "attempts" interacts significantly with
- de level use of ESD

Student characteristics versus study success :
The variable "attempts" interacts significantly with
- score on the examination
- educational level

The variable "score on the examination" interacts significantly with
- educational level

- experience with distance education
- switching between the course materials
- orientating

These results can be interpreted as follows :
- students with a high examination score are more likely to use ESD at a deep level
- students with a low number of examination attempts are more likely to use ESD at a deep level
- students with a low number of examination attempts are more likely to acquire a high examination score
- students with a low number of examination attempts are more likely to have a high educational level
- students with a high examination score are more likely to have a high educational level
- students with a high examination score are more likely to have more experience with distance education
- students with a high examination score are more likely to switch properly between the course materials
- students with a high examination score are more likely to orientate.

6.2 Discussion

Two main conclusions can be drawn from these results.
The first conclusion is that students with a high examination score and with less examination attempts use ESD at a deep level.
The second conclusion refers to the type of students acquiring a high examination score and do this with less examination attempts. The following picture arises: they are highly educated, they have experience with distance education, they switch properly between the course materials and they orientate more easily.
Striking is the fact that "educational level" is related to all the variables that are important in relation to the use of ESD. Again students with a higher educational level seem to use ESD at a deep level and score consequently higher on the examination after less examination attempts.

Again, we have to repeat that caution is needed when interpreting or generalising these results. Our specific student sample and our research procedure can have influenced these particular ourcomes.

7. SPONTANEOUS VERSUS THEORETICAL USE OF ESD

7.1 Comparing spontaneous use and theoretically expected use of ESD

In chapter 4.1 we already anticipated on this topic. In this section we present additional information.
First we reIeat that the theoretical functions and effects of ESD gave been derived from our theory. Second, the functions and effects of ESd as perceived by the students have been derived from the interviews. In order to obtain this information we induced from the students spontaneous reactions to a general open ended question. Next, we posed specific questions based upon our theory (e.g. 'has the content page been helpful to you to orientate in the study material?') to check whether they agreed with the functions and effects recited.

Table 5 summarizes the results[8]. The first collumn gives a list of all ESd we distinguish in our theory.
Next, the other collums refelct all the potential functions/effects that are expected.
The percentage of students that 'spontaneously' reported a certain effect for a certain support device is indicated in the cells. For example, if we look at row 1 and column 15 we can see that 15.8% of the valid cases indicated spontaneously that indications about required prior knowledge have a facilitating effect on understanding the task environment.
The content of some cells contains an asterix (*). This means that students indicated a function although it was not theoretically expected. '0%' means that no student spontaneously mentioned a function, although this was expected.

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[8] The first collum lists all the ESD we discern in our theory. Since the actual study only focuses on a subset of the general set of ESD, the collums for certain ESD are not fully documented.

Embedded support device	MC1 Expln. of problem	MC2 Nature of problem	MC3 Select. lower order comp.	MC4 Select. strategy task perform.	MC5 Select. mental represen-tation	MC6 Allocat. ment. resources	MC7 Monitoring	MC8 Underst. internal & external feedback	EAC1 Selective encoding	EAC2 Selective combining	EAC3 Selective comparing	PC1 Stimuli encoding	PC2 Combine or compare stimuli	PC? Applying	Task Environ-ment	Moti-vation	Reading compre-hension
Starting conditions Indications about required prior knowledge									5,3% ⊓						15,8%	0%	
Learning objectives	0%	0%				0%	31,1%		33,3%			6%			0%	0%	0%
Learning content Structure pages						0%	37,5% ⊓		18,8%	0%		0%	6,3%				
Content pages							16% ⊓		20%								
Advance organizers						0%				23,5%	0%	23,5% ⊓	29,4%	0%			0%
Scheme 1					0%				30%	0%		25%	0%				
Scheme 2					0%				38,9%	0%		44,4%	5,6%				
Addition (additional remark)						5,9% ⊓			5,9% ⊓						0%	17,6% ⊓	
References to other learning units				88,2% ⊓	0%		0%			64,7%			0%				
Introductions to blocks/units							30% ⊓		20% ⊓	25% ⊓			10% ⊓		30% ⊓		
Text structure (paragraphing)					0%				0%	0%		0%	22,2%				0%
Summaries					0%		42,1%		15,8% ⊓	0%		36,8% ⊓	10,5% ⊓				
Text documentation/examples					33,3%				61,1%	0%	0%	0%	0%	0%		11,1%	0%
Formal style / Ou style margin text									36,4%			0%	36,4% ⊓				0%
Formal style / Ou style font type (italics)									61%			0%					0%
Formal styl/Ou style small printed text				13,3% ⊓	6,7% ⊓				13,3%			)%					0%
Learning activities Indications about learning approach (study guideline)				0%											0%		
Facultative activity				0%											0%		
Question 1	0%		0%	0%	0%	0%	4%		16%	0%	0%				0%		
Question 2	0%		0%	0%	12% ⊓	0%	12%		8%	0%	0%				0%		
Pre-question	0%		0%	0%		0%	0%		4%	0%	0%				0%		
Task	0%		0%	0%		0%	0%		0%	0%	0%				0%		
Evaluation Examples of (correct) answers							28%	0%	20% ⊓						0%		

