Developments in Veterinary Medical Education

Intentions, perceptions, learning processes and outcomes

Ontwikkelingen in Diergeneeskundig Onderwijs

Intenties, percepties, leerprocessen en uitkomsten

(met een samenvatting in het Nederlands)

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To Sjoerd and Lara

"Love begins by taking care of the closest ones - the ones at home."
(Mother Teresa)

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Chapter 1

General Introduction

Roughly two decades ago, both the Americans[1] and the Europeans[2] proposed changes for the veterinary profession in general and undergraduate veterinary education in particular. And more recently, more recommendations for veterinary education were published in the United States.[3,4]

The aims of these reports were to ensure that veterinary graduates enter veterinary practice equipped with the appropriate knowledge and skills to meet contemporary professional and societal demands. Today's society is characterised by an almost overwhelming growth in available knowledge and information. In earlier days, the objective of professional training was to provide students with the knowledge related to a specific domain and this knowledge was assumed to last their entire professional career. Nowadays, it is impossible for graduates to possess all the knowledge they will need for the rest of their career. There is too much knowledge and there are too many skills and even those are bound to be at least partly outdated a few years hence.[5] With the exponential growth of the body of veterinary medical knowledge arose the problem highlighted in the above-mentioned reports, that is, how to handle the 'information explosion' without causing curriculum overload.[1-4] An additional problem was the mismatch between academic veterinary training and veterinary professional practice, with recent graduates lacking the appropriate skills, abilities and confidence for (economic) success in a changing practice environment.[1-4,6]

A central feature of the concern with veterinary education expressed in the above reports was general dissatisfaction with the outcomes of conventional veterinary education. Moreover, there was dissatisfaction among students about the imbalance between memorisation and comprehension which they encountered during their education.[7] Conventional programmes are focused excessively on teachers delivering knowledge to students (teacher-centred) while the learning of students receives considerably less attention.[7] In conventional educational programmes, it is the teachers who mostly determine what is to be learnt, how, when and in what sequence. It is generally assumed that the role of students in these programmes is that of more or less passive recipients of knowledge and information.[8]

In response to these issues three radical changes were advocated for undergraduate veterinary education worldwide:

- decreasing reliance on conventional teaching (teacher-centred education) and increasing reliance on student-centred education;[1,2,9-12]
- increasing emphasis on academic skills development;[1,2,9]
- increasing emphasis on generic, non-technical competencies that are relevant to the veterinary professional, such as communication skills and business management skills.[1,3,4,9,10,13-15]

TRANSITION FROM CONVENTIONAL TEACHER-CENTRED EDUCATION TOWARD STUDENT-CENTRED EDUCATION

> *"If students are to learn desired outcomes in a reasonably effective manner, then the teacher's fundamental task is to get students to engage in learning activities that are likely to result in their achieving those outcomes… It is helpful to remember that what the student does is actually more important in determining what is learned than what the teacher does".*[16]

Over the past decades, thinking about learning has changed. The role of the teacher is no longer regarded as primarily concerned with transmitting information to students. The widely held current view is that teachers should use student-focused strategies to help students change their thinking about relevant subject matter. This student-centred approach requires teachers to put the students and their learning at the centre of their attention. Teachers are expected to stimulate students to learn by challenging their ideas through questioning, offering them problems to resolve, and asking them to discuss topics and present what they have learnt.[17-19] In student-centred curricula, students are actively involved in their own learning, through dialogue, discussion, questioning and collaborating with peers and teachers.[20-22] The *teacher's role* within student-centred curricula is that of guiding and stimulating students in their learning. Consequently, it is no longer enough for teachers to give lectures, they are also expected to develop course materials and create learning situations that encourage students to actively engage in learning. Educational methods are needed that stimulate interactions between students and teachers. Student-centred learning also requires assessment methods geared to stimulating deep learning in students instead of requiring only rote learning of facts. The *student's role* needs to change accordingly; students should be active learners who ask questions and spend more time on self study instead of passively listening to their teachers. From predominantly individual learners, students should also become competent team members both in learning and work.[8,23]

Another change is that of the relationship between subject matter and individual disciplines. While formerly subject matter was mostly discipline-based, today subject matter is becoming integrated into broader, interdisciplinary themes in order to provide meaningful learning contexts relevant to the future profession. This is expected to facilitate students' learning and their understanding of subject matter.[24] Conversely, discipline-based subjects that are taught in isolation are likely to be perceived as having little context, so "the horizon of students' need to know is unlikely to rise beyond the passing of the next exam and the subject will be learnt as a series of disembodied facts".[20] A plethora of innovation strategies, instructional methods and educational interventions have been described to

enhance active learning in curricula. They range from fully-fledged problem-based learning programmes to mixed (hybrid) curricula with emphasis on small or medium-sized group learning, such as tutorials, seminars, workshops, and projects. Key features are interaction among students and between students and teachers combined with the use of pedagogical materials that promote problem solving and thinking.[5,25-30]

ACADEMIC TRAINING IN UNDERGRADUATE VETERINARY EDUCATION

Increasing importance is being attached to academic training in (veterinary) medical curricula around the globe. The explosion of new knowledge and the emergence of new technologies require that (veterinary) doctors are capable of appropriately appraising and using new knowledge. In order to do so, doctors need to be equipped with knowledge and skills that enable them to make judicious use of the new (bio-)medical research literature and ascertain when and how new developments and new evidence are relevant to professional practice in their particular setting.[31,32] Also, the decline in the numbers of clinical scientists has given rise to a call for more clinical scientists who can translate clinical problems into research proposals and research results into applications in (veterinary) practice.[32-35]

To address these issues in undergraduate education, academic training is often aimed at introducing students into communities of science, providing access to scientific knowledge, offering research experiences and stimulating an attitude of critical reflection and lifelong learning. Or, as Professor Wintzen put it more simply: "medical students need to learn to generate questions, formulate questions and seek answers to them. Learning this requires lots of practice. A science-oriented curriculum invites students to ask questions and helps them to find answers to these questions."[36]

In an undergraduate curriculum these goals may be addressed by specific academic modules and also by electives which are mainly intended to offer students a broad orientation to a subject.[37-39] Meng showed that activating learning environments can enhance academic competencies.[40]

One specific didactic approach to improve students' scientific competencies[34,41,42] and stimulate their interest in an academic career[43] is to offer research internships with active, hands-on participation in research. Characteristics shared by most research internships are comprehensive literature searches, empirical research and a final report on the work done. Vermunt described a research internship as an active type of learning typically scheduled in the later years of the curriculum and of longer duration (3 – 6 months).[5] Students are

guided by one or two supervisors and write a project proposal outlining the problem definition, goals, and activities. Depending on the phase of the project, supervision is tailored to the level of difficulty and the student's degree of independence.[5] Given the vast resources, both financial and intellectual, which are involved in research internships and the association between students' successful internship experiences and the incorporation of a research component into their professional careers, it is important to identify which factors are conducive to a positive research experience.

PREPARATION FOR PROFESSIONAL PRACTICE

The ultimate goal of higher education is to prepare students for the dynamic working environment of today's labour market by ensuring they have acquired the appropriate competencies. Communication skills, leadership skills, skills for information use and management, independence, and planning and organisation skills are often cited as desired work competencies for a broad range of contexts and situations. Because these competencies can be used in many settings and domains, they are often referred to as 'generic'.[44] Apart from generic competencies every profession has its domain-specific competencies, such as the specific knowledge and skills of (veterinary) medicine.[45]

In a study on labour market outcomes in the medical domain, Semeijn demonstrated that students' generic competencies were a good predictor of success later on in their careers (defined as finding work, obtaining an academic position, a suitable position and earnings).[46] In the domain of veterinary medicine, mismatches were identified between the skills veterinarians had obtained (through training) and those required for (career and economic) success and satisfaction in professional practice.[3,4,15] Several studies identified competencies that *do* lead to success as a veterinarian (in practice), including interpersonal skills (e.g. managing people and processes and effectively working with clients and staff), business acumen, and growing and developing in a changing environment (e.g. enhancing scientific knowledge management).[15,47-49] All of these competencies can be characterised as 'generic' or 'non-technical'.

Veterinary education can help students develop these generic, non-technical competencies.[1,2,15,47,50] To do so, the educational underpinnings and the outcomes and objectives of undergraduate veterinary training need to be attuned to these different competencies and thus become more aligned with contemporary societal and professional demands. Active learning environments (such as problem-based learning) in which generic competencies are emphasised appear to have a positive effect on graduates' general skills without negative affects on domain specific

knowledge or clinical skills.[51] The Dutch veterinary curriculum, which is the learning environment at the centre of this thesis, strives to foster students' generic competencies through an active student-centred learning environment and modules that are dedicated to these competencies.

GENERAL PROBLEM DEFINITION

Developments in the veterinary medicine profession forced veterinary medical educationalists to critically re-examine an almost universally held dogma of conventional, teacher-centred, veterinary education and shift their attention to student-centred learning environments and generic competency development.

Currently, many veterinary institutions around the globe use (inter)active learning approaches whether in fully-fledged PBL programmes or in more mixed curricula with a variety of approaches ranging from traditional didactic lectures to small-group seminars, workshops and tutorials. Many institutions (are starting to) pay attention to generic, non-technical competencies, such as academic skills, communication skills, and business skills. These educational changes need to be evaluated in order to measure whether and to what extent the intended outcomes are achieved. Educational innovations can be complex and extensive and measuring and describing them is complicated by the variety in teaching and learning interventions and by numerous confounding effects. Because curriculum reforms at the undergraduate level may leave their stamp on the way veterinary medicine is practised in the (near) future, it is important to examine and understand the educational processes and outcomes resulting from the new programmes that are being developed and implemented in veterinary schools.

In the veterinary educational literature, more and more attention is given to student-centred approaches to learning and to other outcomes besides specifically veterinary technical outcomes. Most studies are descriptive and report on the contents of the educational programme, best practices and ideas for (changing) teaching (see, e.g.[52-54]) or they seek justification for the use of active learning approaches through small scale (e.g. one interactive lecture) effect studies (see, e.g. [55-57]). However, not many studies have addressed extensive curriculum revisions. This requires moving beyond the "it worked" stage and trying to establish "why or how educational interventions work"[58,59] and what happens to learners so that more insight can be gained into the educational processes on which the new curricula are based.[60,61]

The general research question of this thesis is: *What happens to students in a student-centred veterinary curriculum with ample coverage of generic competencies and what are students', teachers' and alumni's perceptions of this curriculum, in particular in regard of seminar group learning, research internship and preparation for professional practice?*

In order to gain in-depth insight into the effects of educational innovations aimed at establishing a student-centred curriculum, we focused on two instructional methods: seminar learning and research internship.
We formulated four specific research questions to address our broad, general research question.

1. How are different elements of student-centred learning and the acquisition of generic competencies incorporated in the new curriculum design?
2. What are students' and teachers' experiences with seminar group learning? What happens during seminar group sessions? Which factors affect learning in this environment?
3. What are students' experiences with the research internship? What are the strengths and weaknesses of students' research reports? Which factors affect learning in this environment?
4. What are alumni's experiences with the curriculum they completed and how well do they think it has prepared them for professional practice?

The research was carried out in the authentic learning environment of the Faculty of Veterinary Medicine, Utrecht University, the Netherlands and among the veterinary medical profession of the Netherlands. The research can be characterised as descriptive and process oriented as well as outcome based. Different (quantitative) research methods, such as a rating scale, surveys of students, teachers and alumni, and an observation study with analysis of videotapes, were used to arrive at a better understanding of the multifaceted learning environment in a student-centred curriculum.

THESIS OUTLINE

We will end this introduction with a brief outline of the chapters of this thesis. In Chapter 2 the main aim of the study is described, namely to analyse the curriculum of the Faculty of Veterinary Medicine, Utrecht University with respect to the effects of the major curriculum changes of 1995 and 2001 in terms of changed outcomes/objectives, content, teaching/learning and assessment methods, and the educational organisation structure.

The studies in Chapters 3 and 4 focus on the educational processes within seminar learning, which was introduced as the major instructional method when the new curriculum was introduced in 1995. A quantitative study (Chapter 3) explores student groups' perceptions of the effects of the factors: 'teacher performance', 'group interaction', and 'quality of assignments' on the outcome factor: 'perceived learning effect within the context of seminar learning'. A questionnaire was administered to students in Years 1-4 and analysed by means of regression analysis. In Chapter 4 we asked and observed Year 4 students and their teachers to examine what actually happens during seminar groups. We administered a questionnaire and used a coding scheme focused on (verbal) learning–oriented group interactions in order to gain a deeper understanding of group interactions within seminar groups.

The studies in Chapters 5 and 6 examine the research competencies of veterinary undergraduate students and evaluate the introduction of an innovative compulsory 3-month research internship. Chapter 5 investigates students' research competencies by establishing the strengths and weaknesses of their research reports. This study reports on the development of an assessment tool for the research reports. Chapter 6 reports a study in which we examined Year 5 students' experiences during their research internship using a questionnaire we developed on the basis of the Postgraduate Research Experience Questionnaire. Regression analysis was performed to investigate the relationship between students' experiences and learning outcomes, such as the quality of the research reports.

The final study (Chapter 7) presents a comparison of the perceptions of alumni from a traditional, mainly teacher-centred curriculum (C 1982) and the perceptions of alumni from a more innovative student-centred (C 1995) veterinary curriculum regarding their preparation for practice by their training. The main aim of this study was to evaluate whether the main educational objectives were met.

Finally, the findings of the preceding chapters are summarised and discussed in Chapter 8. The main body of this thesis comprises six papers reporting the studies we performed. Since each study was written to be read on its own, repetition and overlap across chapters are inevitable.

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Chapter 2

Developments of veterinary medical education in the Netherlands: A retrospective analysis of the intentions of the curriculum development processes of the past decades

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ABSTRACT

Over the past two decades, The Faculty of Veterinary Medicine of Utrecht University (FVMU) has introduced major curriculum changes in order to keep pace with modern veterinary educational developments worldwide. Programme outcomes changes were proposed according to professional and societal demands with more attention for generic competencies and electives and species/sector differentiation. And, changes in educational approaches and the educational organisation were proposed; aiming at a transition from merely teacher-centred education towards more student-centred education.

Curriculum development is a complex and difficult process with many elements interacting. For a new curriculum to become valid, curriculum elements and their interrelation; such as statements of intent (also called outcomes, goals or objectives), content, teaching and learning strategies, assessment strategies, and context, need to be addressed in the educational philosophy (the intended curriculum).(1)

This paper describes a document analysis of the major curriculum reforms of the FVMU. Curriculum committee reports are critically analyzed in order to gain insight into the intentions of the curriculum designers and the match between the curriculum elements, as described by Prideaux[1]. The results show that the reports paid considerable attention to generic competency training, especially to academic training, and to the introduction of more student-centred teaching and learning strategies. However, little attention was paid to assessment strategies and the statements of intent were defined rather broadly. Curriculum evaluation is needed on all curriculum levels, i.e. what is delivered to the students and how is the curriculum experienced. Possible mismatches between all levels need to be identified.

INTRODUCTION

The stream of new developments in veterinary medical education continues unabatedly and veterinary undergraduate curricula around the globe are undergoing major reforms. Curriculum development and its related aspects are an emerging area of interest for (veterinary) medical educators.[1] As in medical education, veterinary medical educators from a variety of disciplinary backgrounds (e.g. clinicians, scientists, educators, psychologists, and administrators) are involved in significant curriculum change and reform. According to Prideaux: "most will do so without a model of curriculum development." Curriculum development is a particularly complex, difficult and dynamic process in which many elements interact and which transcends the mere selection and organization of content.[1] Prideaux proposes a model of curriculum development that is grounded in some of the major developments in medical education and encompasses five major curriculum elements and their interactions: statements of intent (also called outcomes, goals or objectives), content, teaching and learning strategies, assessment strategies, and context (Figure 1).[1]

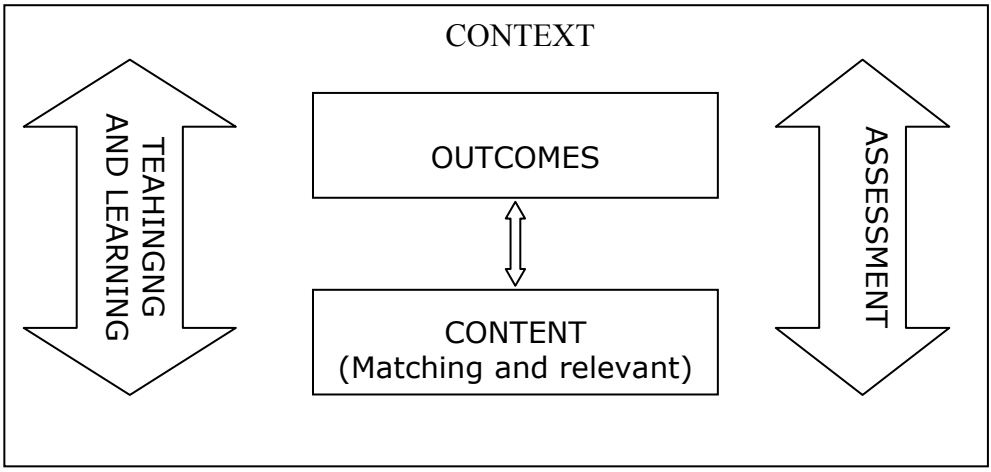

Figure 1 A dynamic curriculum development model according to Prideaux.[1]

In the veterinary educational literature, as in the medical education domain, the importance of significant, enduring and worthwhile outcomes and goals of education is a much debated subject.[2-7] During the past decades, changes in these outcomes have reflected changes in professional and societal demands as well as

the rapid changes in and accumulation of (veterinary) medical knowledge. Today, there is more emphasis on generic competencies, such as knowledge management, scientific skills, problem solving skills, lifelong learning skills and aptitudes and communication skills, obviously alongside continued attention for the specific veterinary knowledge and technical competencies.[8-12]

Selecting relevant content that matches (newly defined) outcomes is a complex activity. Curriculum developers have the responsibility to ensure the coverage of major diseases and diagnosis, management and treatment in addition to attention to generic competencies. Inevitably, the risk of overload looms large. Various measures to combat this have been proposed including the clearing of content not directly attuned to the outcomes, integration of content, differentiation, and electives.[3,8,13,14]

Veterinary medical educators have at their disposal a range of teaching and learning strategies from conventional lectures and practicals to problem- and assignment-based small group learning, flexible (computer-based) self-study methods and the use of models and simulations in clinical skills training. It is of vital importance that methods for teaching, learning and assessment be selected that facilitate a good match between curriculum outcomes and content.[1]

Evaluation is an essential component of curriculum development. Its purpose is to appraise the extent to which the match between outcomes and content is promoted by the strategies for teaching, learning and assessment that have been selected.[1] A curriculum can be envisaged as comprising three different levels, each of which can be the target of evaluation while the alignment of the different levels can be examined as well.

1) what is planned for the students (what is intended by the designers);
2) what is delivered to the students (what is taught by the teachers);
3) what do the students experience (what is learned by the students).[15]

A good starting point for curriculum evaluation is the first level: what has been planned for the students and what is the educational philosophy underlying the curriculum, since it is commonly accepted that a sound educational program is conditional on a clear statement of the educational philosophy.[16] The intended curriculum is often the foundation on which curriculum reform and its implementation are built.

In order to examine curriculum reform in an undergraduate veterinary curriculum, we conducted a study aimed at providing: a critical reflection on how the intended curriculum for undergraduate veterinary medical students in the Netherlands evolved during the development processes which span the period from 1982 to 2001 within the context of the developments in veterinary medical education worldwide.

METHODS

Developments of veterinary medical education in the Netherlands

When veterinary training first started in the Netherlands in 1821, the only Dutch veterinary school offered a unified six-year veterinary course, including both higher education and one year of clinical experience. During the first century of the school's existence the structure of veterinary training remained basically unchanged, with five years of lectures in the morning, practicals in the afternoon and clinical clerkships in the final year. In 1982, minor curriculum changes were introduced in response to a change in the law, but the concept of a traditional discipline-based and lecture-based curriculum remained unchallenged. The time devoted to clerkships was increased to 1.5 years.

It was not until 1995 that Dutch veterinary training really started to transform. This resulted in a curriculum comprising four theoretical years and two years of clinical clerkships (one year of so-called uniform clerkships covering all animal species and one year of differentiation in which students focused on the species of their choice).[17] The next round of curriculum reform started in 2001 with the introduction of differentiation and tracking as early as Year 1.[18]

Most students enter veterinary education immediately after passing the national final exam at the end of pre-university secondary education. Enrolment is capped by the government. Currently, an annual maximum of 225 students are admitted to the six-year, 42 weeks a year, full time program. The Faculty of Veterinary Medicine of Utrecht University has been accredited by the American Veterinary Medical Association/Canadian Veterinary Medical Association (AVMA/CVMA) since 1973. This accreditation is recognized by The European Association of Establishments for Veterinary Education (EAEVE).

Document analysis

We performed 'a document analysis' to study the intended curriculum. The present study reports the results of our analysis of the documents produced by the educational institute for the curriculum revisions of 1995 and 2001 (C'95 and C'01). Documents pertaining to the 1982 curriculum (C'82) are used as a reference point. Using Prideaux's model[1] to structure our analysis, we qualitatively analyzed the outcomes/objectives, content, teaching and learning strategies, assessment strategies, and context of the curricula, based on what we encountered in the documents.

We examined content overload by focusing on integration of content, electives and (species) differentiation. Integration is defined as the integration of two or more disciplines within one module. Coverage of two species in one module is not deemed to constitute integration. Differentiation is defined as a clear focus on a

specific species (group), such as companion animals, horses or farm animals or on specific professional areas such as veterinary public health. We conducted quantitative analyses to establish for each curriculum (1982, 1995 and 2001) the percentages of time of all theoretical years devoted to integration, electives and the percentages of time of all years to differentiation. As well as the percentages of time of all theoretical years devoted to the different teaching and learning strategies, such as lectures, practicals, seminars, group assignments, and self-study. Curriculum context was analyzed by focusing on the educational organization. Wolfhagen et al. mention organizational aspects considered important for the transition from teacher-centered to more student-centered approaches, such as centralization of the coordination and planning of the curriculum (rationalistic organizational model), faculty development, and self-study facilities for students.[19]

RESULTS

Outcomes & goals

The documents of C'82 state only one goal: *"to emphasize (patho-) biologic thinking in students*."[20]

In contrast, the documents of C'95 report more extensively on the outcomes and goals, especially on more generic competencies such as academic/scientific and social competencies, as is illustrated by the following quotes[21-23]:

> *"The objective of veterinary training is to provide students with general qualifications which ensure that graduating students possess starting competencies related to specific species or areas of the veterinary profession….graduates are required to have gained general scientific skills and an attitude that is conducive to the management of knowledge and skills, in addition to a specific veterinary qualification."*
>
> *"General scientific skills and social skills refer to those competencies that, among other things, relate to interpersonal communication; a critical, creative, analytical approach; problem solving skills and learning skills."*

A detailed list of the outcomes of C'95 is presented in Appendix 1.