7.2 Discussion

The results in table 5 reveal that if there is an agreement between theoretically expected and spontaneous mentioned functions, this percentage is low: only for 3 ESD more than 40% of the students mention the functions that are theoretically expected.
Another conclusion that can be derived from table 5 is that many theoretical functions of ESD are not mentioned spontaneously by students (cells with '0 %'). When we confront these results with the results of table 1 we see anyhow that if students are explicitly asked to indicate functions/effects, they indicate that they use the ESD as meant (see column 4 of table 1). These results could imply that students are not aware of specific functions/effects of ESD. It is also possible that students are not able to explain why a certain embedded support device improves text comprehensibility or facilitates the study process.
Also interesting is that the students indicate functions spontaneously that are not theoretically expected (this is represented by the scores with an asterix (*). Students seem to ascribe personal functions/effects to ESD.

Does this imply that we cannot validate our theory about functions and effects of ESD ?
In our opinion, the research results do not contradict our theory. They rather reval that, whatever functions or effects are assigned to certain ESD in written study materials, students redefine the functions/effects in terms of their own study needs, study plan and cognitive functioning. Therefore, the assignment of functions or effects cannot be made in general terms, but has to take account of at least 'types' of students.
The question can also be put forward whether it is relevant to 'learn' students to use specific ESD. We can refer e.g. to the research of Winne (1983) and de Jong & Simons (1988) who demonstrated how training in the use of ESD can result in a better 'supported' learning process. In our opinion the findings stress the importance of such 'training'.

Finally we again remark that these results should be interpreted with caution. The ascription of the general and undetailed student answers to specific theoretically expected functions/effects was not an easy and unambiguous task.

8. GENERAL DISCUSSION

First we will summarize and comment the overall research findings in relation to the use of ESD. Secondly we will link the main findings of our study to related research. Next, problems regarding our method of investigation are considered and finally we focus on possible directions for future research.

8.1 Putting things together : is the elaboration of written study materials worth the effort ? Implications for future elaboration of Ou-courses

When we summarise the research results about the *actual use* of ESD we get the following picture :

- ESD are highly used: with the exception of the 'facultative activity' all ESD are used by more than 60% of the students.
- The level of ESD use is to be qualified as deep level use. If students use ESD, they seem to use ESD at deep level.

To get a picture of the *'type' of students* which use ESD at deep level, we analysed interactions with general and cognitive student characteristics. To get a more clear picture we also explored the interrelations between the set of personal and cognitive characteristics. We found significant interactions between general student characteristics and the deep level use of ESD: gender, educational level, prior knowledge of governmental law and use of study guidance. The interactions between cognitive student characteristics and deep level use of ESD were not significant. When we analysed the cluster of student characteristics we obtained a more clear picture of the 'type' of students which seem to make deep level use of ESD : especially highly educated and intrinsically motivated female students with distance education experience and little prior knowledge make deep level use of ESD.

As to the possible relations between deep level use of ESD and study success it seems that students with a high score on the examination and needing less examination attempts make deep level use of ESD.

The differences between spontaneously mentioned and theoretically expected functions and effects of ESD were striking. Many theoretically expected functions and effects are not or rather rarely mentioned by the students. Students indicate on the other hand functions and effects that are theoretically not expected. Students seem to ascribe their own functions and effects to ESD.

Returning to our main research question we think we can conclude that the high investment in the design and elaboration of study materials is worth the effort. Students use ESD, even at a deep level. The finding that students which use ESD at a deep level have a high examination score and need less examination attempts is an extra indication that it is worth the effort.