The documents of C'01 reflect the same approach as that of C'95 and present a summary of the goals[24]:

- *"The acquisition of problem-solving skills;*
- *The acquisition of social and communication skills;*
- *The acquisition of an academic level of thought and work;*

- *The acquisition of a species-directed starting competence that is adequately attuned to the veterinary labor market for primary care practice;*
- *The awareness of the necessity of lifelong learning."*

Comparison of C'01 with C'95 reveals that further developments are proposed in relation to academic/scientific training and the introduction of separate tracks in Years 1-5 ("*not only for the different species but also for underrated areas of the veterinary profession like veterinary public health, research, business management and policy.")*[24]

Content

In our description of how the content of the veterinary curriculum changed during the period we studied, we focus consecutively on the following content-related aspects: clearance, integration, electives, differentiation, and generic competencies.

Clearance

The documents of C'82 make no mention of clearance of the curriculum.[20] By contrast; the documents of C'95 describe steps taken to address the problems of curriculum overload[25]:

> *"Earlier and prolonged (species) differentiation*" and "c*learance of the overloaded curriculum can be achieved by transferring parts of the content to the differentiation phase and by eliminating parts of content from the curriculum/modules or by transferring topics to elective modules."*

Suggestions are made for criteria to select topics for elimination[26]:

> *1. "The (content of the) module/topic has to be relevant to the (primary care) veterinary profession;*
>
> *2. When a topic is not directly linked to the (primary care) veterinary profession, then it has to be relevant as preparation/background for topics that are relevant to the veterinary profession or to generic academic training."*

The documents of C'95 describe clearance in detail for all the theoretical modules. This is illustrated by the following examples[21]:

> "*There is no clear need for a separate zoology module. Essential topics can be taught in different parts of the veterinary biology modules"* and *"…the relevance of the veterinary physics module is better justified when it is integrated with other parts of the curriculum…, such as physiology, statistics and diagnostic imaging."*

The documents of C'01 report no further clearance of the curriculum.[24]

Integration

In C'82, integration of disciplines is (only) achieved in the 'Structure and Function' (S&F) modules in Years 1 and 2 in which anatomy, histology, physiology and biochemistry are incorporated.[20]

C'95 documents report on further implementation of mainly horizontal integration, illustrated by the following examples[23]:

- Integration of separate microbiology modules (i.e. general virology, bacteriology, parasitology and protozoology) and immunology modules into one Year 2 module, 'Infection Biology and Immunology';
- Integration of the separate modules on (parts of) microbiology (i.e. viral, bacterial, parasitological and protozoologic diseases) and medicine into one 'Medicine' module in Year 3;
- Integration of the separate modules on (parts of) microbiology (i.e. viral, bacterial, parasitological and protozoologic diseases), pathology, pathophysiology, medicine and other clinical subjects (e.g. surgery, reproduction, pharmacotherapy) into one Year 4 longitudinal module, entitled 'Clinical Lessons'.

In C'01, further integration is pursued by integrating the, until then, separate pathology module into the 'Medicine' module.[24]

Figure 2 shows the percentages of time devoted to integration in the three curricula.

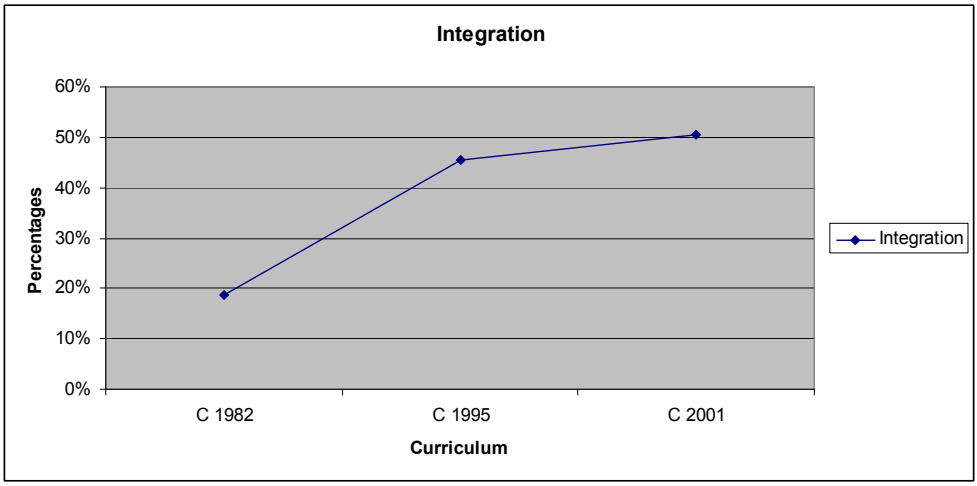

Figure 2 Percentages of time devoted to integration (of all theoretical years) in the different curricula of 1982, 1995 and 2001.

Electives
Figure 3 shows the percentages of time devoted to electives in C'82, C'95 and C'01. The documents of C'82 do not mention any time for electives.[21] In C'95, approximately 20 weeks of electives are described and in C'01 the curriculum time allocated to electives has decreased to approximately 10 weeks.[23,24] The reason for the decrease is that[24]: "*part of the time available for elective modules in C'95 can be used for the implementation of a track curriculum."*

Differentiation
Figure 4 illustrates the global outlines of the three curricula and the distribution of theory and uniform and differentiated clerkships over the curriculum. In C'82, only the second half of the final year is allocated to species differentiation. Students can choose between a clerkship program in companion animals (24 weeks) and a clerkship program in farm animals/veterinary public health (29 weeks).[20] In C'95, a prolongation of the differentiated clerkship of 42 weeks in Year 6 is proposed. Students can choose from seven different programs (described extensively in an earlier paper by van Beukelen).[27] There is vertical integration (i.e. basic sciences and para-clinical subjects are integrated with clinical subjects) in the differentiated clinical clerkship.[23] In C'01, more extensive differentiation is proposed by the introduction of tracks. The tracks start in Year 1 when students are offered a five-week track dedicated to their chosen species differentiation. In Year 2 students undertake an eight-week track and in each of Years 3 and 4 fourteen weeks are devoted to tracks.[18,24]
Figure 3 shows the percentages of time devoted to differentiation in the three different curricula C'82, C'95, and C'01.

Generic competency training
In the documents of C'82 only a few modules are mentioned which are related to generic competency training, such as academic training (the 2-week 'Statistics and Methodology' module in Year 2 and the 6-week 'Research Study' module in Year 4) and societal aspects (1.5-2-week modules in Year 4 devoted to 'Veterinary Medicine & Society', 'Veterinary Legal Aspects', and 'General Rural Economics').[20] The documents of C'95 list considerably more modules related to generic competency training, such as academic training, social and communication training, business skills, and the extension of societal topics.[21-23,25] C'01 retains the modules developed for C'95 and extends competency training in social and communication skills and societal and business management aspects.[24] Appendix 2 presents details of these modules in C'95 and C'01.

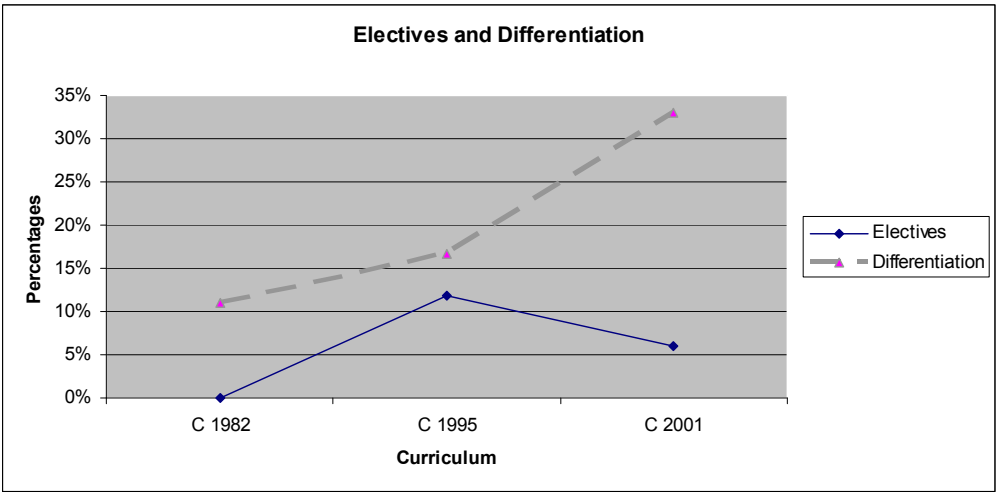

Figure 3 Percentages of time devoted to electives (of all theoretical years) and differentiation (of all years) in the curricula of 1982, 1995 and 2001.

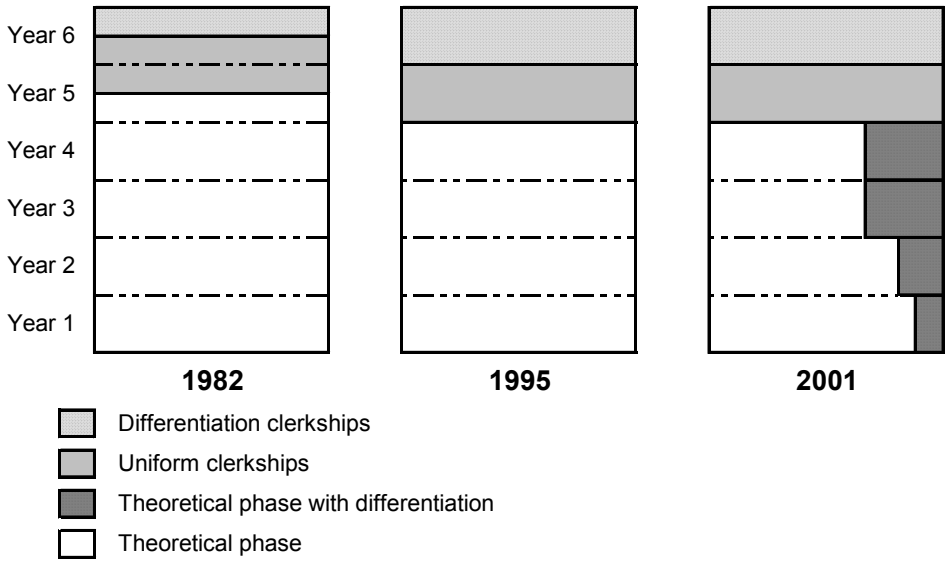

Figure 4 Global outlines of the curricula of 1982, 1995 and 2001.

Teaching and learning

The documents of C'82 contain no description of the teaching and learning strategies used in the curriculum[21], unlike the documents of C'95, which report extensively on these issues, as is illustrated by the following quotes[21-23,25]:

> *"The fostering of scientific and social skills requires teaching and learning strategies that consistently demand the use of and train students in the competencies to be achieved….The adapted teaching and learning strategies refer to the way subject matter is offered, the processing of subject matter and assessment."*
>
> "*The scientific character of the curriculum can be stimulated by relating subject matter, whenever this is relevant, to the scientific research underpinning veterinary knowledge and the uncertainties and questions that still remain to be answered.*"
>
> *"It is desirable that in the elective modules in particular, teaching and learning strategies are used that require the students to show a high degree of self-activation (self-motivation).*"
>
> "*The acquisition of problem-solving skills has to be translated into teaching and learning strategies and assessment. The number of lectures has to be reduced and training in problem-solving skills needs to be strengthened by introducing seminars and tutorials as instructional methods."*

Some explanations and examples are given to show how the use of assignments and communication skills training can support learning[22,23]:

> *"Learning based on problems means that students have to deal with problems related to the veterinary profession. Besides motivational effects, the purpose of problem-based assignments is to foster the use of a methodological approach and the application of knowledge by students. … Communication between students and between students and teachers is an important factor in this learning process and will also contribute to the students' communication skills…More interaction between teacher and student requires that teachers (and students) use different approaches and group dynamic skills. Teacher training will be necessary."*
>
> *"The committee thinks that the new instructional methods, such as seminars and group assignments, provide sufficient opportunities for students to master social and communication skills. An introductory module on skills related to group dynamics and interview techniques will be necessary."*

New instructional methods are introduced, such as seminars and group assignments. The number of lectures and practicals is reduced.[23] Additional

detailed information on the new instructional methods is shown in Appendix 3. From the documents of C'01 a picture emerges of further evolution of the teaching and learning strategies and how these are connected with the C'01 goals[24]:

> *"…a stronger academic level of the curriculum will have consequences for all aspects of the educational process, such as the instructional methods, self study and assessment strategies…One of the consequences of the strengthening of the academic level of the curriculum is a reduction in the number of contact hours in each module. The aim is for contact hours to make up 30 to 40 percent of the available credits study time."*

It is emphasized that self study is important for students' academic skill development[24]:

> "*In every module the use of self study materials on an academic level has to be stimulated, such as the use of textbooks in addition to other materials like module books, self study questions, summaries and references. Teachers have to be available for consultation during parts of the self study time and facilities for self study (such as a library and rooms where students can study) need to be improved*."

Figure 5 shows the percentages of time devoted to the different instructional methods in the three different curricula, C'82, C'95, and C'01.

Assessment

Assessment strategies are not described in the C'82 documents.[20] The C'95 documents say about assessment strategies[22,23,25]:

> "*Students' learning activities are driven by assessment. If tests assess only factual knowledge, students cannot be expected to show a great deal of interest in and motivation for problem solving activities. Therefore it is necessary to tailor the existing test questions to the problem-solving educational activities that are developed, in order to align assessment with the desired learning effects.…Students will only respond well to the renewed teaching and learning activities if assessment is aligned with the content and acquisition of problem-solving skills…..Assessment has to reflect the educational objectives."*
>
> *"Less detailed assessments but emphasis on assessment of procedural knowledge and the application of knowledge; integrated modules require integrated assessment."*

And the documents of C'01 add that[24]:

> *"Students' study behavior will largely be directed by the assessment methods. The assessment methods have to be adjusted to the increased level of self study and academic teaching and learning strategies to ensure that the proposed academic changes will be successful."*

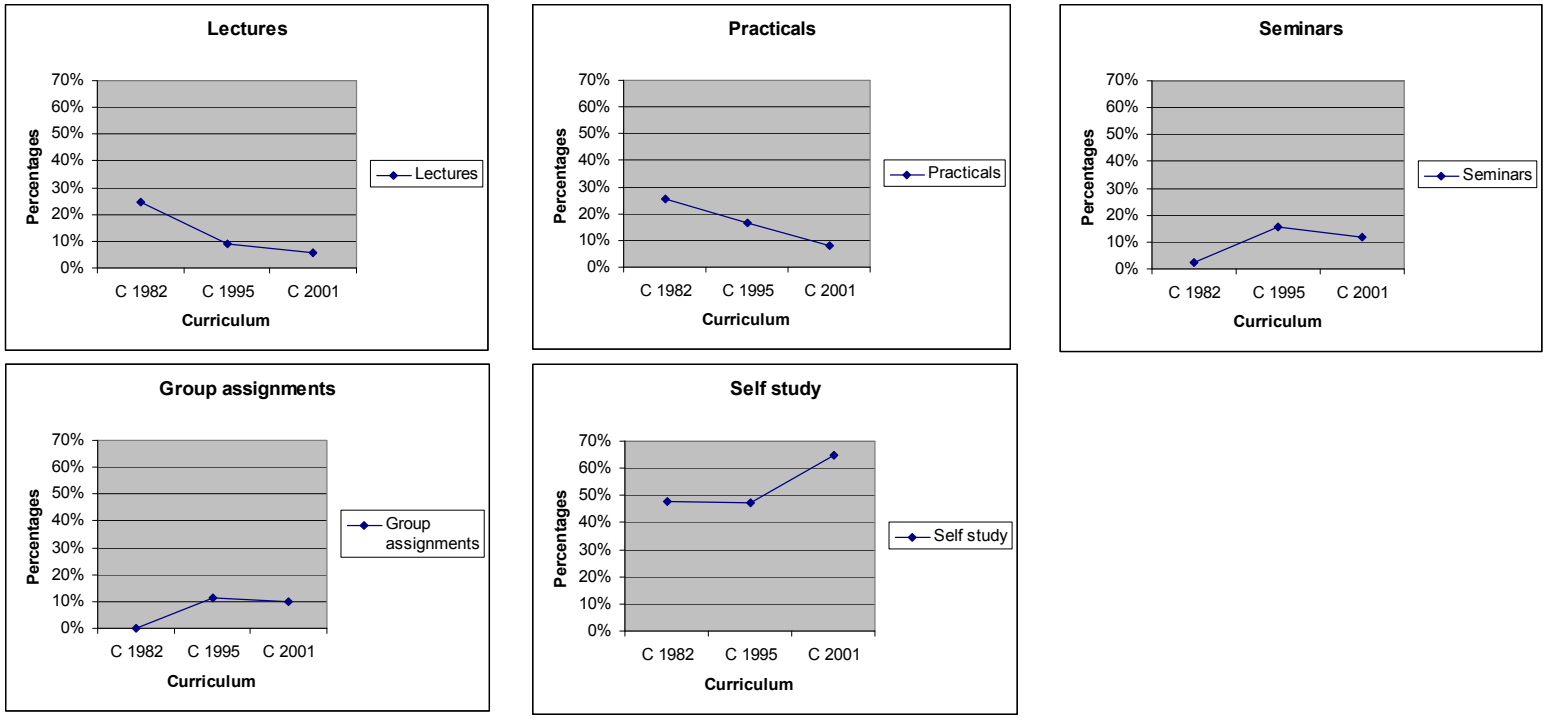

Figure 5 Percentages of time (of all theoretical years) devoted to the different instructional methods in the curricula of 1982, 1995 and 2001.

The educational organization

The decentralized educational organization in C'82 is illustrated by the following quote from an article by Ten Cate: "The curriculum was not much more than the sum of weekly classroom hours, and weeks of clerkships, distributed over the departments as arranged by agreement between professors".[28] Modules are organized around disciplines, organized in departments headed by professors and there was hardly any rationalistic planning of the curriculum. [19,20] Furthermore, no structural evaluation system is in place and staff development activities are non-existent.[19,20]

In the documents of C'95, organizational changes are reflected: the responsibility for individual modules is given to Educational Working Groups (EWGs, consisting of teachers from different departments/disciplines, involved in the module). The purpose of the EWGs is to centralize the coordination and planning of the modules, achieve (real) integration and diminish the autonomy of individual teachers, disciplines and departments. The EWGs report to the Educational Council and, from 1998 onwards, to the Educational Board. The Educational Board was installed to further centralize the coordination and planning of the curriculum and the curriculum revision of C'01.[21] In addition, the C'95 documents report that faculty development programs are implemented, that faculty will be offered career opportunities in education and student facilities are adapted to the instructional methods. Structural quality assurance systems are described. For the evaluation of the modules and the curriculum as a whole, information is collected concerning students' and teachers' perceptions and student outcomes. Each EWG is responsible for the evaluation of its own module. The responsibility for the overall quality assurance system resides in The Educational Board and Council.[21]

The educational organization remains unchanged in C'01, although faculty development programs are strengthened and recommendations are made to arrange a study landscape, in which adequate self study facilities will be available for the students.[24]

DISCUSSION

The aim of this study is to retrospectively analyze the intended goals of two major curriculum revisions in one veterinary school in order to:

1) investigate whether the curriculum development processes address the key elements (e.g. outcomes/goals, content, teaching and learning and assessment strategies and context) of curriculum development according to Prideaux's model[1];

2) investigate whether the intended curriculum reflect developments in veterinary medical education worldwide.

Ultimately, the aim of this study is to learn from the weaknesses that are identified in order to further improve the curriculum and contribute to the quality of veterinary medical education as a whole.

The educational goals and outcomes of both C'95 and C'01 show that one of the aims of the curriculum committees is to devote more attention in the curriculum to generic competencies, such as academic and communication competencies and to differentiation/tracking. This is in line with numerous published studies on the challenges for veterinary medical education which also propose more attention to other than specific veterinary competencies.[8-12] There has been much debate and occasionally considerable confusion about the precise nature of goals and outcomes and how to define these.[2-7] Without going into the details of outcome definitions (significant, worthwhile and enduring), we can conclude that the goals and outcomes of both C'95 and C'01 are defined rather broadly, which can make it relatively difficult for teachers to break them down into more specific outcomes for the various components of modules.

In examining curriculum content we focused on the problems of curriculum overload in both C'95 and C'01 and the efforts to address them by introducing more (horizontal) integration of subjects and opportunities for students to choose electives and follow their own interests in various tracks. Clearance of curriculum content is only explicitly addressed in the documents of C'95 and not in those of C'01. The cult of full coverage and the problems and solutions associated with overload are described extensively in the (veterinary) medical educational literature.[3,8,10,12-14] and the results of this study offer confirmation of what is said in these studies. Measures to match content and goals/outcomes are described in the documents of both C'95 and C'01 for modules of generic competency training, as appears from the substantial amount of curriculum time (16 weeks) that is allocated to academic skills development. However, the amount of time allocated to other generic competencies, such as social/communication skills and business management skills remains rather limited (4 weeks).

As for teaching and learning strategies, the results show that, in C'95 in particular, extensive attention is paid to this element of curriculum development. The traditional mainly lecture-based and laboratory-based curriculum is abandoned in C'95 and a variety of new methods is introduced with an increase in small group teaching (seminars, group assignments) and self-study activities. The use of small group teaching and self-study activities is consistent with contemporary educational concepts underpinning modern veterinary education which advocate a shift from too much focus on teacher-centered, passive learning environments to more student-centered, active learning environments.[8,12-14,19,29-31] Methods which

the literature has shown to be associated with more active learning environments are described in the documents of both C'95 and C'01: (cooperative) peer interaction and interaction between students and teachers, (independent) problem-solving activities supported by meaningful assignments, students' self-regulation and regular feedback on students' progress.[19,23,24] As we stated in the introduction, careful selection of appropriate instructional methods can facilitate the match between curriculum goals/outcomes and content.[1] In C'95 and C'01, suitable teaching and learning strategies for the pursuit of the goals/outcomes related to generic competencies are introduced, such as small group teaching and self-study, which are aimed at promoting academic, social and communication skills in students.

Assessment strategies receive little attention in both C'95 and C'01, although the importance of the alignment of goals/outcomes, content, teaching and learning strategies and assessment is acknowledged in the expressed adherence to the concept that assessment should stimulate students to undertake learning activities that are in line with curriculum goals. However, in order to achieve this type of assessment, curriculum committees will have to provide more detailed descriptions of assessment strategies. From the literature we know that assessment drives the learning of students (at least in a large part).[32-35] Consequently it is of the essence for a curriculum to have a sound assessment program that is explicitly tailored to the stated objectives.[1]

The descriptions of the educational organization across the curriculum revisions show changes to meet the requirements which, according to the literature, are conditional to successful implementation of a more student-centered, active learning environment.[19] An educational institute responsible for the centralized coordination and planning of the training program is established and faculty development is put on the (educational) agenda.

So what do these results tell us and what can we learn from them? First, we can conclude that, on paper, all the elements of Prideaux's model[1] were addressed to a greater or lesser extent and that the proposed changes seem to be consistent with developments in veterinary medical education worldwide. An educational (r)evolution has taken place, at least on paper, from the conventional curriculum of 1982 to the more modern, student-centered curricula of 1995 and 2001.

A precondition for an effective educational program is a good description of the educational philosophy. In our opinion, such a description will only fulfill its purpose if it is explicit, clear and transparent to the entire faculty. Moreover, the rationale for the changes, preferably based on the (veterinary medical) educational literature, should be communicated clearly to all those involved in the curriculum, including the students. A clear vision and mission statement and unambiguous,

specific outcomes are other prerequisites. In the documents we studied, the descriptions lack sufficient detail. Since this study was performed, however, this has been (partly) remedied by the publication of detailed, specific outcomes of veterinary education in 2006.[36]

A critical analysis of the intended curriculum provides a solid starting point for curriculum evaluation on all curriculum levels. Ideally, when the intended curriculum is valid and has gained faculty-wide acceptance, we would expect a good match between what is intended and what actually happens in class and what is learned and experienced by the students. However, under less ideal circumstances, in other words in the real world, mismatches tend to be inevitable.[16] Based on the results of this study we can draw no conclusions as to whether and how the intended curriculum has been successfully implemented. Consequently, many questions related to a possible (mis)match between the curriculum levels remain (as yet) unanswered and are awaiting further study. A clear and adequately described intended curriculum can give direction to further research and lead to specific suggestions for curriculum improvement.

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Appendix 1 Outcomes of the 1995 curriculum[23].

Academic skills	*The veterinarian is able to:*
	Search the scientific literature Critically appraise the content of scientific literature Critically appraise the methodology of scientific literature
	The veterinarian is aware of:
	The necessity to stay up to date with new developments by reading the scientific literature and incorporating new knowledge and methods in professional practice
Veterinary technical skills	*The veterinarian is able to:*
	Perform a physical examination Formulate a differential diagnosis Make a diagnosis Plan additional tests Translate clinical observations into an investigation and treatment plan Perform simple laboratory tests Develop a management plan Explain the management plan and the use of medication Make a prognosis Give advice on disease prevention Give advice on the prevention of zoonoses Give advice on animal husbandry and animal handling Judge whether a disease or treatment is likely to be a public health risk. Judge whether (products of) animals are suitable for human consumption Manage a practice/ business
	The veterinarian is aware of:
	The limitations of his/her own knowledge and skills and knows when and how to consult others

Communication skills	*The veterinarian is able to:*
	Communicate effectively with clients, colleagues, and veterinary nurses
	Give efficient instruction to clients, colleagues, and veterinary nurses
	Work in a team
	Manage a team
	Speak in public
	The veterinarian is aware of:
	His/her professional responsibilities to patients, clients, colleagues and society and is familiar with the legal matters relevant to the veterinary profession

Appendix 2 Modules for generic competency training in C'95 and C'01.

C'95[23]**:**

- Academic training is extended with the introduction of a 4-week 'Introduction to Scientific Training' module in Year 1 and a compulsory 3-month research internship in Year 5;
- Social and communication skills training is incorporated in the 'Clinical Diagnostics' module in Year 3 (0.5 week);
- Training in problem solving skills and skills related to dealing with uncertainties is implemented in the 'Clinical Lessons' module in Year 4. The student groups develop diagnostic and therapeutic scenarios based on clinical cases and real patients;
- Societal topics are extended and addressed in:
    - 'Introduction to Veterinary Medicine' (6 weeks), a newly developed Year 1 module;
    - 'Veterinary Environmental Sciences' (2 weeks), a newly developed Year 3 module;
    - 'Veterinary Medicine & Society' (4 weeks), a newly developed Year 4 module, in which the separate 1982 modules on 'Ethics', 'Veterinary Legal Aspects' and 'Forensic Veterinary Medicine' are integrated.
- Business/ management skills are addressed in the 1-week 'Practice Management' module in Year 5 (core clinical clerkship).

C'01[24]**:**

- Social and communication skills and professional behavior are addressed in the Year 1 module 'Introduction to Veterinary Medicine';
- Societal topics and business management skills are extended and addressed in the newly developed two-week 'Management and Orientation on the Veterinary Profession' module in Year 2.

Appendix 3 Additional quotes relating to the instructional methods of C'95[23].

"The purpose of lectures is to provide an outline of a module, elucidate specific difficult topics and make topics concrete by giving examples."
"Seminars are used as an instructional method to stimulate the learning phases of acquiring and understanding knowledge. The teacher has two main roles: developer of assignments and facilitator of the part of the seminar in which students report what they have found during self-study. The assignments are designed to stimulate application of knowledge and problem solving. The key characteristic of seminar learning should be interaction."
"Group assignments are used as an instructional method to stimulate independent problem solving in students. For this purpose the students engage in the following activities: task analysis; making arrangements about participation of group members; finding, analyzing and interpreting relevant information; reporting verbally and/or in writing. Group assignments are summatively assessed. Maximum group size is 10 students."
"Self study is used as an instructional method to stimulate students to independently study textbooks, module books and e-learning resources. In order to help students direct their self study activities, study guides are provided containing descriptions of the learning outcomes/objectives, recommended readings and resources, content related study questions, assignments that enable students to assess their own competencies, a reference list and possibly an example of the assessment."

Chapter 3

Perceptions of learning as a function of seminar group factors

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Medical Education (In press)

ABSTRACT

Context: Small group learning is advocated for enhancing higher order thinking and the development of skills and attitudes. Teacher performance, group interaction and the quality of assignments have been shown to affect small group learning in hybrid and problem-based curricula.

Objectives: To examine the perceptions of student groups as to how teacher performance, group interaction and the quality of assignments are related to each other and to learning effects in seminars of 15-30 students in a hybrid curriculum.

Methods: A 28-item questionnaire was constructed and administered to 639 students attending 32 seminars in Years 1-4 of an undergraduate veterinary curriculum.

Data analysis: We performed factor analysis and reliability analysis of the questionnaire. Correlation and regression analyses explored the interactions of the four-factor model with teacher performance, group interaction and quality of assignments as independent variables and the perceived learning effect of the seminars as dependent variable.

Results: Response was 99%. Teacher performance (beta 0.78) and group interaction (-0.28) significantly influenced the perceived learning effect. The total effect of the quality of assignments (through effects on teacher performance and group interaction) was 0.47.

Discussion: The strong relationship between teacher performance and learning effect suggests that students rely strongly on their teachers. The negative effect of group interaction may reflect poor alignment of teaching and assessment and poor organisation of group processes. This should be further examined. Comparative studies on seminars are also recommended.

INTRODUCTION

The shift from the lecture theatre to small group settings that has characterised various innovative medical education programmes in recent decades was partly based on research suggesting that lectures are not the best way to foster higher order thinking and the development of skills and attitudes.[1,2] However, large group teaching has been shown to be able to promote higher level thinking and problem solving too, provided interactive formats are used and active involvement of students is achieved.[3] For instance, Copeland et al. found high correlations between participants' ratings of overall lecturing quality and the lecturer's ability to engage participants' attention during the lecture.[4] But although larger groups may also be effective in inducing higher order thinking and problem solving, small group learning is considered by many to be the preferred didactic approach to enhance meaningful learning. Consequently, small group formats have been introduced both in fully fledged problem based programmes with predominantly small group tutorials and in programmes that can be characterised as hybrid programmes with different types of small and medium sized group learning, such as seminars, workshops and group practicals. What these formats have in common is that a teacher and a group of students address a topic or assignment through group discussions.[5]

Many studies have examined conditions enhancing small group learning. Discussion and interaction have been identified as key features[6] as have tutor characteristics, non-threatening group climate, group interaction, clinical relevance and pedagogical materials encouraging problem solving and thinking.[7] Both Astin and McKeachie et al. found that cooperative student-student interaction and student-faculty interaction were important in encouraging critical thinking and influenced students' academic and personal development.[8,9] Furthermore, constructive activity within groups and the quality of group interaction were identified as strong predictors of student achievement by Webb et al.[10] Another important factor to emerge from Webb's study was that it is more important for group interaction to be focused on generating explanations of the problem in hand than on coming up with the correct answer.[10] At the same time it was argued that compared to well-defined assignments, complex, relatively ill-defined assignments were likely to trigger more group interaction.[10] The importance of the way problems are constructed was also emphasised in the literature on problem-based learning (PBL). Problems should be tailored to students' level of knowledge and state clearly what is expected of students without "giving away the solution".[11,12] Other factors that have been identified as important in PBL are the tutor and group interaction. It has been shown that effective tutors are characterised by having both relevant content knowledge and an authentic interest in students' lives and learning

as well as a positive influence on group functioning.[13] The group interaction that occurs in PBL settings when a group is discussing a problem is expected to trigger cognitive processes, such as activation of prior knowledge, elaboration of topics, and learning from each other. Moreover, gaps in knowledge identified during group discussions are regarded as a source of intrinsic motivation and positively related to the perceived learning effect of the group process.[14,15] In summary, important factors in small group learning appear to be group interaction, teacher performance, and the quality of assignments.

We conducted a study to examine the relevance of these three factors in a specific type of group learning, namely seminars in a hybrid curriculum. These seminars consist of groups of 15-30 students facilitated by a teacher which are given specific problems to resolve that students have already studied in preparatory assignments.

We sought to answer the following research question: what is the nature of the relationships between student groups' perceptions of educational processes (teacher performance, group interaction, and the quality of assignments) and the perceived learning effect of seminars?

METHODS

Educational setting

The Faculty of Veterinary Medicine, Utrecht University, the Netherlands offers a six-year undergraduate curriculum consisting of four years of preclinical training followed by two clinical years. Curriculum revisions in 1995 and 2001 were aimed at enhancing learner centeredness, integration, and a skills and attitude-orientated approach. The new principal instructional format that was introduced in all years of the curriculum was the seminar, comprising groups of some 25 students discussing assigned readings, raising questions and issues and discussing these to resolve realistic practice-related problems, the underlying idea being that students learn through confrontation with problems of practical relevance. The groups are facilitated by teachers trained for this role and selected for their content expertise concerning the subject matter addressed. The students are expected to actively contribute to the discussions. Compared to lectures, these seminars are relatively informal.

The formal curriculum stipulates that each trimester (14 weeks) students are assigned to one seminar group of some 25 students. In practice, however, group size varies because attendance is voluntary. Seminar sessions last 2 hours.

Subjects
We collected data on 32 seminars from students in Years 1-4 (n = 639) in the academic year 2005-2006.

Questionnaire
We designed a questionnaire consisting of 28 items relating to three factors derived from the literature on small group learning and considered relevant for learning in the seminars: 'teacher performance', 'group interaction' and 'quality of assignments'. As 'outcome measure' we used the learning effect of the seminars as perceived by students. The items about teacher performance and quality of assignments were mostly derived from existing questionnaires,[11,16,17] while the items on group interaction and learning effect were newly constructed. The participants were asked to indicate the degree of their agreement with the questionnaire items on a five-point Likert scale (1 = 'completely disagree', 5 = 'completely agree'). The full questionnaire is available from the first author.

Data collection
The students were asked to complete the questionnaire at the end of a seminar. Together with the questionnaire they were given a letter explaining the aims of the study and stating that participation was voluntary. Additionally, the students were assured that their data would be treated confidentially and that it would be impossible to relate study outcomes to individual students. There was no teacher-student relationship between the first author, who collected the data, and the students at the time of this study. Data collection was scheduled in the second trimester of Years 1-4, not too early in the trimester or too close to the exams at the end of the trimester. We collected data on all seminars that were being conducted during that period, ensuring an even distribution over the four curriculum years. A requirement for inclusion was that the seminar was the main instructional format during that trimester and that the subject of the seminars was included in the next examination. The questionnaire was administered to 32 student groups.

Data analysis
Scales were constructed on the basis of an exploratory factor analysis of the questionnaire items. Although several items were derived from existing questionnaires developed especially for PBL settings, some items were newly designed and it is possible that the setting of our study differs from the PBL settings of the existing questionnaires. Principal component analysis was performed followed by oblique rotation (direct oblimin). We included only factors consisting of at least three items and with an eigen value of > 1. Item clusters were composed on the basis of the results and a reliability analysis was performed for

each cluster to examine internal consistency and to identify (and remove) items with a negative effect on reliability. An alpha coefficient of ≥ .70 was considered acceptable. The clusters were analysed for their interpretability as a meaningful scale. For further analysis, the item scores were averaged for each factor.

Reliability of the group level aggregation

In order to assess the reliability of the group level aggregation, the intraclass correlation coefficient (ICC) was calculated.[18] This required one-way analysis of variance to estimate the between-group and within-group variance components for each of the four group variables. The corresponding ICC for the aggregation was calculated for varying group sizes (*n)*, according to

$$ICC(n) = \frac{Variance_{between-group}}{Variance_{between-group} + (Variance_{within-group})/n}$$

Relationships between the variables

A specific characteristic of the data set in this study is its nested two-level structure: the level of the individual student and the group level. Students' perceptions of teacher performance, the quality of the assignments and group interaction are group-related characteristics because all students in a group share the same teacher, subject content and group interaction. This supports the use of the group average of these variables (aggregation) in the analysis. 'Perceived learning effect' can be regarded as a variable on the individual level, but it can also be argued that the group average is a valid characteristic for the perceived learning effect at group level. Because we were interested in how teacher performance, the quality of assignments and group interaction affect perceived learning on the level of the group, we performed the analysis at group level. In order to account for correlations between the independent variables, we analysed the model shown in Figure 1: 'quality of assignments' is assumed to affect 'teacher performance' and 'group interaction', and all three independent variables are assumed to affect 'perceived learning effect'. We analysed these relationships through (partial) correlation analyses and regression analyses using SPSS version 14.

RESULTS

Of the 627 questionnaires that were handed in, ten were excluded because of incomplete data, which left 617 questionnaires with data on 32 seminars.

The response rate was 99%. Group attendance was 84% for Year 1, 93% for Year 2, 71% for Year 3, and 82% for Year 4. The mean number of students per group was 18.6 (SD = 9.71, min. 7 - max. 29).

Analysis of the questionnaire

The exploratory factor analysis (EFA) yielded four factors (F1-F4), largely matching the a priori item clusters used in constructing the questionnaire (Table 1). Eigen values and explained variance were 8.0 and 29.3% for 'teacher performance' (F1), 2.6 and 9.3% for 'group interaction' (F2), 2.0 and 7.6% for 'quality of assignments' (F3) and 1.4 and 5.3% for 'perceived learning effect' (F4). This factor model explained 51.5% of the total variance. The factor loadings show the extent to which a variable (item) is explained by its underlying factor (F1–F4). Two items were removed from the model, because of factor loadings < 0.50: "The teacher stimulated interaction between students" and "I have learned from the questions and answers of my fellow students".

The alpha coefficients per factor were: 0.90 for F1, 0.78 for F2, 0.81 for F3 and 0.54 for F4, indicating acceptable internal consistency of three of the four factors. The alpha coefficient of the factor 'perceived learning effect' was low (0.54) but the corresponding scale consisted of a low number of items (n = 3).

Table 1 Exploratory factor analysis structure.

Factors	Items	Factor loadings			
F1: Teacher performance		F1	F2	F3	F4
1	The atmosphere in the group was open and friendly.	**0.59**	0.06	0.08	0.03
2	The teacher had sufficient content knowledge.	**0.65**	0.04	0.26	-0.09
3	The teacher explained the subject matter well.	**0.72**	0.22	0.22	0.16
4	The teacher understood the students' learning difficulties.	**0.76**	-0.12	0.07	0.15
5	The teacher provided useful feedback concerning the problems.	**0.75**	-0.14	0.21	-0.01
6	The teacher was easily approachable.	**0.74**	-0.04	0.08	-0.05
7	The teacher showed enthusiasm.	**0.85**	-0.03	0.06	-0.00
8	The teacher showed interest in me as a student and in my study activities.	**0.82**	0.02	-0.11	0.07
F2: Group interaction					
1	The problems stimulated group discussion.	0.15	**0.66**	0.16	-0.03
2	Students had to work together to solve the problems.	-0.05	**0.65**	0.08	-0.10
3	Students engaged in a lively discussion.	-0.02	**0.82**	-0.16	0.11
4	Student asked each other questions related to the content.	0.07	**0.53**	-0.00	-0.02
5	Most of the students participated in the group discussion.	0.04	**0.72**	0.09	-0.06

Factors	Items	Factor loadings			
F3: Quality of assignments					
1	The assignments were clearly formulated.	0.19	-0.18	**0.61**	-0.15
2	The assignments fitted well with my prior knowledge.	-0.03	0.00	**0.70**	-0.23
3	The assignments were stimulating/challenging.	-0.09	0.16	**0.66**	0.18
4	The assignments were well structured.	0.05	-0.09	**0.58**	0.05
5	The assignments had clear practical relevance.	-0.01	0.09	**0.69**	0.03
6	This seminar stimulated my interest in the subject matter.	0.08	0.20	**0.53**	0.15
7	This seminar enlarged my insight in the subject matter.	0.15	-0.03	**0.57**	0.19
F4: Perceived learning effect					
1	This seminar helped me gain insight into gaps in my knowledge.	0.11	-0.03	0.12	**0.78**
2	I feel this seminar was relevant to my preparation for the exams.	-0.05	0.03	-0.10	**0.61**
3	In this seminar I have learned more than when I would have studied the subject matter on my own.	0.15	-0.15	0.18	**0.60**

Reliability of the group level aggregation
Table 2 shows that the intraclass correlations (ICC) were high for the three process variables (teacher performance, group interaction and quality of assignments) indicating high within-group agreement. The ICC was satisfactory (> 0.70) for the outcome variable (perceived learning effect) when group size exceeded 20 students.

Table 2 Intraclass correlation coefficients (reliability) for the 4 group level variables.

Group size	Teacher performance	Group interaction	Quality of assignments	Perceived learning effect
10	0.87	0.84	0.87	0.54
15	0.91	0.89	0.91	0.64
20	0.93	0.92	0.93	0.70
25	0.94	0.93	0.94	0.75
30	0.95	0.94	0.95	0.78

Relationships between the variables
Table 3 shows the means, standard deviations and correlations for the four factors on the aggregated group level (n = 32). The mean scores vary between 2.79 for group interaction and 3.99 for perceived learning effect, with corresponding standard deviations of 0.44 and 0.23 (n = 32).
The results demonstrate strong and significant correlations for teacher performance and perceived learning effect (0.75), for teacher performance and quality of assignments (0.65), and for quality of assignments and perceived learning effect (0.47). The correlation coefficient for quality of assignments and group interaction was 0.36. No significant correlations were found between teacher performance and group interaction (0.26) and between group interaction and perceived learning effect (-0.05).

The linear regression analysis shows the simultaneous impact of the three independent variables on perceived learning effect (Table 4). The regression analysis shows significant effects for teacher performance ($\beta = 0.78$, $p < 0.0005$) and group interaction ($\beta = -0.28$; $p < 0.05$), while quality of assignments shows a non-significant effect ($\beta = 0.07$).

Table 3 Mean scores, standard deviations (SD) and correlations between factors (n = 32).

	Mean	SD	F1	F2	F3
F1: Teacher performance	3.97	0.42			
F2: Group interaction	2.79	0.44	0.26		
F3: Quality of assignments	3.71	0.35	0.65**	0.36*	
F4: Perceived learning effect	3.99	0.23	0.75**	-0.05	0.47**

* Correlation is significant at the 0.05 level (2 tailed).
** Correlation is significant at the 0.01 level (2 tailed).

Table 4 Regression analyses for the dependent variable (Perceived learning effect) and the three independent variables (Teacher performance; Group interaction; Quality of assignments). Unstandardised coefficients (B), standardised coefficients (β), standard errors and significance levels are presented. In addition, the zero-order and partial correlations are presented.

Perceived learning effect	B	SE B	β	Sig.	Zero-order correlations	Partial correlations
Constant	4.00	0.03		0.000		
Teacher performance	0.42	0.08	**0.78**	0.000	0.75	0.70
Group interaction	-0.14	0.06	**-0.28**	0.035	-0.05	-0.39
Quality of assignments	0.04	0.10	0.07	0.666	0.47	0.08

To further investigate the relationship model pictured in Figure 1, zero-order correlations and partial correlations were obtained, and added to the path diagram. The relations in this model reveal that the direct effect of quality of assignments on perceived learning may be non significant and small (partial correlation 0.08, see Table 4), but the additional effects of quality of assignments via teacher performance and group interaction add to the total effect of quality of assignments on perceived learning amounting to

$$\sqrt{(0.36\times(-0.39))^2+(0.65\times 0.70)^2+0.08^2}=0.47,$$

which (by definition) agrees with the zero-order correlation of quality of assignments and perceived learning effect. The negative effect of group interaction

indicates that, teacher performance being equal, a higher level of group interaction is associated with a lower perceived learning effect.

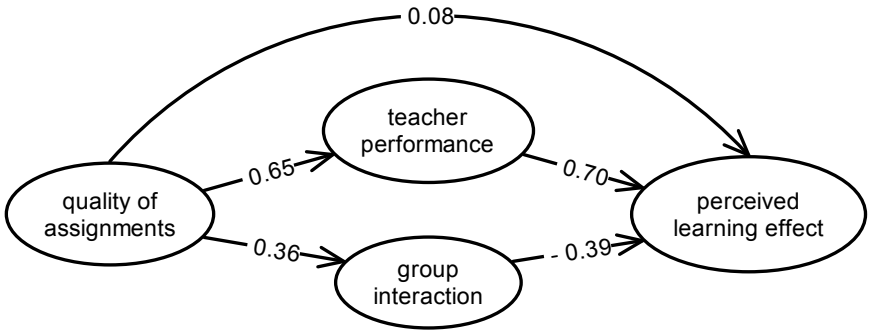

Figure 1 Path diagram for the group-level variables quality of assignments, teacher performance, group interaction, and perceived learning effect. The arrows indicate the relations between the variables and the attached figure indicates the associated partial correlation. For teacher performance and group interaction there is a single independent variable, quality of assignments, and this implies that the associated partial correlation is equal to the zero-order correlation.