The results concerning the interaction between general student characteristics and use of ESD indicate that student characteristics have to be taken into account when developing or presenting study materials. Study materials have to be flexible and adaptable to individual student needs or the needs of 'types' of students. The fact that students spontaneously ascribe their own functions and effects to ESD can be considered as an extra stress for further flexibilisation. Moreover, it can be argued to train students to make use of ESD.

8.2 The research results compared to earlier findings

In chapter 5.3 we already linked our findings to other research set up at the Dutch open university. Our results are in line and confirm the results of earlier Ou-studies. But we can also relate the results of this study to the research results of three researches especially linked to the course "Introduction to governmental law" :

1. The actual use of ESD by students in the course 'Introduction to governmental law': the opinion of tutors (Martens & Daal, 1992).
2. The use of ESD in the course 'Introduction to governmental law'. (Martens et al, 1991).
3. Evaluation of the course 'Introduction to governmental law' (van Meurs, 1987)[9].

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[9] The three titles are translated from Dutch to English by the authors.

The first study to be contrasted with our own results is based upon the opinion of tutors. The conclusions of this research indicated that the abstraction level of the course is - in general - too high. The amount of examples is too restricted.
Can this be related to some the findings of the actual study ? When we look at the ESD 'examples' in table 1, we perceive that all students make use of examples and this at a deep level. This can be expounded as an indication for the high need for examples. However, these figures cannot tell us whether there is a need for extra examples.

The results from a second earlier study are based on a review from an educational point of view. For this review we used a checklist developed by Valcke et al (1991). The conclusion of this checking was that some ESD are not adequately implemented. A typical illustration is again the ESD 'examples'. Only 4% of the learning units reflect a fitting and proper use of 'examples'. When relating the findings from report 2 to the actual study we get the pattern displayed in table 6. In the first collum are printed the ESD used at deep level by less than 80% of the students. In the second collum the ESD that are not appropriately implemented (based on report 2) are displayed. The figure < 80% in the first collum is misleading since - with the exception of 'facultative activities' - most ESD are still used by more than 60% of the students.

Table 6: comparison of deep level use of ESD with some conclusions from report 2

deep level use < 80%	not correctly implemented from an educational point of view
content pages	-[10]
indication about prior knowledge	X
study goals	
tasks	X
examples of correct answers	
additional remarks	X
facultative activities	X
text in italics	
small print	
advance organizer	X

Due to the high amount of ESD use, we cannot easily derive conclusions from this table. If the amount of ESD use was extremely low for certain ESD, this could have meant that restricted ESD could be explained by a bad implementation. But since this prior condition is not true (cf. table 1) we cannot confirm the latter statement and reject more easily the suggestion that the actual use of ESD might be influenced by the specific (poor or restricted) implementation of the ESD.

A third, earlier, study evaluated the general acceptance of the course by a sample of law students.
The main conclusions from this evaluative research were :
1. Students have problems with handling the textbook-workbook-reader construction.
2. Students tend to follow the suggested working method.
3. In general the students are satisfied with the course.
The first conclusion is in line with our findings, 13 students of the 25 students have problems with handling the three books.
Also the second conclusion can be confirmed when looking at table 1 : alle 25 students use study guidelines.
To compare conclusion 3 we have to look again at table 1. In most cases students are satisfied with the implementation of support devices. Of course this can only be said about the ESD from which we obtained 'appreciative' information.

[10] '-' means that there is no information available about this ESD.

8.3 Putting the results in the right perspective

At some points during the discussion of the research results we already asked for caution when interpreting the results. We repeat here these considerations in order to put the results in the right perspective.
We structure them by looking at the one hand to shortcomings in the research method adopted and on the other hand to shortcomings resulting from our research sample.

When considering the alternative research methods for this research project (Valcke & Martens, 1992) 9 methods for investigating ESD were discussed. It was concluded that the interview-method was to be choosen for this study but that there are also disadvantages linked to this choice :

- Students are not always conscient of their reading- and study process. Being aware of the use of ESD would demand from the students a functioning at different levels (a study and a meta-study level), and the question is whether the cognitive load is not too high to expect this level of awareness.
- Analyzing the student's answers demands an interpretative activity of the researchers. Also the translation from interpretations to variable categories implies a translation phase. These translation phases might affect the reliability and validity of the research data.
- Analyzing interviews is time consuming. The price to be paid for the high quality of the research data is a huge investment in time and energy to transcribe, to analyze and to categorize student answers.