DISCUSSION

The aim of this study was to explore the relationships between factors of the educational process in seminars and the learning effect of these seminars as perceived by groups of students.

Of the four factors to emerge from the factor analysis: group interaction, teacher performance, quality of assignments and learning effect, group interaction received the lowest mean score from the student groups. The high ratings of the three other factors indicate that the student groups valued these aspects of seminar learning.

The perceived learning effect was directly related to perceived teacher performance (0.70) and to the perceived level of group interaction (-0.39) and indirectly related to the perceived quality of assignments (0.47). This suggests that the groups rely strongly on their teachers for the learning effect and do not perceive group work and group interaction as making a positive contribution to their learning. Furthermore, no significant relationship was found between teacher performance and group interaction (0.26) indicating that good teacher performance

is not necessarily related to active student participation in the group. A possible explanation, also considering the relatively low score on 'group interaction' (2.79), could be that in the seminars there is less student interaction than we anticipated and that as a result the seminars are more teacher centred than student centred. These results are not in line with the existing literature on interaction and group discussion.[14,15] It seems that the learning effect as perceived by the student groups depends on other educational processes within the seminars. Perhaps teaching method and assessment system are not sufficiently in alignment in the curriculum. Also student groups may rely primarily on the teacher to provide 'the right answer to problems'. Perhaps the organisation of the group process may not be effective in promoting group interaction causing interaction to depend on teachers' preferences. Alternatively, teachers may have difficulty facilitating meaningful group interaction. Furthermore, students may not prepare adequately for group sessions. This area deserves further study, for example by interviewing students and teachers to explore their views on the interaction in the groups or by observing learning-oriented types of interaction within the groups and the teacher's role. It cannot be ruled out that teachers may need additional training.

Since the results show positive associations between the quality of assignments on the one hand and group interaction (0.36) and teacher performance (0.65) on the other hand, improvements in the quality of the assignments may help teachers to facilitate meaningful group interactions. Improvements in the quality of the assignments should be sought in a good mix of ill defined but at the same time not too complex assignments and focus on teamwork, so that students really need to work together (positive interdependence between students) to complete their assignments.[10-12,19]

There are some design-related limitations to this study. Firstly, one might question our decision to analyse the data at group level, because with multi-level data, associations at an aggregate level may differ from lower level associations. This potentially misleading discrepancy is referred to in the literature as the 'ecological fallacy'.[20] However, this effect can be ruled out in this study, because all the independent variables are group level predictors. To check whether a multilevel analysis would be indicated we performed a multilevel analysis (using MlwiN version 1.10) for the three group predictors, explaining 'perceived learning effect' at the individual level. The results showed no significant random residual at group level, implying that a multilevel analysis is not indicated. Regular linear regression analysis with 'perceived learning effect' either at the individual or at the group level resulted in similar estimates of the regression coefficients as well as similar levels of significance of the coefficients (even slightly higher significance with the group level dependent variable). Apparently, the expected loss of power due to analysing a set of 32 groups instead of 617 individual observations of the

dependent variable is compensated by the gain of power resulting from reduction of noise due to the aggregation of the dependent variable. In conclusion: these findings indicate that the group level analysis is appropriate not only from a conceptual point of view but also from the perspective of optimal statistical power. The fact that our investigation is restricted to student perceptions is another limitation to our representation of reality. Further studies should explore different perspectives. Another potential weakness is the possibility of reverse causality: the model in Figure 1 shows the direction of the investigated relationships but one might argue that the direction can be reversed for teacher performance and quality of assignments. However, although it is true that some assignments are produced by the teacher facilitating the related seminar session, most assignments are produced by other teachers and most assignments constitute input for the educational process during the seminars because they are intended as preparation for the seminar. Finally, this being a single study within one particular setting, it can be seen as a first attempt to elucidate seminar learning. Future research should compare the outcomes of this study to those of other studies conducted in similar settings and using other research methods, such as observation of group interaction processes. It would also be of interest to investigate the optimum alignment of assignment qualities and group interaction within these specific settings.

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Chapter 4

Students' and teachers' perceived and actual verbal interactions in seminar learning groups

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ABSTRACT

Aims: To examine how much time students and teachers devote to different learning oriented interactions during seminar sessions and students' and teachers' perceptions about the occurrence and desirability of these interactions.

Methods: The students and teachers participating in 8 seminar group sessions in Year 4 of an undergraduate veterinary curriculum completed an 11-item questionnaire by rating, on a five-point Likert scale, the occurrence and desirability of three learning-oriented types of interaction: exploratory questioning, cumulative reasoning, and handling conflicts about knowledge. The questionnaire also invited positive and negative responses to aspects of group interactions and an overall mark (1-10) for the seminars and group interactions. Four group sessions were videotaped and analysed using a coding scheme. The amount of time devoted to the different interactions was calculated.

Results: Both students and teachers reported moderate occurrence of exploratory questioning and cumulative reasoning and low occurrence of handling conflicts about knowledge. The desired occurrence of all interaction types was significantly higher than the actual occurrence according to students and teachers. The teachers were responsible for the majority of the interactions (93%). The percentages of session time devoted to teacher-centred cumulative reasoning, exploratory questioning, and handling conflicts about knowledge were 65.8%, 15.6% and 3.1%, respectively.

Conclusion: Group interactions in seminar groups are dominated by teachers posing questions to students. The moderate occurrence of groups' interactions as perceived by students and teachers may be explained by the relatively large group size, and inadequate preparation of teachers and students in stimulating group interactions.

INTRODUCTION

Many curricula in higher education, based on (social) constructivist theories of learning, aim to promote deep and powerful learning by casting students in the role of active constructors of their own knowledge as opposed to that of passive recipients of knowledge imparted by their teachers. Moreover, many of these curricula are designed to stimulate students to consider issues from different angles and engage in problem solving activities with others, based on the concept that knowledge building is fostered by interacting with others in the learning environment.[1-3] Various studies have reported on positive effects of interacting with others on students' learning[4-6] and on group productivity[7,8], whereas absence of interaction has been reported to be detrimental to the effectiveness of tutorial groups[9]. However, a study we conducted recently yielded results that were not consistent with this pattern.[10] Interactions in seminar groups were not perceived as having a positive influence on learning by the participating students and group interaction appeared to be negatively associated with perceived learning. Furthermore, the strong positive effect of teacher performance in our study suggested that students relied heavily on their teacher.[10] We decided to conduct a more detailed study of interactions in seminar groups to elucidate these findings. We examined both teachers' and students' perceptions of group interactions and we videotaped and analysed group sessions.

Seminar groups are the setting of our explorations of group interactions. This educational format consists of weekly sessions in which a group of students, facilitated by a teacher, discusses questions and issues emerging from assigned readings on a topic of practical relevance, for example anaesthesia in a horse. The underlying assumption is that interaction will stimulate active and deep learning. Many studies have examined why different types of interaction take place during small group learning.[11,12] In a study conducted by Van Boxtel three types of interactions were distinguished: asking and answering questions; reasoning; and acknowledging and resolving conflicts about knowledge.[12] Elaborating on this study, Visschers-Pleijers et al. distinguished three types of learning-oriented interactions: exploratory questioning, cumulative reasoning, and handling conflicts about knowledge.[13,14] Because these interactions involve verbalisation of the subject matter learned by students, they are assumed to stimulate deep learning.[15,16] By asking questions and engaging in discussions, students share their thoughts and ideas and obtain a deeper understanding. When disagreements about knowledge arise, students are expected to search for new information, new explanations and new justifications and to engage in reflections, all of which may contribute to deep learning.[11,17,18] We wanted to examine whether these types of interaction occurred in seminar groups and, if they did, whether students and

teachers perceived them as valuable for the educational process. We addressed two research questions:

1. How do students and teachers perceive verbal learning-oriented interactions in seminar groups, particularly the occurrence and desirability of exploratory questioning, cumulative reasoning, and handling conflicts about knowledge?
2. How much time do students and teachers devote to these different types of verbal interaction during seminar groups?

METHODS

Educational context

This study was conducted at the Faculty of Veterinary Medicine, Utrecht University, the Netherlands, which offers a six-year undergraduate curriculum consisting of preclinical training and two years of clinical clerkships. Curriculum changes promoted a shift from teacher-centred education towards student-centred education to foster an active learning environment. In 1995, seminar groups were introduced as the new principal instructional format. Students are assigned each trimester to one seminar group guided by one teacher. During sessions the group discusses a preparatory reading assignment. The students are expected to elaborate on what they have learnt from the assignment and what is not (yet) clear to them.

We investigated verbal group interactions during the seminars in the Year 4 Anaesthesiology Course in which students discussed an assignment about 'induction and maintenance of general anaesthesia' (Appendix 1). The sessions were structured as follows:

- introduction of the topic by the teacher;
- brief discussion about the topic of the assignment without input from the teacher;
- group discussion facilitated by the teacher.

The seminars lasted between 60 and 95 minutes.

Subjects and procedure

We collected data from teachers and students participating in 8 seminar groups in the academic year 2007/2008, which varied in size from 10 to 22 students. Attendance of group sessions was not compulsory and 117 out of the total of 180 students (divided over the total of 8 groups) in Year 4 participated in the sessions we studied. During the second and third weeks of the 12-week course students and teachers were asked to complete a questionnaire immediately after each seminar session.

From the 8 group sessions, we randomly selected 4 groups (n = 59 students) to be observed and recorded on video. Of the four different teachers participating in the questionnaire study, two facilitated the observed sessions. The participants received a covering letter explaining the aims of the study and guaranteeing confidentiality. Both students and teachers gave informed consent by signing the covering letter.

Questionnaire

We used a group interaction questionnaire developed and validated by Visschers-Pleijers et al.[14] containing 11 statements with five-point Likert scales (1=completely disagree; 5= completely agree) pertaining to 3 types of learning-oriented interactions: exploratory questioning (4 items), cumulative reasoning (4 items) and handling conflicts about knowledge (3 items). Students and teachers were asked about the occurrence and desirability of these interactions. We interpreted an average score of < 3.0 as low, a score of 3.0-3.5 as moderate, while a score of > 3.5 was interpreted as sufficient or high. Additionally, the students and teachers were asked to rate the overall quality of the interaction and overall perceived learning on a 10-point scale from 1 = extremely poor to 10 = excellent. The students were also asked to indicate the amount of time they had spent on self-study and the amount of time they thought they should have spent on it (scale 1 = 0 hour, 2 = 0.5 hour, 3 = 1 hour, 4 = 1.5 hours, 5 = 2 hours and more). Both students and teachers were asked, in an open question, to indicate which aspects of the group interaction in the seminars they generally perceived as positive or negative (Appendix 2). The responses were coded as positive or negative and classified as themes related to (deep) learning issues and teacher dependency. Comments not relating to these themes were mentioned when relevant. All responses were coded and classified by the first author.

Video recording and coding

Only the teacher-guided part of the discussion was analysed and coded, because this is the part of the seminar in which students and teacher are interacting. In accordance with a study by Visschers-Pleijers et al.[19], we used as unit of analysis the utterance, defined as an individual message unit that:

1. "is expressed by one participant (student or teacher) and deals with one topic. In other words a change of topic announces the beginning of a new utterance, and
2. has a single communicative function, to put it differently, a single message or expectation is communicated by the speaker, such as a question or an argument."[19]

Utterances can range from one word to several sentences. We analysed the verbal interactions in the seminar groups using the coding scheme adapted by Visschers-Pleijers et al.[19] from the scheme developed by Van Boxtel[6,12]. This scheme contains the three learning-oriented types of interaction and two non-learning oriented interaction types (i.e. procedural interactions and irrelevant/off-task interactions). A full description of this coding scheme is given by Visschers-Pleijers et al.[19] and is summarised in Table 2.

We coded the verbal interactions using ATLAS TI, computer software for quantitative analysis of primary sources of observational and qualitative data (www.atlasti.com). Two of the authors (DJ and TB) independently coded a randomly selected portion (about 20%) of the videotaped sessions. Interrater reliability (Cohen's kappa) was 0.74, which is 'substantial'.[20] TB was trained by DJ, who coded all the tapes. The amount of time devoted to each type of verbal interaction in each of the seminar sessions was calculated for the teachers' and students' contributions separately. The group discussion lasted between 52 and 73 minutes. In order to standardise for these differences, time spent on each interaction type was expressed as a percentage of the total discussion time in the group session.

Analysis of the questionnaire and videotapes

The scores for each type of interaction were obtained by averaging the relevant item scores. Total occurrence and desirability scores were obtained by averaging the scores on the three interaction types. Similarly, the percentage of discussion time spent on each interaction type was obtained by summing the percentages of session time spent on the associated interaction subtypes. The total score consisted of the summed interaction type scores. All scores were calculated and analysed for students and teachers separately.

Because the issue of interest was the group process, the perceived interactions and the amount of time spent on each type of interaction were regarded as characteristics of the group sessions. That is why the students' responses to the questionnaire and time percentages were aggregated at group level.

Descriptive statistics (means and standard deviations over 8 seminar sessions) are reported for the questionnaire scores. The differences between perceived and desired occurrence of interactions were analysed by means of Wilcoxon signed-rank test. Means and standard deviations of the percentages of time devoted to each interaction type were computed over the 4 seminar sessions.

RESULTS

Perceptions of learning-oriented interactions/questionnaire

All the students (n = 117) and teachers (n = 4) who participated in the 8 seminar sessions completed the questionnaires for each session (response rate 100%). One student questionnaire was not analysed because of incomplete data. Table 1 shows the questionnaire scores.

The highest score on occurrence from both students and teachers was that for 'alternative arguments'. Students' lowest ratings of occurrence were those of 'conflicts about knowledge' and the teachers' lowest ratings related to 'verification questions' and 'negations'. 'Open questions', 'argument reasons', and 'conclusive arguments' received the highest desirability ratings from the students and the teachers. The latter group also gave a high rating to 'alternative arguments'. The lowest ratings from both groups related to the desirability of 'conflicts about knowledge' and 'negations', while the teachers' rating of the desirability of 'verification questions' was low as well.

The total ratings for occurrence and desirability differed significantly. This difference was less pronounced for the students' ratings, because their occurrence rating was higher while the desirability ratings were the same for teachers and students. The standard deviations indicate greater agreement among the students, which is not surprising since aggregation at group level reduced measurement variance by a factor 1/(number of students in the group), whereas there was only a single teacher measurement for each group. All desirability scores exceeded the occurrence scores, except one (Table 1).

Students reported spending between 0 and 0.5 hours (1.7, SD = 0.2) on self study in preparation for the seminar session and said they should have spent 1 to 1.5 hours (3.6, SD = 0.3). The students rated the perceived learning effect of the seminars as 8.0 on a scale 1-10 (SD = 0.2). The students and the teachers rated the quality of the interaction both on a scale 1-10 as 6.8 (SD = 0.4) and 7.1 (SD = 1.5), respectively.

Table 1 Teachers' and students' mean scores and standard deviations on a 5-point scale for the occurrence and desirability of the different interaction types, by interaction type and by individual items. The difference between the occurrence and desirability scores is also reported (n = 8 groups).

Learning-oriented interaction types and related items	Occurrence of interactions		Desirability of interactions		Desirability versus occurrence	Occurrence of interactions		Desirability of interactions		Desirability versus occurrence
	Students					**Teachers**				
	Mean	SD	Mean	SD	Mean difference	Mean	SD	Mean	SD	Mean difference
Exploratory questioning	**3.3**	**0.2**	**3.8**	**0.1**	**0.49****	**3.2**	**1.0**	**3.7**	**0.4**	**0.53**
Q1: Open questions	3.7	0.4	4.2	0.1	0.50*	3.5	1.4	4.6	0.5	1.13*
Q2: Critical questions	2.9	0.5	3.7	0.2	0.86**	2.9	1.4	3.4	0.8	0.63
Q3: Verification questions	2.7	0.3	3.3	0.2	0.62**	2.5	0.9	2.6	0.5	0.00
Q4: Alternative arguments	4.1	0.2	4.1	0.2	-0.02	3.9	0.9	4.3	0.5	0.38
Cumulative reasoning	**3.6**	**0.2**	**4.1**	**0.1**	**0.47****	**3.4**	**0.9**	**4.1**	**0.4**	**0.72***
Q5: Arguments in general	3.3	0.3	3.8	0.1	0.53**	3.3	0.9	3.9	0.4	0.63
Q6: Argument reasons	3.6	0.2	4.2	0.2	0.56**	3.4	0.7	4.3	0.5	0.88*
Q7: Continuation arguments	3.7	0.3	4.0	0.1	0.37**	3.6	1.1	4.0	0.6	0.38
Q8: Conclusive arguments	3.7	0.2	4.2	0.2	0.43**	3.4	1.2	4.3	0.8	1.00*
Handling conflicts	**3.0**	**0.4**	**3.3**	**0.2**	**0.29**	**2.7**	**0.7**	**3.4**	**0.7**	**0.71***
Q9: Conflicts about knowledge in general	2.6	0.5	2.8	0.4	0.18	2.8	1.0	3.3	0.8	0.63
Q10: Negations	3.0	0.5	3.1	0.2	0.09	2.5	0.8	3.0	0.6	0.50
Q11: Counter-arguments	3.4	0.3	4.1	0.2	0.61**	2.8	0.7	3.7	0.9	1.00
Total item scores	**3.3**	**0.2**	**3.8**	**0.1**	**0.43****	**3.1**	**0.8**	**3.8**	**0.4**	**0.65***

* Significant at the 0.05 level; ** Significant at the 0.01 level.

In the answer to the open question, the students reported 116 positively perceived interaction processes and 101 negatively perceived interaction processes.

Positive:

- learning effect (81 comments): content is better understood by discussing it, asking questions, hearing new insights/opposing student views/different opinions, learning from each other's mistakes; you learn deeper, information is easier to remember and recall;
- teacher's role (12 comments): the teacher should say which information is correct/incorrect and draw conclusions, draw schemes/maps;
- practical relevance (3 comments): interaction is important because you hear more practical examples;
- social/communication skills (3 comments): group interaction leads to better social/communication skills;
- preparation/self study (2 comments): group interaction is only useful if students are well prepared.

Negative:

- efficiency (52 comments): discussions take too long when every detail is discussed; when questions are not relevant to the assignment; when students do not know the correct answer and the teacher waits too long to give it; the process is boring and inefficient;
- teacher's role (10 comments): sessions are not informative when the teacher does not control the interaction process; fails to provide the correct answers or draw conclusions; especially when students discuss incorrect information, the teacher should provide the correct answers in the end;
- textbook (3 comments): group interaction is ineffective when students present quotes from textbooks;

Some examples of the answers from students and teachers are shown in Figure 1.

Students:
"Students asked questions about content which I also found difficult to understand. The answers given by other students were formulated in a student way and therefore easier to understand than when an experienced teacher would explain things."
"Group interaction stimulates students to put forward alternative arguments and different views; things you did not think of before."
"Group interaction also means making mistakes, followed by feedback and as a result you learn more."
"Group interaction is only effective when the content/assignment is complex and there is not one correct answer. Interaction is less effective when the content consists solely of simple facts."
"Endless discussions about irrelevant (to the exams) topics are negative experiences with group interaction for me."
"The teachers should provide the correct answer at the end of the session so we know what to learn for the exams. Sometimes teachers refuse to give the correct answer or wait too long for students to come up with some answers, which is very tedious and boring."

Teachers:
"I think it is positive when answers are supported by arguments so students learn from each other's reasoning."
"For me group interaction is effective because it gives insight into how students understand the content and whether and where extra guidance is needed."
"Group interaction is not effective when the content is completely new to the students and as a result may be too confusing. Even today's students want to hear the right answer."

Figure 1 Selected comments relating to positive and negative experiences with group interaction in the seminar group made by **students** and **teachers** in response to the open question in the questionnaire.

Observations/video analysis

Table 2 shows the mean percentages of total seminar time spent on the three interaction types. Of the time devoted to verbal interactions, 92.8% was accounted for by teacher-led interaction, consisting mostly of cumulative reasoning (65.8%) and exploratory questioning (15.6%). Cumulative reasoning consisted mostly of statements by teachers (38.2%) and other arguments by teachers (18.4%). Exploratory questioning by teachers consisted largely of open-ended questions (12.5%). Students' modest contribution to the verbal interactions consisted mostly

of cumulative reasoning (Table 2). Figure 2 gives an impression of the discourse during the session.

Table 2 Percentage of total group discussion time devoted to the different interaction (sub)types in four video recorded seminar sessions. Means and standard deviations (SD) for students' and teachers' contributions to the interaction.

	Time (% of total group discussion time)			
	Students		**Teachers**	
Interaction types + subtypes	**Mean**	**SD**	**Mean**	**SD**
Exploratory questioning	**2.4**	**2.2**	**15.6**	**4.1**
Open question	0.4	0.3	12.5	1.8
Critical question	0.1	0.1	0.2	0.3
Verification question	1.8	1.9	0.3	0.2
Alternative argument	0.1	0.1	2.7	2.6
Cumulative reasoning	**5.2**	**0.5**	**65.8**	**6.4**
Statement	2.8	0.6	38.2	16.6
Other argument	2.0	1.2	18.4	10.0
Other question	0.2	0.4	2.8	1.3
Judgment acceptance/ confirmation	0.1	0.1	6.4	2.5
Handling conflicts about knowledge	**0.2**	**0.2**	**3.1**	**2.7**
Counter argument	0.1	0.1	2.2	2.4
Judgment negation/disagreement	0.1	0.1	0.8	0.4
Evaluation	0.0	0.0	0.03	0.1
Procedural	0.0	0.0	8.3	2.3
Irrelevant/off-task	0.0	0.0	0.1	0.1
Total	**7.8**		**92.8**	

(Seminar session 2 – start time: 23.56)

T: Okay, tell me, when you see this horse and you need to deal with it, which aspects would you take into consideration? (open question) What do you think when you see this patient? (open questions) And do not jam a needle into it right away, please! (statement) So what would you do? (open question) What do you think? (open question) Which aspects do you need to consider? (open question)
S1: That the horse has lost a lot of blood and that it may suffer from hypovolemia. (statement)
T: Yes, the horse has lost a lot of blood but you never know how much….but you can think of hypovolemia, yes. (judgement acceptance/confirmation)
T: What else? (open question) What consequences does this have for the anaesthesia? (open question)
S1: That you need to give a certain drug with as little cardiovascular side effects as possible or at least not a drug that worsens the situation the horse is in. (argument other)
T: Yes, that is one reason. (judgement acceptance/confirmation)
S2: And no decrease of blood pressure. (argument other)
T: Yes, (judgement acceptance/confirmation) but what might be unforeseen side effects if you give a horse anaesthesia when it has suffered major blood loss? (open question)
S1: Maybe because the blood volume that is circulating is less? (verification question)
S3: And then maybe you'll give the horse too much of the drug? (verification question)
S4: And then you'll give an overdose because the horse has less plasma protein. (argument other)
T: Yes, (judgement acceptance/confirmation) and what effect will you see in the horse? (open question)
S4: That the drug will cause lots of side effects. (argument other)
T: Yes, ... (judgement acceptance/confirmation)
S1: The horse will go in anaesthesia too deeply and therefore it will have a longer recovery. (argument other)
T: Yes, (judgement acceptance/confirmation) so that means that the effects of your anaesthesia will be stronger and the first thing you'll see is that the horse falls down when you do not want that to happen. (statement)

T is the teacher; S1 – S4 are four different students

Figure 2 An example of the discourse during one seminar session.

DISCUSSION

The aim of this study was to gain insight into students' and teachers' perceptions of and engagement in different types of learning-oriented group interactions when discussing assignments in seminar groups.

According to both students and teachers, exploratory questioning and cumulative reasoning occur at a moderate rate. The desirability scores were significantly higher than the occurrence scores. However, handling conflicts about knowledge is perceived as relatively unimportant with low to moderate scores on occurrence and desirability. The uniformly higher scores on desirability versus occurrence suggest a perceived need for improvement, especially for open and critical questions, arguments in general, additional explanations and counter-arguments. The higher desirability scores as compared to the occurrence scores are in line with findings reported by Visschers-Pleijers et al., who investigated types of learning interactions in small PBL groups, from the students' perception.[21]

The answers to the open-ended questions provided useful information about why certain types of group interactions were considered useful or not. On the one hand, students were of the opinion that retention and understanding, integration and application of knowledge were the main positive effects of group interaction in seminar learning. On the other hand, some students indicated that they preferred to be given the correct answers. The students also indicated that they wanted the discussion to be efficient and focussed on the assignment under study. Some teachers supported the students' comments by stating that interaction and differences of opinion may confuse students and thus are not beneficial to learning. These answers may (partly) explain the low desirability scores for the items relating to handling conflicts about knowledge. Also of interest is the finding that students gave higher ratings for the instructiveness of the seminar groups whereas the quality of the interaction received considerable lower ratings. This finding indicates probably that students feel much more comfortable hearing the teacher present the important facts and 'right' answers instead of having to sort it out by themselves. A common fear among students is that group members will be wrong in their answers.[22]

The results of the observational part of the study reveal that the interaction is dominated by the teacher asking questions to which students give brief answers. Student-student interactions are rare. This is not consistent with Visschers-Pleijers' study where student-student interactions dominated the discussion.[19] However, in that study, the group size was smaller. The dominant role of the teacher in our study can perhaps be explained by the group size being too large for intensive involvement of students in group discussion. Another possible explanation is that among students and teachers there is a lack of awareness of or support for the

educational ideas underlying the interactive seminars. Still, another reason may be inadequate preparation by students or assignments that are not geared to stimulating group discussion, for instance due to an abundance of closed questions.

From the results of the present study, we can derive some recommendations for improving seminar group learning. First of all, smaller groups or small group work within the larger group may enhance student-student interactions. Secondly, additional training of students and teachers may be needed to help them stimulate effective group learning, such as training in facilitating group learning. Thirdly, since the preparatory assignments are the main vehicle to stimulate the discussion in the seminar groups, the assignments themselves may need improvement. For example, they could be made more complex and ill-defined, with more open than closed questioning and less emphasis on reproduction of factual knowledge.

Although this study offered a more detailed picture of interactions in seminar groups than our previous study, there are some limitations. The survey was limited to 8 seminar groups, yielding a rather low number of participants from a statistical point of view. However, it was impossible to include more seminar groups since these 8 groups comprised all the students discussing the same assignment from the Anaesthesiology course. Furthermore, the video analysis was limited to 4 of these 8 groups and to the group discussion facilitated by the teacher thereby precluding conclusions based on the brief discussion among the students at the start of the session. Finally, this study focused on the cognitive aspects of group interaction in seminar groups. Other factors that may affect seminar learning, such as motivational issues and social aspects, were not investigated.

Further research could use in-depth qualitative methods, such as interviewing students and teachers, to explore teachers' and students' expectations and beliefs concerning seminar group learning and factors inhibiting successful group interaction. Motivational and social aspects of seminar sessions should also be studied. Finally, design-based research could help to determine whether changes in seminar format can enhance group interactions and which changes are to be preferred.

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Appendix 1 Assignment 'Anaesthesiology'.

Induction and maintenance of general anaesthesia

You are a veterinarian and you are called to a young stallion that has severely wounded himself. There is a large wound on the fetlock joint and an artery has been traumatised. The stallion is not excited and you decide to stitch the wound. Since the horse cannot be treated standing up, you decide to lay down the horse and start general anaesthesia.

You estimate that cleaning and stitching the wound will take approximately 30 minutes.

1) Describe 3 possibilities of induction and describe the strengths and weaknesses of each possibility with regard to the circulation status of the horse.
2) Which methods of maintenance would you prefer for the possibilities referred to in question 1?

After the horse was put under general anaesthesia and after closer inspection of the wound, it turns out that you will need more time for surgery than the 30 minutes you anticipated.

3) What are the consequences with regard to each possibility referred to in question 2?

Just before you finish the procedure - you only need to bandage the wound - the horse suddenly starts moving its hind legs.

4) What are your options for prolonging the anaesthesia for a few more minutes?

Appendix 2 The items of the student and teacher questionnaire. The teacher questionnaire did not comprise questions 13, 14, and 15. The students and teachers were asked to rate each item on two dimensions: 1) the perceived occurrence and 2) whether it was desirable for the interaction to occur in the seminar session[21].

	Exploratory questioning
Q1	The students asked questions that were relevant for gaining a good understanding of the subject. (open questions)
Q2	Probing questions were asked by students to challenge other students' observations. (critical questions)
Q3	When a student explained a problem, s/he regularly asked the others whether they thought the explanation was accurate. (verification questions)
Q4	The group was not satisfied with just one explanation. Alternative explanations were also suggested. (alternative arguments)
	Cumulative reasoning
Q5	The group built on ideas that were put forward. (arguments in general)
Q6	Observations that were put forward were supported by arguments. (arguments reason)
Q7	Students' explanations led to additional explanations by other students. (continuation arguments)
Q8	Conclusions were drawn from the information discussed in the group. (conclusive arguments)
	Handling conflicts
Q9	Contradictory ideas or information about a subject were discussed in the group. (conflicts about knowledge)
Q10	The opinions and views of one or more students were challenged by other students. (negations)
Q11	When students expressed disagreement with information presented by another student, they explained why they disagreed. (counter arguments)
Q12	Please rate the quality of the interaction in this seminar on a scale from 1-10.
Q13	Please rate the learning effect of this seminar on a scale from 1-10.
Q14	How much time did you spend on self study in preparation for this seminar?
Q15	How much time do you think you should have spent on self study for this seminar to be useful for you?
	Open question
Q16	Indicate the aspect of the group interaction in seminar sessions that you generally perceive as either positive or negative.

Chapter 5

Assessing students' research reports: Development of a rating scale

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ABSTRACT

Introduction: There is a paucity of explicit criteria for the assessment of students' research reports. Teachers tend to use their own idiosyncratic sets of implicit criteria. A well-defined set of criteria could foster reliable and valid assessment of students' research reports. The aim of this study was twofold: 1) to detect the strengths and weaknesses of students' research reports and 2) to develop an assessment tool for students' research papers.

Methods: Based on the literature and advice from experts, we developed a list of nineteen criteria comprising fifteen specific items and four global items. Three raters independently scored a sample of eighteen research reports using the list.

Results: The strengths of the reports were the description of materials and methods and the structure of the results. The weaknesses were the research questions, the grounding of the study in the research literature, analysis, statistics and clarity of visuals. With three raters, the reliability of the rating scale was reasonable.

Conclusion: The rating scale appears to be a useful tool for judging and giving feedback on students' research reports. This will have to be confirmed in studies with larger samples.

INTRODUCTION

In the past decade there has been growing recognition that education in scientific research should be part of the undergraduate medical curriculum.[1] Several factors played a role in this awareness. First, the explosion of biomedical and scientific information and the emergence of new technologies require that doctors are capable of appropriately appraising and using new knowledge. In other words, doctors need to be able to make judicious use of the medical research literature and ascertain when and how new developments and new evidence are relevant to professional practice in their particular setting.[2,3] Second, the decline in the number of clinician-scientists during the second half of the 20th century has given rise to a call for more clinician-scientists, who seek new knowledge about health and disease through research.[1,4] These factors are equally as important in medical curricula as they are in veterinary curricula, the latter being the focus of this study. Veterinary science deals with the same explosion of new knowledge, the same need to practice Evidence-Based-Veterinary-Medicine and the same declination of scientists.[2,5]

Several universities have levels of research competency that medical students are expected to attain by the end of their studies. These competencies include knowledge of general principles and methodology of scientific research, statistics skills, literature search skills, and management of scientific knowledge. There are several didactic options for incorporating research competencies into the curriculum. Some medical schools offer Evidence-Based-Medicine courses or require students to take part in 'critical appraisal' journal clubs.[6,7] Others encourage students to participate in research projects. It is thought that students who actively participate in research will be more likely to become involved in research in their professional lives and may even choose academic careers.[1,8] Although medical (and veterinary) schools are academic settings and research projects are to be a logical and relevant part of these curricula, surprisingly little is described in literature about these projects.

When research competencies are included in the curriculum, they should be properly assessed to determine whether the required competence levels are being achieved and the objectives of the curriculum met. Scientific competencies can be assessed in many ways. A popular assessment method is to have students write a scientific report on a research project. The report should follow the customary format of research papers: research questions; methods; results; and conclusions. However, there are generally no well-defined criteria for assessing such reports, and teachers tend to base their judgements on idiosyncratic sets of implicit quality criteria.[9] Assessment of research reports, and, thus of students' research competencies may gain validity and reliability when it is based on sound, well

defined, uniform criteria. Those who undertake to develop such criteria should, however, be on the alert for problems inherent in the use of detailed checklists. Studies have shown that detailed checklists do not necessarily yield more reliable assessments than do subjective judgements. Analytic and highly detailed criteria may result in meaningless assessment and have a detrimental impact on students' study behaviour.[10] Nevertheless, there is little doubt that transparent and fair judgement requires assessment criteria that provide cues for assessment and feedback to students.[11]

We performed a study in which we developed a rating scale for the assessment of research reports, taking care that the list was more specific than global rating scales, yet not overly detailed. The criteria were derived from the literature and resembled the requirements customarily met by authors of scientific papers: that reports should be embedded in relevant research and theory in the subject area, present a clear problem definition with well-defined research question(s), describe appropriate methods, give a clear description of the results, present a critical discussion of the findings and appropriate conclusions. The consistency of these elements was considered to be particularly important.[12-15] The rating scale was used by experts to assess students' research reports. The aim of this study was twofold: to gain insight into students' research competency levels by identifying the research reports' strengths and weaknesses using the rating scale; and to produce a useful tool for assessing students' research reports.

METHODS

Context

The study was conducted at the Faculty of Veterinary Medicine (FVMU), Utrecht University, the Netherlands between September and December 2004. In the fifth year of their 6-year programme, students undertake a compulsory 3-month research internship. Students can apply for an internship at Utrecht University (a research institute in the Netherlands) or a research institute or university in another country. The internship is supervised by faculty of one of the 11 departments of the FVMU.

The aim of the research internship is to enhance students' research competencies, use and critical appraisal of the scientific literature, and scientific communication. The students perform a study and write it up in a research report. Teachers do not currently use a dedicated instrument to assess these reports because no such instrument is available. The internship is assessed by three marks: one for the practical work, one for the report, and one for presentation.

Instrument

We developed a set of criteria for assessing the quality of students' scientific research reports and identifying the reports' strengths and weaknesses. The criteria were derived from various publications. They address key aspects of good research reports, such as a well-defined research question, a clear and appropriate theoretical background, appropriate methods and results, and conclusions that answer the research question.[9,13-15] In accordance with an approach used by Geerligs[9], we distinguished global (i.e. global impression) items from specific (detailed) items.

The list was developed by the first and second authors of this article. Four experts were asked to comment on the list independently to ensure its relevance, clarity, and precision. The experts were from different backgrounds (veterinary, biomedical, and educational) and were experienced in supervising and assessing students' research reports. They discussed any problems they encountered in relation to the list with the first author. All the experts emphasised the importance of well-defined research questions, an introduction that shows that the study is firmly embedded in the literature and a relevant and clear discussion. As a result of the experts' comments, the requirement of "clear and necessary tables and figures" was added to the list and "described relevance of research" was replaced by "embedded in the scientific literature". Additionally, items about "readability" and "use of language" were added to the global rating scale.

The resulting list consists of 19 items: 4 global items to be rated on a 10-point scale (from 1 = very poor performance to 10 = outstanding performance), and 15 specific items to be rated on a 5-point scale (from 1 = strongly disagree to 5 = strongly agree).

Sample of research reports

In total, 139 research reports were handed in by students between August 2003 and August 2004. The majority (71/139) of the reports originated from 3 of the 11 departments of the Faculty of Veterinary Medicine: Farm Animal Health; Companion Animal Medicine; and Veterinary Public Health. The reason for this occurrence is that most of the students do their research projects in those departments.

We divided the 71 reports into 3 groups according to the marks (10-point scale) given by departmental teachers- either 6 or 7 (n = 18), 8 (n = 33), or 9 or 10 (n = 20). Per department, two reports were randomly selected from each group, yielding a sample of 18 reports.

Raters

Three independent raters with a great deal of experience in judging students' research reports were asked to rate the 18 research reports using the new criteria list. All raters were staff of the Faculty of Veterinary Medicine, but did not hold a position in any of the departments from which the reports originated. Nevertheless, their knowledge of the research subjects was sufficient to make a well-considered judgement. The raters had not seen the reports before. The raters rated the reports on the 19 items. Before the rating procedure started, an introduction was given to the raters on how to use the criteria list. Emphasis lay on procedural aspects; for instance it was recommended that the raters start with the global items, and then apply the specific items. After the reports were rated, any inter-rater differences in scores were discussed in order to gain more insight into the list's practicability and interpretation of items.

For validity reasons the global ratings obtained with the list were compared with the ratings given by the students' teachers in order to investigate if and how they were correlated.

Data analysis

We calculated descriptive statistics in order to obtain an impression of the quality of the reports and their strengths and weaknesses. A mean item score from the three raters of < 3 was considered unsatisfactory. Box-plots were generated for the specific and global items to show median ratings and the distribution of the ratings per item.

Inter-rater reliability coefficients (R) were calculated per item according to the following equation:

$$R = \frac{\text{var(report)}}{\text{var(report)} + (\text{var(rater)} + \text{var(rater} * \text{report}))\,/\,\text{Nrater}}$$

where var(report), var(rater), var(rater*report) represent the variance components associated with the factors 'report', 'rater' and their interaction, respectively, and Nrater represents the number of raters participating in the assessment procedure. Analysis of variance was used to estimate the variance components (*var*) in the above expression. Note that reliability can be predicted for any hypothetical number of raters by varying *Nrater*.[16] The inter-rater reliability for each item is shown in Table 1.

We explored the relationship between the scores on the global items (16-19) and the teachers' marks by obtaining scatter plots and calculating the corresponding bi-variate correlations (Pearson's product-moment correlation). Statistical analysis was performed using SPSS 12.0.1 (SPSS Inc., 1989-2003).

RESULTS

One of the eighteen reports was judged by the three raters as being a literature review rather than a research report. This report was difficult to score using the rating scale and was, therefore, excluded from the study, leaving a sample of 17 research reports.

The strengths and weaknesses of the research reports

The specific items yielded ratings varying between 2.28 and 3.62, with standard deviations (SDs) between 0.44 and 1.17. The items 2, 6, 7, 10, 13, 15 yielded mean ratings of ≤ 3. The other items had mean ratings of > 3, with the following items having mean ratings of > 3.5: items 4, 5, 8, 9.

The global item ratings were 6.69 (SD = 1.16) for item 16, 6.92 (SD = 0.70) item 17, 6.75 (SD = 0.98) for item 18, and 7.06 (SD = 0.95) for item 19. The mean teachers' mark was 7.82 (SD = 1.29). For item descriptions, see Figure 1 and 2.

The box-plots (Figure 1) show that scores of < 3 were given to 25% - 50% of the reports on items 1, 10 and 12 and to $\geq 50\%$ of the reports on items 2, 6, 7, 13 and 15. The raters rated some reports ($< 25\%$) below 5.5 on the global items (16-19), whereas none of the teachers' marks were below 5.5.

Inter-rater reliability

With three raters the inter-rater reliability was higher than 0.70 for 11 of the 19 items. For 4 items it was between 0.60 and 0.70 and for items 4 ($R = 0.00$) and 5 ($R = 0.26$) it was extremely low, due to lack of between-report variance.

With two raters, reliability was higher than 0.70 for only 5 of the 19 items and with one rater, it was less than 0.70 for all items (Table 1).

Agreement between teachers' marks and global ratings

Significant linear relationships were found for the 4 global items (Figure 3), with correlations varying between 0.73 and 0.95. No significant linear correlation was found for the global ratings and teachers' marks.

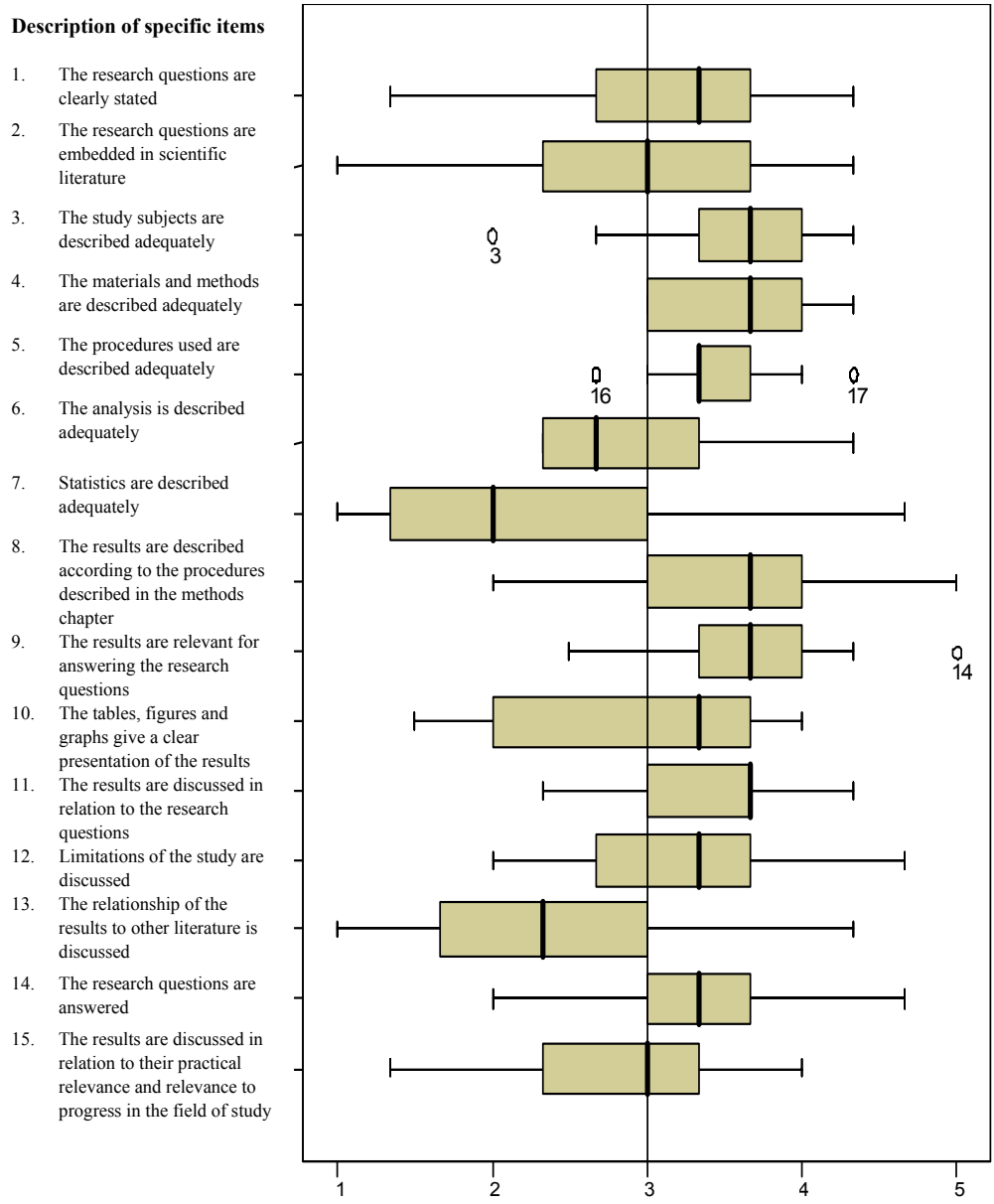

Figure 1 Number and description of specific items, and box-plot
Note: a bold line is the median, box ranges 25-75 percentiles, thin lines 0-25 percentiles and 75-100 percentiles, and dots are outliers.