We cannot neglect the first disadvantage mentioned. We attempted to scaffold the retrograde introspective process by carefully building up the interview session and by making use of the students' study materials. The stepwise building up of questions (e.g. first asking spontaneous reactions before asking for specific responses to specific functions/effects) still cannot prevent the students from giving unreliable or socially acceptable answers.
Regarding the second disadvantage, we tried to overcome this problem as much as possible by interviewing on the basis of a detailed interview protocol. The interview followed a structure that evolved from the general to the very specific (at ESD level) aspects of the individual learning process. This facilitated to check the comprehension of the questions by the students and the consistency of the student answers. We also repeat that the interview was structured by a rigid structure that linked question unambiguously to interview variables. It is our opinion that this resulted in 'translation' phases that did not affect the reliability of the student answers.
The third disadvantage 3 is again difficult to overcome. We reduced the time load for administering, transcribing and analysising the interview by carefully prestructuring the interview. But still under these conditions the set up was so time-consuming that the number of students in the sample had to remain restricted.

Our research sample is - as said earlier - restricted. Although the 25 students interviewed form a representative sample from the Ou-law student population still other problems remain unsolved. We restricted for instance our study to students :
- taking an **introductory** course;
- studying **law**;
- taking **examination.**

8.4 Future research

Taking account of the former section, we have to stay decent when extrapolating conclusions from this research. Future research has to be set up to confirm/disconfirm our findings with other courses, other student populations and in different settings. Moreover, the research methodology has to be adapted to incorporate methods that result in reliable and objective student reactions. We briefly elaborate this issue :

- A methodological problem regarding our research setup is caused by the 'subconscious nature' of parts of the study process. It is difficult to get access to these processes by means of an interview. To enrich the reserach set-up a combination of research instruments could be developed, including for instance eye-movement registration, reading comprehension tests, etc.
- Our research was linked to only one content domain: law. Even within this domain only one discipline was selected: governmental law. One can anyhow question whether the research results

are to be generalised to other domains and disciplines. Further research of use of ESD within other domains and disciplines is therefore needed.

- In this research some clear interactions between student characteristics and use of ESD were found. More research is needed to explore these relationships : is it e.g. possible to separate in a better way 'types' of students ?
- Also the ways in which students can be trained in using ESD has to be explored in a systematic way.
- Further research can focus on preliminary implementations of the reserach findings.
  A first idea can be linked to flexible course development: student characteristics should be taken more in account. An automated interactive learning envirnment could be linked to a course. In this course, the student can opt for the incorporation of specific ESD. For instance the abstraction level of the course can be lowered by implementing more examples and by providing more text structure. Also the position and combination of ESD can be varied. Only after this preliminary study phase in front of the computer a text version of the course is produced.
  Another example can result in a special course to train "study skills" for starting students. The individual differences found in this research support the rationale of such initiative.

9. FINAL CONCLUSIONS

In this investigation we tried to answer the question : "Is the high investment in the design and elaboration of written study materials for use in a distance education setting, worth the effort ?". From the results of this study we can conclude that it is worth the effort.

Several null hypotheses could be rejected:

- Students do use ESD.
- Moreover they use them at deep level. Also important is the fact that deep level use of ESD is related to higher examination scores and fewer examination attempts.
- There are interaction between the (deep level) use of ESD and general student characteristics.

A specific null hypothesis could not be rejected :

- We did not find significant interactions between use of ESD and cognitive student characteristics.

General student characteristics, such as gender, education level, prior knowledge of governmental law and use of study guidance play a role in the use of ESD. To get a better picture of the 'type' of students which use ESD at a deep level, we looked at interactions within the large set of student characteristics.
The 'type' of students making deep level use of ESD could be described as highly educated with study experience, a high examination score and few examination attempts. Students with little prior knowledge use testing ESD more at a deep level.
Implications from these results suggest that it might be necessary to take into account student characteristics when developing course materials and implementing ESD.

Finally it was concluded that there is a difference between spontaneously mentioned functions/effects of ESD and theoretical expectations. Students mention their own functions and effects. This can be caused by the fact that students are not always aware of the functions and effects of the ESD as they are conceived by the course developer.
This could imply that it is necessary to give students training in making use of ESD.
An alternative explanation of the disagreement between theoretical and actual functions/effects of ESD can be found in the capability of the students to ascribe their own functions and effects to ESD.
This plausible alternative explanation, combined with the finding that there is an interaction between student characteristics and ESD use, puts forward extra arguments to develop and deliver Ou-courses in a flexible way. These conclusions are in line with current research activities at the Open university where automated interactive learning environments are linked to Ou-courses.