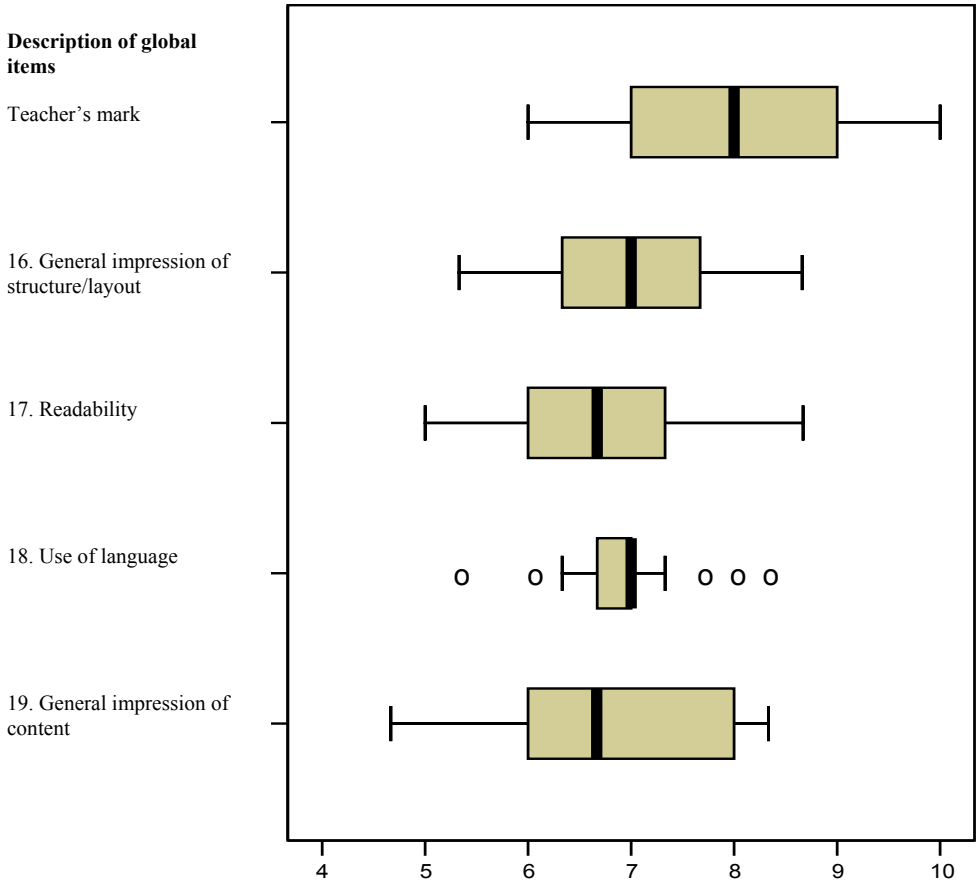

Figure 2 Number and description of global items, teacher's mark, and box-plot
Note: a bold line is the median, box ranges 25-75 percentiles, thin lines 0-25 percentiles and 75-100 percentiles, and dots are outliers.

Table 1 Interrater-reliability per item for varying number of raters.

Item	One rater	Two raters	Three raters
1	0.46	0.63	0.72
2	0.61	0.76	0.82
3	0.46	0.63	0.72
4	0.00	0.00	0.00
5	0.10	0.19	0.26
6	0.40	0.57	0.67
7	0.60	0.75	0.82
8	0.31	0.47	0.57
9	0.38	0.55	0.65
10	0.54	0.70	0.78
11	0.54	0.70	0.78
12	0.43	0.60	0.69
13	0.65	0.79	0.85
14	0.27	0.42	0.52
15	0.34	0.51	0.61
16	0.45	0.62	0.71
17	0.44	0.61	0.70
18	0.53	0.69	0.77
19	0.52	0.68	0.76

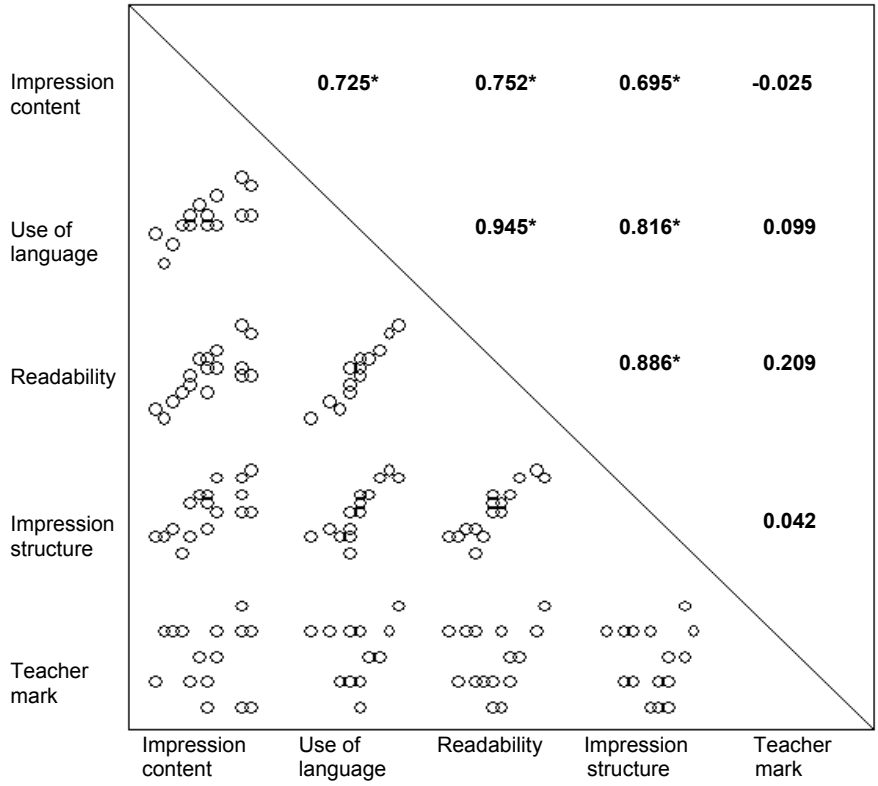

Figure 3 Scatter plot and correlations of the four global items with the teacher's mark.
Note: * Correlation is significant at the 0.01 level (2-tailed).

DISCUSSION AND CONCLUSIONS

The first aim of this study was to gain insight into the level of students' research competence by identifying strengths and weaknesses of their research reports with a newly developed assessment instrument. When considering the results, the small sample size of this study should be taken into account, as the findings will have to be confirmed with larger study samples.

The results demonstrate that weaknesses (defined as aspects of the students' reports that received a mean score ≤ 3 on a 5-point scale) were mainly related to research questions and their grounding in the literature, analysis and statistics, and

clarity of tables and graphs. The strengths of the reports (aspects that received a mean score > 3.5 on a 5-point scale) were related to description of materials and methods and organisation of the results.

Organisation and content of the veterinary curriculum may account for the weaknesses. The research internships last 3 months, which is rather short for students to conduct research and write a report. Another explanation may be that, although research competencies are addressed in the first year of the programme (in a 12 week course on "scientific skills"), internships are not until the fifth year, interposing a 4-year gap between research theory and practice. Research skills, such as formulating well-defined research questions and embedding research in the literature, are known to be especially difficult for students[17] and thus require practice and feedback, ideally throughout the curriculum. The low scores on graphs and tables are consistent with reports in the literature that clear visuals are difficult to produce.[13] Further research will have to determine the precise impact of these factors on the quality of students' research skills.

The reports' strengths are in line with findings from the literature that the materials and methods section is regarded as the easiest section to write and begin with, and the results section as the next easiest one.[13]

The second aim of the study was to develop a tool for the assessment of research reports. The items of the rating scale were based on key aspects of good research reports, as described in the literature.[9,13-15] Three independent raters judged 17 reports using the rating scale.

The results show that with three raters, inter-rater reliability is reasonable, with 11 out of 19 items showing reliability coefficients of > 0.70.[18] Reliability declined significantly when only one or two raters were involved. With more thorough rater training on how to use and interpret the criteria set, the overall reliability might have improved. The correlations between teachers' regular assessments, consisting of one global mark not based on clearly defined criteria, and the assessments by independent raters, using the new rating scale, are remarkably low. This suggests that the teachers may have assessed different aspects to those measured by the rating scale. The teachers' marks (mean score around 8 and no marks < 5.5) were substantially higher than the raters' scores on the global items (mean score ≤ 7 and several scores < 5.5). An explanation may be that the teachers do not assign marks solely on the basis of the quality of the reports, but also on the basis of their overall impression of students, including aspects like commitment, independence, and enthusiasm. This might introduce a halo effect, with a strong bias towards more lenient ratings. Another explanation for the high ratings may be that teachers judge the reports of their own students and somewhere in that process may begin to judge "their own work".[9]

In conclusion: the strengths and weaknesses of the reports give insight into students' competency levels with regard to research. The absence of correlations between the ordinary assessments by teachers and the assessment by independent raters using the rating scale suggests that we should ask ourselves if he competencies measured by the scale are sufficiently addressed in the current curriculum, and if the standards the scale is designed to measure are too ambitious for our students.

The assessment tool we developed is reliable with three raters. We tried to ensure face and content validity by carefully constructing the scale on the basis of the literature and experts' views and comments. In the opinion of the three raters, the rating scale was useful and practical (scoring one report took only 30 minutes) for assessing research reports. Further studies with larger samples should investigate the applicability of the scale to educational practice.

The results of this study give rise to some recommendations for educational practice. It might be worthwhile to discuss the strengths and weaknesses of the research reports with teachers of the internships and curriculum designers, in order to examine the need for and possibilities of reconsidering curriculum programming and content. It seems advisable to reduce the time lag between the teaching of research competencies and the research internship in the veterinary curriculum. This could be achieved by the introduction of a longitudinal research strand.

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Chapter 6

Undergraduate research internships: Veterinary students' experiences and the relation with internship quality

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ABSTRACT

The learning environment of undergraduate research internships has received little attention, compared to postgraduate research training. This study investigates students' experiences with research internships, particularly the quality of supervision, development of research skills, the intellectual and social climate, infrastructure support, and the clarity of goals and the relationship between the experiences and the quality of students' research reports and their overall satisfaction with internships.

A questionnaire (23 items, 5-point Likert scale) was administered to 101 Year 5 veterinary students after completion of a research internship. Multiple linear regression analyses were conducted with quality of supervision, development of research skills, climate, infrastructure and clarity of goals as independent variables and the quality of students' research reports and students' overall satisfaction as dependent variables.

The response rate was 81.2%. Students' experiences are generally positive. Students' experiences with the intellectual and social climate are significantly correlated with the quality of research reports whilst the quality of supervision is significantly correlated with both the quality of research reports and students' overall satisfaction with the internship.

In conclusion: both the quality of supervision and the climate are found to be crucial factors in students' research learning and satisfaction with the internship.

INTRODUCTION

The current decline in the number of new physician-scientists[1,2] underlines the urgent need to encourage students to pursue an academic career. A study found evidence that a research elective can enhance medical students' interest in a career in research and improve their self-perceived skills in critical appraisal, information literacy and critical thinking.[3] Hoping to reap the potential benefits of undergraduate research experiences, many universities offer research internships enabling students to actively participate in research.[3,4] Actively engaging in research activities has been shown to be more beneficial to student learning than listening to lectures on research.[4-6] During research internships, students typically engage in activities and acquire knowledge related to library and critical appraisal skills, (principles and methods of) empirical research, statistics, and reporting of research results.

There is a sharp contrast between the learning environment of the regular undergraduate curriculum and that of a research internship. Learning in undergraduate programmes is well structured and all students are exposed to the same curriculum, study materials and assessments. Research internships, by contrast, differ in subject, site and supervisors and require the use of new skills for practical (lab) work, dealing with new situations and uncertainties, developing one's own ideas and engaging in planning and time management.[6] As with all educational activities, undergraduate research experiences should be evaluated to ascertain whether they are effective and if and where improvement is needed. Good evaluation instruments are indispensable and should be based on a comprehensive picture of all aspects that determine the quality of the learning environment. Unfortunately, there are no evaluation instruments readily available which are designed for undergraduate research experiences since, so far, most studies have focused on postgraduate education.[5,7-10]

One of these studies resulted in a conceptual framework consisting of factors influencing the *postgraduate* research experience and its success or lack of it: 'student characteristics' (gender, prior research experience, intellectual capacities), 'environment' (research culture, research education, supervisors' assessment strategies, student/supervisor relationship), 'processes' (students' discipline, motivation and expectations), 'supervisor/mentor characteristics' (supervisors' expectations/experiences) and 'outcomes' (such as the quality of theses, completion time).[7] A similar approach was used, based on the Postgraduate Research Experience Questionnaire (PREQ), in evaluating PhD students' experiences regarding supervision, clarity of goals, social and intellectual climate, infrastructure support as well as outcomes comprising generic skill development and overall satisfaction.[8] The latter outcome proved to be associated not only with

the quality of supervision but also with other factors of the learning environment, such as intellectual climate, infrastructure and the frequency of student-supervisor contacts.[8] We used these two frameworks in exploring experiences and learning outcomes in undergraduate research internships, despite being aware of the potentially substantive differences between postgraduate and undergraduate research experiences in setting, duration, assessment and end products. However, we did not think that the factors determining the quality of undergraduate and postgraduate research experiences would be essentially different although some discrepancies in their importance and effects might emerge.

The setting of our study of *undergraduate* research experiences was the Faculty of Veterinary Medicine (FVMU), Utrecht University, the Netherlands, where students attend a 6-year undergraduate programme including a compulsory three-month research internship in Year 5. FVMU is the only veterinary faculty in the Netherlands. Students can apply for a research internship in one of the departments of FVMU, at a university in another country or at a (veterinary) research institute in or outside the Netherlands. They are also free to choose their area of research in basic, clinical or social/behavioural sciences. Most students are assigned two supervisors who coach and assess their work. The actual research work consists of conducting an empirical study culminating in an oral presentation and a written report structured like a paper for a scientific journal with sections on introduction/background, methods, results and discussion and conclusions. At the start of the internship, student and supervisors sign a research contract containing the student's research proposal, a brief description of the work planned, the student's motivation for undertaking this particular research, how the objectives are to be achieved, what kind of facilities are needed and a time schedule.

In order to evaluate the research experiences of undergraduate students we addressed the following research questions:

1) How do undergraduate students experience a research internship, more specifically the quality of supervision, research skill development, social and intellectual climate, infrastructure support, and clarity of goals?
2) How do these factors relate to the quality of students' research reports and their overall satisfaction with the internship?

METHODS

Participants and procedures

We collected data from veterinary students in Year 5 between October 2006 and June 2007. All of the 101 students completing their research internship in that period were invited to participate in the study. The aims of the study were

explained to them in a letter, which also stated that participation was voluntary and data would be treated confidentially and were impossible to link to individual students. Those who consented to participate were asked to fill out a questionnaire about the internship after completing their research internships and receiving their internship marks. The questionnaires were distributed by e-mail and as a paper hand-out. Non-responders received one email reminder at which time the questionnaire was also sent to them by post. Ethics committees at Dutch universities are not required to give approval to studies of the type reported in this paper.

Measurement of students' research internship experiences

The Australian Council for Educational Research (ACER) and the Graduate Careers Council of Australia (GCCA) designed the Postgraduate Research Experience Questionnaire (PREQ) to evaluate the quality of postgraduate research and research masters in a variety of disciplines including veterinary science.[9] Marsh and co-workers found solid psychometric properties for the PREQ at the individual student level, with factor analysis revealing six underlying dimensions (28 items) of the quality of students' experiences: 1 quality of the supervisor, 2 research skill development, 3 intellectual and social climate, 4 infrastructure and organisation, 5 clarity of goals and expectations and 6 the way thesis examination was performed.[10] One overall satisfaction item was included in the PREQ.[9]

We assessed the applicability of the PREQ to the FVMU undergraduate veterinary research internship in a pilot among six veterinary students who had recently finished their research internship. Discussion of the problems these students encountered in completing the questionnaire, resulted in removal of 2 items: "A good seminar programme for postgraduate students was provided" and "There was appropriate financial support provided for research activities". Additionally, the word "postgraduate" was consistently replaced by "undergraduate" and "thesis" was replaced by "research report". To assess whether the 6-factor PREQ model fitted our data, we conducted confirmatory factor analysis using the Multiple Group Method (MGM).[11,12] MGM reports on the percentage of observed variance that is explained by the tested item grouping and on the item-rest correlations after correction for test length and self-correlation. Based on the correlations of items with the sum scores of the clusters of items, it is possible to analyse whether items are in 'the right cluster', i.e. show high correlations with the pre-assigned cluster and low correlations with other clusters. Appendix 1a shows the item-rest correlations (after correcting for test length and self correlation) for individual items in their pre-assigned clusters. Of the total of 26 items, 20 showed the highest correlations within their pre-assigned cluster indicating a good fit. The five remaining items ('my research sharpened my

analytical skills', 'I was able to organise good access to necessary equipment', 'the examination process was fair', 'I was satisfied with the examination process', 'the examination of my internship was completed in a reasonable time') did not fit into the pre-assigned clusters. Based on the item-rest correlations and on analysis of item content in relation to the educational context under study, two items on 'the way thesis examination was performed' were moved to 'quality of the supervisor'. This appears to be a logical step since the students in our study were assessed by their own supervisor(s). The three remaining items ('my research sharpened my analytical skills'; 'I was able to organise good access to necessary equipment', and 'the examination of my internship was completed in a reasonable time') were removed from the questionnaire. Confirmatory factor analysis using MGM showed that the new 5-factor model fitted the data (Appendix 1b).

After these adjustments our validated questionnaire consisted of 23 statements (including one overall satisfaction item) inviting a response on a 5-point Likert scale (1 = 'completely disagree', 2 = 'disagree', 3 = 'neither agree nor disagree', 4 = 'agree', 5 = 'completely agree'). The items represented five underlying clusters: supervisor, skill development, climate, infrastructure, and clarity. In addition, the two open answer questions from the PREQ on best aspects and what needs improvement were also included. The internal consistency of the factors varied between 0.66 and 0.84 indicating that the instrument was both valid and fairly to highly reliable. Table 1 shows the five factors and the corresponding items.

Outcome measurement of the quality of students' research internships

Two outcome measures were used to evaluate the quality of the undergraduate research internship: the overall quality of research reports and students' general satisfaction with the quality of the internship. When examining the quality of students' research reports in an earlier study, we found that it was best reflected in assessors' ratings of 'general impression of content' on a scale from 1: very poor performance to 10: outstanding performance.[13] In the present study, two assessors used the same scale to assess the quality of research reports. The mean of their ratings was used as the first outcome measure. Inter-rater reliability was 0.77. The second outcome measure, students´ overall satisfaction with the internship, was measured by item 23 of our developed questionnaire. (5-point Likert scale: 1 = 'completely disagree', 2 = 'disagree', 3 = 'neither disagree/or agree', 4 = 'agree', 5 = 'completely agree').

Analyses

Descriptive statistics (mean and SD) were computed for the five factors of the questionnaire. We used hierarchical multiple linear regression analysis to explore the relationships between the 5 factors (as independent variables) and the two

outcome measures (as dependent variables). Some student characteristics which we regarded as possible external variables were controlled for by entering them into step 1 of the regression model. These variables were gender and grade point average (average test score during the first four years of veterinary training). The factors quality of supervision, intellectual and social climate, and infrastructure support were entered into step 2 in order of their predictive value based on results from research in postgraduate training.[8] All the independent variables were entered into step 3. In order to account for correlations between the independent variables, we present both zero order (representing simple Pearson correlation coefficients) and part (representing the unique relationship of each predictor with the outcome variables) correlations.[14] The assumptions of the multiple regression model were checked (multicollinearity, Durbin-Watson, linearity and normal distribution of the residuals)[14] and found to have been met. SPSS ® 12.0.1 was used for the statistical analyses.

RESULTS

Participants' characteristics

We received 80 questionnaires aimed at seeking information on the research internship experience (response rate 81.2 %). Four reports were judged as being literature reviews rather than research reports. These reports were difficult to score using the rating scale and were, therefore, excluded from the study. Two other questionnaires were also excluded because the students stated in the open comment area of the questionnaire that their supervisors had actually not assessed their research reports, but had just handed in the examination form, leaving the sample at 74 questionnaires and corresponding reports.

Of the participants, 60 (81.1 %) are female and 14 (18.9 %) are male, a distribution reflecting that in the FVMU student population. The internship settings are distributed as follows: 54 (72.9 %) at FVMU, 18 (24.3%) at a research institute or university in another country and 2 (2.7%) at a research institute in the Netherlands.

Research internship experience

The factor scores vary between 3.57 (SD 0.86) for 'infrastructure' and 3.94 (SD 0.58) for 'clarity'. The lowest and highest item scores are those for "I received good guidance in my literature search" (3.34, SD 1.00) and "My supervisor(s) provided helpful feedback on my progress" (4.14, SD 0.71), respectively. Both belonged to the 'supervisor' factor (Table 1).

Table 1 Scores (5-point scale) on factors and corresponding items related to the undergraduate research experience (means and standard deviations (SD) and alpha coefficients per factor).

Item	Factor	Mean	SD	Alpha
	1. Supervisor items	**3.87**	**0.65**	**0.84**
1	Supervision was available when I needed it	3.66	1.14	
2	My supervisor(s) made a real effort to understand difficulties I faced	4.03	0.83	
3	My supervisor(s) provided additional information relevant to my topic	3.89	0.99	
4	I was given good guidance in topic selection and refinement	3.78	0.89	
5	My supervisor(s) provided helpful feedback on my progress	4.14	0.71	
6	I received good guidance in my literature search	3.34	1.00	
7	The examination process was fair	4.10	0.73	
8	I was satisfied with the examination process	4.04	0.89	
	2. Skill Development items	**3.88**	**0.51**	**0.68**
9	My research further developed my problem solving skills	3.95	0.79	
10	I learned to develop my ideas and present them in my written work	4.07	0.65	
11	Doing my own research helped me to developed my ability to plan my own work	3.74	0.71	
12	As a result of my research I feel confident about tackling unfamiliar problems	3.75	0.72	

Item	Factor	Mean	SD	Alpha
	3. Climate items	**3.64**	**0.91**	**0.85**
13	The department provided opportunities for social interaction with other undergraduate students	3.59	1.19	
14	I was integrated into the department's community	3.93	1.02	
15	The department provided opportunities for me to be involved in the broader research culture	3.67	1.04	
16	I used the research ambience in the department or faculty to stimulate my own work	3.45	0.96	
	4. Infrastructure items	**3.57**	**0.86**	**0.75**
17	I had access to a suitable working space	3.55	1.18	
18	I had good access to the technical support I needed	3.77	0.93	
19	I was given good access to computing facilities and services	3.38	1.04	
	5. Clarity items	**3.94**	**0.58**	**0.66**
20	I developed an understanding of the standard of work expected	3.93	0.67	
21	I understood the required level for the research report	3.97	0.78	
22	I understood the requirements of examination	3.92	0.90	
23	**Overall satisfaction item**	**4.20**	**0.67**	

Note: The percentage of observed variance is 61.58% for the 5-factor model

In total, 74 different students made 134 responses on the two open-ended questions.
The top four of responses on "What were the best aspects of the research internship?" were:

1. Learning: to conduct research, write a report, deepen knowledge specific subject (28)
2. Ability to work independently/sense of ownership (18)
3. Supervision: enthusiastic, good relationship, great research group ambience (17)
4. Practical skills: clinical work, laboratory work, client contact (17)

On the question "What aspects of the research internship were most in need of improvement?" the top four responses were:

1. Supervision: more time, delays in feedback, more structured and frequent meetings (18)
2. Infrastructure: better computer facilities and working place (12)
3. Organisation in advance of the internship: offer of subjects, clarity of expectations (10)
4. Planning: duration of internship too short, too much practical work (9)

Relationship between undergraduate research experience and outcomes
'General impression of content' is rated as 7.03 (SD 1.06) on a 10-point scale. Students' overall satisfaction with the internship is rated as 4.20 (SD 0.67) on a 5-point Likert scale.