Finally, we repeat that the research results have to be interpreted with caution since particularities of the research setup (interview procedure and research sample) could have affected the quality of the research data inhibiting a generalisation of the research results to the general education Ou-practice.

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APPENDIX 1 OVERVIEW OF FREQUENCY TABLES IN RELATION TO THE RESEARCH VARIABLES

A. Variables related to the general orientation of students towards studying at the Open university:

Experience with distance education materials:	
Low	3
Medium	9
High	11
Missing	2
Locus of control:	
Intrinsic motivation	24
Extrinsic motivation	0
Missing	1
Level of intrinsic Motivation:	
Low	7
Medium	13
High	4
Missing	1
Level of extrinsic motivation:	
Low	6
Medium	12
High	6
Missing	1
Motivation level:	
Low	1
Medium	4
High	20
Use of study guidance facilities:	
Yes	16
No	9
Reliance on external support:	
Low	9
Medium	7
High	2
Missing	7

B. Variables in relation to studying law and the course "introduction to governmental law"

Prior knowledge in relation to the law domain:	
Low	4
Medium	13
High	8
Prior knowledge in relation to the course "Introduction to governmental law":	
Low	17
Medium	4
High	3
Missing	1

C. Variables specifying the nature of cognitive functioning of students

Orientation strategies at the start of the study:

Low	10
Medium	12
High	1
Missing	2

Evolution in study speed during long term study process:

Change	8
No change	17

From the 8 students who indicate that there have been changes, 3 worked at a slower rate and 5 worked faster at the end of the course.

Development of metacognitive skills:

Yes	11
No	13

3 students reported that they have developed skills that are typically related to the law domain (e.g. 'looking up lawtexts') and 8 students have developed more general study skills such as "planning", "thinking more logical", "making annotations".

General learning strategy:

Surface level approach	1
Combination of both approaches	7
Deep level approach	11
Missing	6

Self-controlled versus external controlled studying:

External control	11
External and internal control	10
Internal control	4

Insight in the main purpose of the course:

Insight via ESD	9
Insight via external support	2
Other ways	4
Missing	10

Average time spent studying:

5-10 hours	7
12-19 hours	9
20-55 hours	9

Regularity of study-time:

Regular	18
Irregular	7

Planning:

Study-plan	17
No study-plan	7
Missing	1

Time spent per learning unit:

The same time per unit	7
Variation in time per unit	18

Difficulties with switching between course materials:	
Yes	12
No	13
Annotations in study-books:	
Yes	16
No	9
Problems with looking up:	
Enough trained	18
Not enough trained	6
Missing	1
Source of overview:	
Overview strongly via ESD	3
Average overview via ESD	8
Overview not via ESD	10
Missing	4
Overview strongly via external source	1
Average overview via external source	15
Overview not via external source	5
Missing	4
Self-testing by means of ESD:	
Testing strongly by means of ESD	6
Average testing by means of ESD	17
No testing by means of ESD	1
Missing	1
Self-testing by means of external source:	
Testing strongly via external source	3
Average	10
Testing not via external source	11
Missing	1
Elaborative versus deep (or within-course) processing:	
Deep processing	8
Elaborative processing	6
Missing	11

D. Variables in relation to the performance of the students on the course exam

Score for the examination on the course "Introduction to governmental law"	
< 6	5
6-7	11
8-10	9
Number of examination attempts	
1	11
2	7
> 2	7

APPENDIX 2 EXAMPLES OF TRANSFORMATIONS OF VARIABLES

- Students were asked whether or not they had experience with law 'ERVRW'. If they had, they were asked to describe this experience 'OMERVRW'. The answers to this questions were recoded to compute the variable 'VOORKREC', the dutch shortening of prior knowledge law:

recode ervrw omervrw1 to omervrw4 (1=1) (2=0) (9=0).

compute voorkrec=ervrw + omervrw1 + omervrw2 + omervrw3 + omervrw4.

The number of categories for this new variable was 5. Analysis of the frequency table for this new variable helped to reduce the 5 categories to three by the following rule:

voorkrec (0=1) (2=2) (3=3) (5=3)

These new values are labelled: 1 = low, 2 = medium, 3 = high.