The hierarchical multiple linear regression analyses show regression coefficients and correlations between the five factors and the two outcome measures (Table 2).

The model in step 2 showed the best fit to the data: there is a significant relationship between 'overall quality of the research report' on the one hand and on the other hand 'quality of supervision' (beta 0.303) and 'intellectual and social climate' (beta 0.258). This model explains twenty-six per cent of the variance. 'Quality of supervision' (beta 0.547) is also significantly related to 'students' overall satisfaction with the research internship'. Forty-two per cent of the variance is explained by this model.

Table 2 Regression analyses for the two dependent variables (quality of research reports and overall satisfaction with research internship) and the five independent variables (supervisor, skill development, climate, infrastructure, clarity of goals) and the possible external variables i.e. grade point averages (GPA) and gender. Unstandardised coefficients (B), standardised coefficients (β), standard errors and zero-order and part correlations are presented.

Quality of research report						**Overall satisfaction**					
	B	**SE B**	**β**	**Zero-order correlations**	**Part correlations**		**B**	**SE B**	**β**	**Zero-order correlations**	**Part correlations**
Step 1						*Step 1*					
Constant	2.620	2.282				Constant	3.008	1.506			
GPA Years 1-4	.689	.321	.253	.265	.252	GPA Years 1-4	.166	.212	.096	.095	.095
Gender	-.213	.309	-.081	-.118	-.083	Gender	.009	.204	.005	-.009	.005
Step 2						*Step 2*					
Constant	1.151	2.134				Constant	1.915	1.272			
GPA Years 1-4	.572	.301	.210	.265	.229	GPA Years 1-4	.007	.180	.004	.095	.005
Gender	-.301	.290	-.115	-.118	-.128	Gender	-.128	.173	-.077	-.009	-.092
Supervisor	.491	.227	**.303***	.377	.258	Supervisor	.563	.136	**.547****	.567	.458
Climate	.295	.146	**.258***	.360	.244	Climate	.113	.087	.155	.398	.159
Infrastructure	-.167	.159	-.137	.139	-.130	Infrastructure	-.068	.095	-.088	.263	-.089
Step 3						*Step 3*					
Constant	1.484	2.243				Constant	1.070	1.271			
GPA Years 1-4	.585	.309	.214	.265	.232	GPA Years 1-4	-.017	.175	-.010	.095	-.013
Gender	-.303	.295	-.115	-.118	-.128	Gender	-.120	.167	-.072	-.009	-.090
Supervisor	.530	.248	**.328***	.377	.260	Supervisor	.459	.141	**.445****	.567	.380
Climate	.316	.158	**.276***	.360	.243	Climate	.070	.090	.097	.398	.098
Infrastructure	-.148	.173	-.121	.139	-.107	Infrastructure	-.123	.098	-.157	.263	-.155
Skill development	-.120	.274	-.059	.160	-.055	Skill development	.264	.155	.204	.449	.209
Clarity	-.062	.270	-.035	.142	-.029	Clarity	.187	.153	.165	.450	.152

$R^2 = 0.08$ for Step 1; $\Delta R^2 = 0.18$ for Step 2; $\Delta R^2 = 0.01$ for Step 3. * $p < 0.05$, ** $p < 0.001$ $R^2 = 0.09$ for Step 1; $\Delta R^2 = 0.34$ for Step 2; $\Delta R^2 = 0.07$ for Step 3.

CONCLUSIONS AND DISCUSSION

Our questionnaire study provides insight into how students experience undergraduate research internships and whether and how these experiences are related to the outcomes of the internship in terms of the quality of research reports and students' overall satisfaction. The relatively high factor scores suggest that students' experiences are generally positive. The relatively low scores on 'guidance in literature searches' and the 'department's research ambience' confirm Ainley's finding of low agreement among respondents on these PREQ items.[9] The quality of supervision was mentioned as one of the best aspect of the internship as well as the issue most in need of improvement, which coincides with the findings of the correlations between the quality of students' experiences and the two outcome measures (quality of research reports and overall satisfaction with the internship) suggesting that the success of research internships hinges on the quality of supervision. This key factor appears to be associated both with the quality of research reports and with overall satisfaction, whereas intellectual and social climate of the internship setting is only associated with the quality of research reports but not with overall satisfaction. This is in line with the relationship reported by Ginns and colleagues between PhD students' satisfaction with the quality of supervision and the quality of the prevailing intellectual and social climate in the department.[8] However, our study did not replicate their finding that infrastructure support is a significant predictor of successful outcome of research experiences.[8]

Given the strong resemblance between learning during research internships and apprenticeship learning,[6] it seems only to be expected that the perceived quality of the supervisor and the department's working climate play a prominent role in both undergraduate and postgraduate research experiences. There are also differences, however. A PhD project usually takes 3 years or more to complete, whereas most undergraduate research experiences do not extend beyond 3 months. This may explain why infrastructure support appears to feature less prominently in undergraduate experiences compared to postgraduate ones.

Our finding that supervision is key to the quality of undergraduate research internships implies that supervisors should be keenly aware of the impact of their role as well as that of the department's working climate. This is particularly relevant since students with more positive research experiences may be more inclined to pursue a career in research later on.[1-3,5] The quality of supervision may be enhanced by offering training to supervisors to improve their guidance skills. Another recommendation aimed at enhancing the quality of research internships, based on the impact of social climate, is for departments to facilitate interactions

between students and to have groups of students simultaneously undertake internships within one department.

The robustness of our findings is supported by the use of outcome measures based not only on students' subjective experiences but also on two independent ratings of their research reports using a valid and reliable rating scale. Most other studies have relied exclusively on students' self-reports as outcome measures.[8] This brings us to the first limitation of this study, the fact that the internship experiences were investigated solely through students' self reports. A second limitation is that the questionnaire has been validated in a veterinary curriculum and not in a medical curriculum. Although these curricula have many commonalities, it is important that validation should be repeated in other settings. A third limitation is that it was not possible to rule out that the results are influenced by dependency among cases due to students sharing the same supervisor.

It is strength of this study that it has yielded a validated questionnaire for evaluating the quality of undergraduate research experiences, whereas so far there was only a validated questionnaire for postgraduate research experiences.

Finally, we want to discuss suggestions for further study of this topic. The 26%–42% explained variance of the two models suggests that there may be other variables affecting undergraduate research learning. For example, students' motivation for undertaking a research internship.[7] Further studies should examine in greater detail the factors affecting research experiences established in this study as well as try to identify other explanatory variables. Another research angle could be to investigate factors influencing the intellectual and social climate of internship settings, for instance by interviewing undergraduates and supervisors. It would also be of interest to further investigate differences between supervisors. This study leaves a gap in our understanding of learning during research internships because it did not measure students' performance *during* internship. Learning outcomes of students' activities, such as technical or laboratory skills, developing their own ideas, work planning and scientific presentation skills, could be explored to complete the picture of learning from research experiences during undergraduate training presented in this study.

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Appendix 1a Confirmatory factor analysis using Multiple Group Method. Item-rest correlations after correction for test-length and self-correlation are shown for the (original) 6-factor model. The highest correlation coefficients are indicated in bold. In grey are marked the correlation coefficients not highest in the pre-assigned factor.

Item	Factor	SUP	SKL	CLM	INF	CLR	EXA
	1. Supervisor (SUP) items						
1	Supervision was available when I needed it.	**.462**	.227	.294	.255	.327	.215
2	My supervisor(s) made a real effort to understand difficulties I faced.	**.505**	.243	.408	.351	.276	.352
3	My supervisor(s) provided additional information relevant to my topic.	**.434**	.136	.262	.253	.205	.125
4	I was given good guidance in topic selection and refinement.	**.513**	.244	.414	.274	.346	.304
5	My supervisor(s) provided helpful feedback on my progress.	**.410**	.119	.214	.316	.331	.384
6	I received good guidance in my literature search.	**.540**	.212	.353	.329	.282	.316
	2. Skill Development (SKL) items						
7	My research further developed my problem solving skills.	.299	**.465**	.311	.220	.107	.337
8	I learned to develop my ideas and present them in my written work.	.187	**.359**	.341	.163	.130	.163
9	Doing my own research helped me to developed my ability to plan my own work.	.032	**.309**	-.025	.042	-.116	.290
10	As a result of my research I feel confident about tackling unfamiliar problems.	.166	**.299**	.230	.264	.095	.231
11	My research sharpened my analytical skills.	.300	**.308**	**.345**	.192	.233	.263
	3. Climate (CLM) items						
12	The department provided opportunities for social interaction with other undergraduate students.	.236	.193	**.474**	.246	.019	.155
13	I was integrated into the department's community.	.299	.233	**.599**	.386	.219	.137
14	The department provided opportunities for me to be involved in the broader research culture.	.411	.288	**.654**	.367	.222	.219
15	I used the research ambience in the department or faculty to stimulate my own work.	.351	.308	**.544**	.414	.228	.294

Item	Factor	SUP	SKL	CLM	INF	CLR	EXA
	4. Infrastructure (INF) items						
	I had access to a suitable working space.	.341	.090	.327	**.526**	.291	.428
17	I had good access to the technical support I needed.	.386	.089	.344	**.456**	.218	.258
18	I was given good access to computing facilities and services.	.164	.205	.293	**.477**	.167	.340
19	I was able to organise good access to necessary equipment	.294	.321	**.448**	**.381**	.162	.360
	5. Clarity (CLR) items						
20	I developed an understanding of the standard work expected.	.282	.184	.216	.320	**.353**	.044
21	I understood the required level for the research report.	.176	.318	.168	.355	**.425**	.203
22	I understood the requirements of examination.	.400	.270	.220	.365	**.499**	.316
	6. Examination (EXA) items						
23	The examination process was fair.	**.296**	.102	.189	.218	.291	**.248**
24	I was satisfied with the examination process.	**.316**	.081	.217	.180	.311	**.232**
25	The examination of my internship was completed in a reasonable time.	**.276**	.087	.110	.232	.001	**.083**
26	**Overall satisfaction item** – not included in factor analysis						

Appendix 1b Confirmatory factor analysis using Multiple Group Method. Item-rest correlations, after corrections for test-length and self-correlation are shown for the 5-factor model

Item	Factor	SUP	SKL	CLM	INF	CLR
	1. Supervisor (SUP) items					
1	Supervision was available when I needed it	**.415**	.203	.297	.257	.219
2	My supervisor(s) made a real effort to understand difficulties I faced	**.472**	.236	.425	.341	.364
3	My supervisor(s) provided additional information relevant to my topic	**.349**	.117	.259	.203	.125
4	I was given good guidance in topic selection and refinement	**.485**	.240	.415	.304	.307
5	My supervisor(s) provided helpful feedback on my progress	**.483**	.221	.380	.341	.335
6	I received good guidance in my literature search	**.414**	.123	.237	.358	.389
7	The examination process was fair	**.350**	.090	.214	.259	.264
8	I was satisfied with the examination process	**.370**	.069	.238	.190	.246
	2. Skill Development (SKL) items					
9	My research further developed my problem solving skills	.261	**.487**	.334	.170	.351
10	I learned to develop my ideas and present them in my written work	.195	**.381**	.361	.080	.181
11	Doing my own research helped me to developed my ability to plan my own work	.015	**.324**	.016	.017	.304
12	As a result of my research I feel confident about tackling unfamiliar problems	.178	**.329**	.317	.260	.256
	3. Climate (CLM) items					
13	The department provided opportunities for social interaction with other undergraduate students	.196	.214	**.489**	.198	.173
14	I was integrated into the department's community	.294	.240	**.610**	.373	.153
15	The department provided opportunities for me to be involved in the broader research culture	.385	.289	**.665**	.311	.237
16	I used the research ambience in the department or faculty to stimulate my own work	.358	.306	**.559**	.425	.312

Item	Factor	SUP	SKL	CLM	INF	CLR
	4. Infrastructure (INF) items					
17	I had access to a suitable working space	.334	.100	.334	**.559**	.432
18	I had good access to the technical support I needed	.332	.071	.343	**.511**	.259
19	I was given good access to computing facilities and services	.178	.223	.303	**.521**	.347
	5. Clarity (CLR) items					
20	I developed an understanding of the standard work expected	.221	.159	.218	.340	**.354**
21	I understood the required level for the research report	.225	.360	.195	.334	**.432**
22	I understood the requirements of examination	.406	.304	.244	.364	**.506**
23	**Overall satisfaction item** – not included in factor analysis					

Chapter 7

Preparation for practice by veterinary school: A comparison of the perceptions of alumni from a traditional and an innovative veterinary curriculum

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ABSTRACT

Alumni survey research can tap users' perspectives on an educational product and thereby provide valuable information for outcomes assessment aimed at improving the quality of educational programs.

We compared the perceptions of two groups of alumni from two curricula offered by the same veterinary school. The traditional lecture-based curriculum of this school had been gradually replaced by a reformed, more student-centered curriculum. Year 1 of the new curriculum started in 1995, while the old curriculum continued to be delivered to the entering classes of 1994. The aim of our study was to determine whether the new program received more positive evaluations from the alumni and was perceived as offering better preparation for veterinary practice.

A questionnaire was sent to all alumni who had graduated in the period 2001-2003. Compared to the alumni of the traditional program, the alumni of the innovative curriculum reported higher perceived competence levels for clinical knowledge and skills (specific competencies) and for communication skills and academic skills (generic competencies). Alumni of both programs attributed difficulties in the transition from university to work to lack of experience with practical/technical skills and with primary care cases. They suggested that more attention should be paid to these aspects and to practice/business management and communication with clients.

The concrete changes in the curriculum appear to have had a noticeable, positive effect without the feared detrimental effect on knowledge acquisition. The results point to further program improvements, particularly for practice-oriented specific and generic skills.

INTRODUCTION

Studies of alumni's retrospective views on their training provide valuable information about the quality of education from the users' perspectives. These studies can yield vital information for educational outcomes assessment.[1] From the perspectives of institutions, accreditation bodies, constituents and various stakeholders, alumni research can help to gain insight into employment status, transition between university and work and how well alumni feel prepared for practice. Alumni are able to evaluate what they have learned in light of the demands they encounter in the workplace. As a result they are uniquely able to offer feedback to institutions about achievement of educational objectives, the competencies acquired by students, the design and organization of the curriculum, and gaps in the curriculum that alumni discover in professional practice.[1-3]

Most studies address the relevance and purpose of outcomes assessment within the setting of individual institutions. The results can be used by the institutions to judge the attainment of goals and missions, identify opportunities for change, promote continued improvement of curriculum design, and enhance the competence of their alumni.[3,4] A comparative angle has been taken by only a few authors. Comparative outcomes assessment, and alumni research in particular, has been used to compare the outcomes of different educational programs.[5-7] Schmidt and Van der Molen compared the views of alumni from a problem-based (PBL) medical curriculum and a traditional, lecture-based medical curriculum. The PBL alumni gave more positive evaluations of their preparation in terms of generic competencies, such as collaborative skills, problem-solving skills, skills to manage meetings and the ability to work independently. The results of this study demonstrated that, according to the alumni, a curriculum that emphasizes active and self-directed learning promotes attainment of 'generic competencies'.[6] Other studies within medical education settings have also demonstrated that alumni from innovative curricula consider themselves better prepared for practice in terms of 'generic competencies'. At the same time these alumni do not report feeling less prepared for 'specific competencies', such as discipline-specific knowledge and skills.[7-9] That an emphasis on generic competencies can have additional value was also demonstrated by Semeijn, who found that students' specific competencies were a better predictor of successful entry into the labor market, whereas generic competencies were a better predictor of success later on in their careers.[10]

Several veterinary schools have changed their curricula in response to the 1988 report of the Pew National Veterinary Education Program, *Future Directions for Veterinary Medicine* and the 1990 EAEVE (European Association of Establishments for Veterinary Education) report.[11,12] The EAEVE report recommended that veterinary education become problem oriented, with more

emphasis on students' ability to find and use information and less on memorization of facts. Moreover, assessment should require students to demonstrate problem-solving skills rather than recall of facts. It was also recommended that the goal of full coverage of subject matter be abandoned and that students should be given more opportunities to pursue personal (species-related) interests. The latter implied giving up the unrealistic concept of the universal veterinarian, who can minister to the health needs of all animals. Furthermore, veterinary schools should ensure that their graduates enter veterinary practice equipped with the appropriate skills to meet societal and professional demands.[11,12] A set of professional skills, comprising interpersonal skills, communication skills and teamwork skills, is fast becoming indispensable to satisfy potential employers as well as an increasingly sophisticated clientele.[13] In brief, the reports advocate more attention for generic competencies, such as communication, problem solving, and academic skills.

The importance of clinical, diagnostic and surgical skills and the paucity of practical instruction and experience (in surgery and in primary care cases) featured prominently in two studies reporting veterinary graduates' perceptions of their training.[2,14] Interestingly, the alumni in both studies expressed a need for generic skills, such as those for client communication and practice (business) management.[2,14] The importance of communication skills for success in veterinary and medical practice has been highlighted in other studies too.[7,15-17] Lofstedt observed, based on conversations with veterinary colleagues and on a CVMA member survey, that recent veterinary graduates were lacking in confidence or competence or both. By way of a solution she suggested that veterinary medical education might be organized along the lines of different species and that in-depth elective courses might be added and externships extended. She also drew attention to the mismatch between academic veterinary medicine and veterinary practice as a possible contributor to graduates' lack of confidence/competence. The academic focus tends to favor specific competencies in secondary and tertiary care, whereas private practice requires generic competencies related to team and business skills and specific competencies for primary care cases.[18]

The undergraduate curriculum of the Faculty of Veterinary Medicine of Utrecht University, Netherlands was reformed to comply with the recommendations of the PEW and the EAEVE reports[11,12], by shifting from a teacher-centered curriculum towards a more student-centered curriculum. In a teacher-centered curriculum there is much emphasis on direct transmission of information from the teacher to the student, whereas in a student-centered curriculum, students play a more active role in their own learning. This opened a window of opportunity to explore and compare the opinions of graduates from the old and the new curriculum about the relevance of their training for professional practice. We collected the opinions of recent graduates about their preparation for

(clinical) practice and the match between the competencies they had, or had not, attained in veterinary school and the requirements of clinical practice. We hoped to gain insights that could help improve the new program.
The objectives of this comparative study were to obtain and compare alumni's perceptions of:

1. their careers after veterinary school;
2. the attainment of specific and generic competencies during their training;
3. the curriculum, specifically species-related tracking, the assessment program, and the transition from university to work;
4. the overall quality of the curriculum;
5. any topics they felt should have been included in the curriculum or any changes they thought desirable.

METHODS

Context

This study was conducted at the Faculty of Veterinary Medicine (Utrecht University, Netherlands). Most Dutch students enter veterinary training after graduating from secondary school (with a compulsory national end exam) around the age of 18. From the start of veterinary training in 1821 until the curriculum change in 1995, the school offered a traditional discipline-based and lecture-based curriculum, which was only subject to some relatively minor changes in 1982. The aim of the curriculum reform of 1995 was to bring about a shift from teacher-centered towards student-centered education. The change was primarily intended to foster active learning by students. The time devoted to traditional lectures was reduced by 50% and was replaced with new methods, such as active small-group learning, self-directed learning and integrated courses. The new educational goals focused on problem-solving skills, communication skills, academic skills, and the possibility for students to select a specific species-related track. These goals were pursued by integrating them in the instructional design (team work, giving presentations) and by designing and implementing new curricular components.[19]
The following innovations were introduced:

- a Year 1 module: Introduction to Scientific Training, addressing general principles and methodology of scientific research, statistics, and literature search skills;
- a compulsory 3-month research internship in Year 5;
- problem-oriented clinical sessions aimed at integrating basic science, clinical science, and clinical reasoning;
- integration of communication skills training in existing courses in Years 1-6;

- extending clinical rotations from 54 to 72 weeks and species tracking (students select a species-related track) from 24 to 42 weeks.

Subjects

All alumni graduating between 2001-2003 were asked to complete a questionnaire twenty-four months after their graduation. This group had completed either the slightly revised but still traditional curriculum introduced in 1982 (C'82) or the extensively revised innovative curriculum introduced in 1995 (C'95). The implementation of C'95 started with Year 1 in 1995 and was completed with the start of the new Year 6 in 2000. Students entering in 1995 could only enroll in the new curriculum, but between 1995 and 2003 the old curriculum continued to be delivered to the cohorts who had entered in 1994 and earlier. As a consequence, in 2001–2003, students were graduating from both curricula. Both curricula had six-year programs, which most students entered immediately after high school. However, it was and still is customary for many students to take longer than six years to graduation.

Survey instrument

In order to obtain the alumni's views on their training, we designed and administered a questionnaire with 29 Likert scale items (three-point or five-point scale) and open-ended questions. Thirteen items asked about specific competencies relating to clinical knowledge and skills (12 items) and practical/technical skills (1 item) and sixteen items pertained to generic competencies relating to communication (12 items), practice management (1 item) and academic skills (3 items) (Table 1). Items that were specifically designed to evaluate the curriculum asked about species tracking (3 items), focus of assessment (3 items), the transition from university to the workplace (1 item), and the increase in independence (students' active role in learning, more responsibility for making decisions about case management) during veterinary training (1 item). One question asked the alumni to rate their overall satisfaction with their training on a scale from 1 (extremely dissatisfied) to 10 (extremely satisfied) and one question asked the same about their careers. Three open-ended questions addressed the transition from university to work, the attainment of practical skills, and any topics the alumni felt had been underrepresented in the curriculum.

The survey was mailed to the total of 498 alumni, graduating in the study period, whose names and addresses were recorded in the electronic database of the Royal Dutch Veterinary Society (KNMvD). In a cover letter the aims of the study were outlined. In addition the respondents were assured that any information they gave would be confidential and that the issue of interest was their opinion of the curriculum, not their ability as a veterinarian. A post-paid return envelope was

enclosed with the questionnaire. Four and eight weeks after the initial mailing, reminders were sent to non-responders. We did not seek ethical approval for the study, because national practice in the Netherlands does not require this for educational survey studies.

Data analysis

The data were entered into a Microsoft Access (Microsoft Corporation) database. SPSS 12.0 was used for the analysis. The results are presented separately for the C'82 and the C'95 alumni. Because not all respondents answered all items, the numbers of responses (n) are given in the tables. A mean score of < 3.0 was considered unsatisfactory, a score between 3.0 and 3.5 was considered indicative of a need for improvement, and a score of > 3.5 was considered satisfactory. Cronbach's alpha (a measure for internal consistency) was computed to assess homogeneity among items before they were categorized by competency domains relating to clinical knowledge and skills, communication skills, and academic skills. Alpha coefficients of > 0.70 were considered acceptable. For all quantitative results, means and standard deviations were calculated. T-tests were performed ($p < 0.01$), if appropriate, to test the statistical significance of the differences between C'82 and C'95.