- Students were asked what their study approach was by the start of their study 'STRBEGI'. The study approaches were reduced to orientating or no orientating. The new variable 'ORIENTAT' was created as follows:

recode strbegi1 to strbegi3 strbegi5 to strbegi7 (1=1) (2=0)/ strbegi4 (2=1) (1=0).

compute orientat= strbegi1 + strbegi2 + strbegi3 + strbegi4 + strbegi5 + strbegi6 + strbegi7.

The number of categories for this new variable was 6. These 6 categories were reduced to three by the following rule:

orientat (0=1) (2=1) (3=2) (6=3)

These new values are labelled: 1 = no or litle orientating, 2 = medium orientating, 3 = much orientating.

- All variables which referred to study approach, such as 'STRALG' (study approach in general) 'STRATLEH' (study approach of self chosen learning unit) 'STRATTWI'(study approach of learning unit 20) etc, were recoded: 1 = deep level approach, 0 = surface level approach. Only the variable 'WEERGAVE' was recoded as follows: 0 = deep level approach, -1 = surface level approach. This because this variable referred, in our opinion, less to the study approach compared with the other variables. The new variable 'DIEPTE', the dutch shortening of deep, was created as follows:

recode stralg1 stralg9 tijdleh (1=0) (2=1)/ stralg2 stralg5 stralg6 stralg7 stralg8 stralg10 stralg11 stralg12 stralg13 planalg (1=1) (2=0)/ overzich bedoelle typedoel relatie overztwi (1=2) (2=0)/ stratleh (01=0) (02=1) (03=sysmis) (04=sysmis) (05=1) (06=1) (08=1) (09=0) (10=1) (11=1) (13=1) (14=sysmis)/ weergave (01=0) (02=0) (03=0) (04=0) (06=-1) (07=0) (08=0)/ strattwi (01=0) (02=1) (04=sysmis) (05=1) (06=1) (08=1) (09=0) (10=1) (11=1) (13=1) (16=1) (18=1).

compute diepte=planalg + tijdleh + stralg1 + stralg9 + stralg2 + stralg5 + stralg6 + stralg7 + stralg8 + stralg10 + stralg11 + stralg12 + stralg13 + overzich + bedoelle + typedoel + relatie + overztwi+ stratleh + weergave + strattwi.

The number of categories for this new variable was 25. These 25 categories were reduced to three by the following rule:

diepte (6 thru 8=1) (9 thru 14=2) (15 thru 25=3)

These new values are labelled: 1 = surface level approach, 2 = mixed approach, 3 = deep level approach.

- A set of variables which refer to the cognitive functioning of students were reduced to externally or internally controlled study behavior. The variables were recoded as follows: intern controlled study behavior = 1; externally controlled study behavior = 0. The new variable 'INTERN' was created as follows:

recode stralg14 (1=0) (2=1)/ samenv stralg15 schema strepen overign toetsen (1=1) (2=0)/ eighulp (1=1) (2=0) (5=0.5).

compute intern= stralg14 + samenv + stralg15 + schema + strepen + overign + toetsen + eighulp.

The number of categories for this new variable was 8. These 8 categories were reduced to three by the following rule:

intern (2 thru 4=1) (5 thr 6=2) (7 thru 8=3).

These new values are labelled: 1 = externally controlled, 2 = mixed controlled, 3 = internally controlled.

APPENDIX 3 CROSSTABS OF THE VARIABLE "EDUCATIONAL LEVEL" WITH OTHER GENERAL AND COGNITIVE STUDENT CHARACTERISTICS

Educational level by prior knowledge of law

	Prior knowledge of law		
Educational level	Low	Medium	High
Low			1
Medium	3	8	1
High	1	5	6

Educational level by prior knowledge of governmental law

	Prior knowledge of governmental law		
Educational level	Low	Medium	High
Low	1		
Medium	10	1	
High	6	3	3

Number of Missing Observations: 1

Educational level by intrinsic motivation

	Intrinsic motivation		
	Low	Medium	High
Educational level			
Low		1	
Medium	4	6	1
High	3	6	3

Number of Missing Observations: 1

Educational level by general learning approach

	General learning approach		
	Low	Medium	High
Educational level			
Low			
Medium	1	4	4
High		3	7

Number of Missing Observations: 6

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