RESULTS

Of the total of 498 alumni to whom questionnaires were sent, 337 returned a completed questionnaire. The overall response rate was 67.6% and did not differ between C'82 and C'95. Most of the alumni were in veterinary practice. The data of 22 (6.5%) respondents were excluded from further analysis, because these respondents held no or no known job or were in non-veterinary employment. Another nineteen alumni were excluded because they had switched from C'82 to C'95 because of study delay. This resulted in a final study sample of 297 alumni.

Demographics

Of the total of 297 participants, 208 (70.3 %) were female. This percentage reflects the gender distribution in the cohorts of both curricula. The group of C'82 alumni consisted of 163 respondents (54.9 %). The overall mean age of the respondents was 28.3 years (SD 3.4 years). It differed significantly between the two curricula: 29.1 years (SD 4.0 years) for C'82 and 27.4 years (SD 2.1 years) for C'95. The time from entry to graduation also differed significantly between the two curricula: 8.6 years (SD 1.7 years) for C'82 and 7.2 years (SD 1.0 years) for C'95.

There were no differences between the curricula in students' track choices for clinical rotations. Of the C'82 alumni, 61.3 % and 38.6%, and of the C'95 alumni 63.2% and 37% chose 'Companion animals/Horses' and 'Farm animals/Food Quality', respectively.

Positions and careers after graduation

Most of the alumni (81.6%) were in private practice, 6.7% were in specialty training (post-veterinary training/residency) at a university veterinary hospital, 2.2% had jobs in veterinary public health, 1.6% in (agricultural or veterinary nurse) education, 3.3% were in 'alternative veterinary careers', for instance in industry, and 4.4% combined specialty training, veterinary public health, or education with private practice. The ratio of alumni in private practice to alumni with other positions was similar for C'82 and C'95, namely 82.3 % versus 17.7 % and 80.8 % versus 19.2 %, respectively.

The alumni of the two curricula did not respond differently to the question "What percentage of your time is devoted to each of the following species or activities." Therefore the results are presented for all alumni together. The responses showed that 84% of the alumni in private practice spent 62.3% of their time on work related to companion animals. The percentages of alumni devoting time to other species were: 37% devoted 19.2% of their time to cattle/small ruminants; 37% spent 9.7% of their time on horses; 20% spent 4.1% of their time on pigs; and 1.3% devoted 4.1% of their time to poultry. Of the respondents, 28% said they spent 3.5% of their time on practice management.

Alumni of both curricula were equally satisfied with their veterinary careers: 7.7 (SD 1.0) on a scale from 1 (extremely dissatisfied) to 10 (extremely satisfied).

Competencies acquired during training

Table 1 presents the results for the different competencies. There were significant differences between the two curricula in the overall mean scores for clinical knowledge and skills, communication skills, and academic skills but not for practical skills and practice/business management. All significant differences were in favor of C'95. Practical skills and practice management scored quite low for both curricula. Item scores showing significant differences between the curricula were related to giving advice on disease prevention; giving advice on prevention of zoonoses; giving advice on animal husbandry and animal handling (clinical knowledge and skills); communication with clients; teamwork; team management; speaking in public; breaking bad news and negotiating (communication skills); and all items relating to academic skills. For both curricula, the overall scores on communication skills were < 3.5 as were the item scores on communication with clients, with colleagues, and with veterinary nurses; on efficient instruction to

clients and nurses; on team management; on conflict management; on breaking bad news and negotiating. Practice management skills scored < 3.5 for both curricula. Academic skills received significantly higher ratings from C'95 alumni. C'82 alumni's item scores and overall score were < 3.5, whereas the C'95 alumni scored > 3.5 on all items except appraisal of the methodological quality of scientific literature (Table 1).

Curriculum evaluation: Track choice, assessment and transition from university to work

More curriculum time for species tracking was one of the main innovations of C'95. Items on this aspect asked about the percentage of species tracking in the curriculum, the duration of elective tracks (clinical rotations) in Year 6, and tracking before Year 6. The alumni of both curricula rated the desirability of tracking before Year 6 as 3.61 (SD 1.37) on a five-point scale. According to C'82 graduates, 38.1% (SD 21.37) of the curriculum should be dedicated to species tracks and the C'95 alumni gave a percentage of 36% (SD 21.62). Alumni from C'95 were significantly more satisfied with the duration of their chosen species track compared to the alumni from C'82: 1.76 (SD 0.51) and 1.54 (SD 0.59), respectively on a three-point Likert scale (1 = too short; 3 = too long).

There were no differences between the curricula in the number and content of the responses to the open-ended question asking the alumni for additional information on the quality of their chosen tracks. The total number of answers was 125 and the two most frequent answers were:

1. not enough experiences with primary care cases (49 responses)
2. not enough extramural experiences (externships) (20 responses)

In answer to the items (five-point scale) asking the alumni whether they felt the assessment program was sufficiently focused on factual knowledge, problem solving skills, and practical skills, respectively, factual knowledge received the highest scores and was the only item to score > 3.5 for both curricula. The scores of the C'82 alumni were higher for factual knowledge, whereas the C'95 alumni gave higher scores for problem-solving skills. Practical skills received low scores from all alumni (Table 2). The transition from university to workplace was neither easy nor difficult for the alumni of both curricula (scores 3.07 and 3.08) (Table 2). The increase in independence during veterinary training was rated more highly by the C'95 alumni (3.31) than by the C'82 alumni (2.99) (Table 2).

Table 1 The scores given by the alumni of C'82 and C'95 for the items of the clusters of 'specific' and 'generic' competencies.

'Specific' Competencies	Items	Mean '82	SD '82	Mean '95	SD '95	Alpha
	Veterinary training (sufficiently) prepared me to:					
Clinical knowledge and skills		**3.53**	**0.50**	**3.70***	**0.46**	**0.83**
1	Perform a physical examination	4.29	0.69	4.31	0.63	
2	Formulate a differential diagnosis	4.15	0.64	4.25	0.62	
3	Make a diagnosis	3.55	0.86	3.71	0.83	
4	Plan additional tests	3.95	0.73	4.07	0.67	
5	Translate clinical observations into an examination and treatment plan	3.57	0.86	3.70	0.86	
6	Perform simple laboratory work	3.73	0.81	3.80	0.76	
7	Make a management plan	3.13	0.97	3.15	0.98	
8	Explain the therapy plan and the use of pharmaceuticals	3.18	0.93	3.19	0.99	
9	Give a prognosis	3.17	0.92	3.24	0.88	
10	Give advice on prevention of diseases	3.34	0.83	3.72*	0.68	
11	Give advice on prevention of zoonoses	3.18	0.76	3.64*	0.78	
12	Give advice on animal husbandry and animal handling	3.27	0.90	3.55*	0.78	
Practical skills						
13	Perform practical/technical skills	2.30	1.07	2.25	1.04	

'Generic' Competencies	Items	Mean '82	SD '82	Mean '95	SD '95	Alpha
	Veterinary training (sufficiently) prepared me to:					
Communication skills		**2.74**	**0.64**	**3.04***	**0.64**	**0.91**
14	Communicate with clients	2.60	1.15	3.07*	1.13	
15	Communicate with colleagues	3.09	1.12	3.32	1.08	
16	Communicate with veterinary nurses	2.47	1.09	2.65	1.14	
17	Take and record a history	3.36	1.03	3.59	0.88	
18	Give efficient instruction to clients	2.80	0.99	3.00	0.94	
19	Give efficient instruction to nurses	2.51	0.94	2.65	0.93	
20	Teamwork	3.45	1.03	3.71*	0.98	
21	Team management	2.09	0.86	2.46*	1.03	
22	Speaking in public	3.34	0.98	4.05*	0.88	
23	Handle conflict	2.09	0.93	2.71*	0.99	
24	Breaking bad news	2.20	0.94	2.80*	1.06	
25	Negotiate	1.86	0.87	2.23*	0.96	
Practice management						
26	Manage a practice/business	1.61	0.78	2.02	0.85	
Academic skills		**3.08**	**0.74**	**3.53***	**0.75**	**0.85**
27	Search the scientific literature	3.48	0.94	3.74*	0.91	
28	Critical appraisal of the content of scientific literature	3.18	0.93	3.65*	0.81	
29	Critical appraisal of the methodology of scientific literature	2.66	0.92	3.25*	0.96	

* = Significant differences ($p < 0.01$) Likert scale: 1 = strongly disagree – 5 = strongly agree

Table 2 Mean scores on alumni's perceptions whether assessment during veterinary training was sufficiently focused on factual knowledge, problem solving skills and practical skills and means scores on alumni's perceptions of the transition between university and work and the increase in independence during veterinary training for two different curricula.

	C '82			C '95		
	N	Mean	SD	N	Mean	SD
Assessment of factual knowledge	161	4.25	0.77	134	4.01*	0.90
Assessment of problem-solving skills	161	2.93	0.90	134	3.49*	0.93
Assessment of practical skills	161	2.12	0.84	134	2.31	0.91
Transition university - work	159	3.07	1.19	133	3.08	1.25
Independent work	160	2.99	1.07	134	3.31*	0.96

* = Significant differences ($p < 0.01$) Likert scale: 1 = strongly disagree – 5 = strongly agree

Open-ended questions asked the alumni to give additional information on the transition from university to work and on preparation for practice through acquisition of practical skills. Of the total of 411 responses, 221 were from C'82 alumni and 190 from C'95 alumni.

The top 3 explanations as to why the transition was difficult were:

1. not enough experience with practical/technical/surgical skills (221 responses);
2. not enough experience with primary care cases (100 responses);
3. not enough experience in working independently/with responsibility (15 responses).

The top 3 explanations as to why the transition was relatively easy were:

1. supportive employers and colleagues who acknowledged the inexperience of recent graduates (38 responses);
2. own initiatives during extramural studies or veterinary related jobs during undergraduate training (16 responses);
3. personal attributes, such as good communication skills, self-confidence and assertiveness (14 responses).

Overall quality of the curriculum
Alumni of both curricula were equally satisfied with the overall quality of the curriculum: on a scale of 1 (extremely dissatisfied) to 10 (extremely satisfied), the mean scores were 7.0 (SD 0.85).

Underrepresented topics/desired changes in veterinary education
The alumni were asked to list topics they felt should have been covered by the curriculum on the basis of their experiences as veterinarians. This resulted in 393 suggestions, 260 from C'82 alumni and 133 from C'95 alumni. The top four responses for each of the curricula were:

C'82 alumni:
1. practice/business management (92);
2. client communication (85);
3. primary care cases (49);
4. practical (surgical, technical) skills (34);

C'95 alumni:
1. practice/business management (53);
2. primary care cases (33);
3. client communication (19);
4. practical (surgical, technical) skills (18).

Other suggestions were: self-management skills (time management, stress, and negotiating), pharmacology, information and communication technology (ICT) in practice, general agricultural knowledge, academic skills, and ultrasound techniques.

DISCUSSION

The purpose of this study was to examine how veterinary alumni of two different educational programs evaluate their training in light of their experiences in veterinary practice.

The response rate of 67.6% suggests that the results may be regarded as representative of the whole group. Systematic differences between the students on entering veterinary medical education are unlikely. In the Netherlands, students enter veterinary school directly from high school. Pre-university high school education is very homogeneous and the same admission criteria are used nationally for all applicants to veterinary school. The significant differences between the

alumni of the two curricula in age and study duration may at least partly be explained by changes in the student grant system in 1996. In that year, the seven-year government grant for students was reduced to six years. At the same time the two-year entitlement to a student loan after the grant period was extended to three years. As a result, after 1996, it became more expensive for students to extend the duration of their studies beyond 6 years. Other potential indicators of systematic differences, such as track choice in Year 6, employment status and satisfaction with veterinary practice, showed no systematic differences between the alumni from the two curricula.

The results for specific competencies were somewhat surprising in light of concerns within the Faculty that the shift towards generic skills in C'95 would be to the detriment of specific competencies. Surprisingly, and contrary to the feared decline in competence, the C'95 alumni reported significantly better preparation for clinical knowledge and skills than their C'82 counterparts. This appears to suggest that emphasis on generic competencies does not have to be at the expense of specific competencies. In the introduction we referred to similar findings in medical education.[7-9] Preparedness for practical/technical skills was low for both curricula, with practical skills coming fourth in the alumni's list of topics requiring more attention. Lack of practical skills was mentioned most frequently as a factor that had complicated the transition from university to work. Coupled with a perceived low emphasis on practical skills in assessment, these findings appear to be indicative of a curriculum weakness that has remained unremedied in C'95. Indeed, no specific measures were taken in this area in the new curriculum. Fitzpatrick noticed a similar dissatisfaction of alumni with practical instruction.[14] The fact that alumni of both curricula were dissatisfied with this competence should raise concern within the Faculty.

The increased attention for generic competencies in C'95 seems to be reflected in the results. The alumni of C'95 rated their preparedness for communication skills and academic skills significantly higher than did the alumni of C'82. However, it should be noticed that, despite some improvements compared to C'82, preparation for most of the communication skill items remained unsatisfactory (< 3.5). Communication with clients came second in the C'82 alumni's list of topics that were underrepresented in the curriculum. In the list of the C'95 alumni it came third. The importance of communication skills is also manifest from the third place of good communication skills in the list of factors facilitating the transition from university to work.

The main area of concern to the alumni appears to be the perceived deficiencies in practice-related competencies, such as practical/technical skills, practice management, communication with clients, primary care cases, and working independently. They asked for more extramural experiences to be

incorporated into the curriculum. These findings differ from those of a study among junior medical doctors who appeared to be satisfied with the transition from university to work.[9] A possible explanation may be that junior medical doctors enter clinical practice in a relatively structured and supervised environment (house officers, interns), whereas most veterinarians are expected to 'perform' from their first day at work, regularly without any supervision. The alumni who experienced the transition as relatively easy pointed to the importance of supportive colleagues who helped them through their first period in practice. Others acknowledged the importance of their own personal initiatives to improve their practical skills.

The results appear to show that the curriculum reform of 1995 has succeeded to some extent in bringing about the desired effects. The responses of the C'95 alumni appear to reflect an increased focus in assessment on problem-solving skills and a slightly decreased focus on factual knowledge. Together these effects seem to be indicative of a change in emphasis that is in line with the recommendations of the PEW-report.[11] Fortunately, the diminished focus on factual knowledge was not associated with a decrease in preparation for clinical knowledge and skills. The significant improvement in academic skills may be attributable to the new module on scientific training and the research internship in C'95. The integration of communication skills in existing courses in C'95 may be responsible for the better scores on preparation for communication skills. Noticeably fewer C'95 alumni compared to C'82 alumni indicated that communication with clients was underrepresented in the curriculum. The results on species tracking did not support the views expressed by Lofstedt, who contended that increased focus on species-related tracks would ease the transition between university and work.[18] Nevertheless, compared to their C'82 counterparts, the C'95 alumni were significantly more satisfied with species tracking, which covered a longer period in C'95 than in C'82. The areas where the results showed no differences between the curricula were those for which no concrete reforms had been implemented. The responses to the open-ended questions about the transition from university to work and topics underrepresented in the curriculum revealed a perceived deficiency in specific and generic competencies related to practical skills, primary care cases, communication with clients and business management. The latter findings are in line with those of a study conducted by Bristol, in which North Carolina alumni mentioned a lack of attention to skills in business management and communication in their veterinary education, in addition to the desirability of more emphasis on clinical time, surgery, everyday applications and externships.[2]

One of the limitations of this study is that the differences in mean age and study duration between the alumni of C'82 and C'95 suggest that we cannot entirely rule out a systematic effect of differences between the two groups. For example, we may have been dealing with the brightest (and fastest) alumni from

C'95 and the slower alumni from C'82. Unfortunately, the above mentioned change in the Dutch student grant system precludes a clear assessment of these differences. Another possible weakness is that alumni may forget details of programs as the time since graduation increases. Furthermore, those who are extremely successful or unsuccessful may inappropriately attribute their successes or failures to the teaching program, evaluating it with undeserved bias.[2] Another limitation of this study is that the results are based on the perceptions of the alumni only. Further studies should also explore employers' and teachers' opinions. Finally, the questionnaire was not yet thoroughly tested for reliability and validity purposes, which need to be established in future studies.

The results of this study offer leads for improving educational practice. The main message seems to be that any steps that are taken should focus on competencies related to primary practice to help smooth the transition between university and work. Since this study was completed, some interventions have been implemented, such as structuring and increasing the amount of communication skills training and training in practice/business management throughout the curriculum. Some interventions are still in a preliminary phase. We are planning to extend the duration of extramural studies (externships) in Year 6, with a structured increase in students' responsibilities and more opportunities for primary care experiences and practical skills development. The most recent ideas focus on setting up a skills lab.

In order to collect longitudinal data for future studies, it would be interesting to develop a reliable and valid questionnaire to survey alumni immediately after graduation and, for instance, after two, five and ten years. Examining employers' opinions of recent graduates would help to augment our understanding of the match between the preparation of students by the university curriculum and the demands and expectations of veterinary practice.[20]

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Chapter 8

Conclusions and discussion

In this chapter we summarise and discuss the conclusions of the studies and present practical implications for veterinary medical education. Finally, recommendations for future research are made.

GENERAL CONCLUSION AND DISCUSSION

The aim of the studies described in this thesis was to find answers to the general research question: *What happens to students in a student-centred veterinary curriculum with ample coverage of generic competencies and what are students', teachers' and alumni's perceptions of this curriculum, in particular in regard of seminar group learning, research internship and preparation for professional practice?*

The answer to this question is based on a synthesis of the answers to the subquestions of the broad research question that emerged from the various studies we performed. These subquestions are:

1. How are different elements of student-centred learning and the acquisition of generic competencies incorporated in the new curriculum design? (Chapter 2)
2. What are students' and teachers' experiences with seminar group learning? What happens during seminar group sessions? Which factors affect learning in this environment? (Chapters 3 and 4)
3. What are students' experiences with the research internship? What are the strengths and weaknesses of students' research reports? Which factors affect learning in this environment? (Chapters 5 and 6)
4. What are alumni's experiences with the curriculum they completed and how well do they think it has prepared them for professional practice? (Chapter 7)

Research question 1: "How are different elements of student-centred learning and the acquisition of generic competencies incorporated in the new curriculum design?" (Chapter 2)
The results of this study point to the conclusion that the different curriculum aspects of Prideaux's model[(1)]: outcomes/objectives; content; teaching and learning strategies; assessment strategies; and the educational organisation are specified in the written documents about the curriculum revisions of 1995 and 2001. The written documents also paid attention to coherence between the different aspects of the curriculum. Furthermore, the conclusion appears to be justified that the instructional methods proposed are consistent with current student centred

approaches to learning and teaching.[2-4] Ambitious plans were proposed for the development of innovative instructional methods. The transition from large group lecturing to small seminar group learning and more time for self-study activities were the major changes proposed in the documents. In addition, academic training was promoted by the introduction of a research internship, which was described in the documents as one of the major curriculum changes. The study also showed that there was little emphasis in the documents on assessment as an integral part of the curriculum. This is a potential obstacle to the successful implementation of a new curriculum, because it is known that assessment drives student learning.[5-7] Students tend to learn what is required to pass their exams. Therefore, assessment should be in alignment with the aims of the student centred curriculum.[5-8] Another conclusion from the analysis of the documents was a paucity of attention for social/ communication skills and business management skills in the curriculum. In order to gain more insight into what actually happens to the students in our student-centred veterinary curriculum, we decided to focus our studies on two main instructional methods that featured prominently in the curriculum revisions: seminar groups and the research internship.

Research question 2 pertains to seminar learning and was formulated as follows: "What are students' and teachers' experiences with seminar group learning? What happens during seminar group sessions? Which factors affect learning in this environment?" These research questions were answered in Chapters 3 and 4. The study in Chapter 3 focussed on factors influencing seminar learning. A questionnaire was used to measure students' perceptions of different aspects of seminar learning and it was investigated how different aspects of group learning influenced each other. It was concluded from the results that the quality of the assignments and the teacher's performance were highly rated by the students and were positively related to the perceived learning effect. However, group interaction scored low and was negatively associated with the perceived learning effect. These findings seem to indicate that students do not perceive group interaction as conducive to learning. No significant relationship was found between teacher performance and group interaction indicating that in this study good teacher performance was not related to active student participation in the group. A possible explanation for these findings is that the interaction between students and teachers and between students and students was limited in the seminar groups, which suggests that seminar group learning sessions were less student-centred than intended. Lack of interaction is perceived as detrimental to the effectiveness of group learning.[9] The findings of this study are not in line with other studies where students perceived positive relationships between group interaction and learning.[10-15]

To gain more insight into the interactions during seminar group sessions, we investigated in depth what types of learning-oriented interactions occurred during seminar learning, what students' and teachers' perceptions are of their occurrence and desirability and how much time was spent on the different types of interaction. The results of this study are reported in Chapter 4. Within this study a questionnaire was used and seminars were analysed through video observations. From this study, it was concluded that in the opinions of both students and teachers the quality of group interactions in the seminars can be improved. The video analysis showed that most of the discussion time was spent on the teacher's interactions (93%) and only a small proportion on students' interactions (8%). The observed interactions were mostly between teacher and student. Interactions between students were rare. It was concluded that the students were not stimulated to discuss subjects with each other because the group seminars were more teacher-centred than student-centred. However, from this study we cannot conclude whether the students were merely passively absorbing knowledge or whether they were mentally active but not participating verbally. Finally, because so little time was used for student interaction, the objectives of seminar learning concerning the stimulation of social/communication skills, as described in the intended curriculum, are unlikely to be achieved.

Research question 3 was formulated to address the research internship. The central questions were: "What are students' experiences with the research internship? What are the strengths and weaknesses of students' research reports? Which factors affect learning in this environment?" These questions are answered in Chapter 5 and 6. To measure what students learn from a research internship and to gain insight into their research competencies, an instrument was developed to assess students' research reports (Chapter 5). This instrument was used to assess the strengths and weaknesses of the research reports. From this study it was concluded that the strengths of the reports were related to the description of materials and methods and to the presentation of the results. Weaknesses were mainly related to research questions and their grounding in the literature, analysis and statistics, and clarity of tables and graphs. The finding that the research questions were not clearly reported is in line with a previous study conducted by Oost[16], in which he concluded that the research questions were also not well documented in dissertations that were investigated. A possible explanation is that students are not well prepared for their research internship in our curriculum. Research skills require practice and feedback throughout the whole curriculum and not only during the research internship.

In Chapter 6, we investigated the research internship using a questionnaire in which the students were asked to rate different aspects of the research internship.

From this study it was concluded that research internship experiences were generally perceived as instructive by the students. Students appreciated the quality of supervision, development of research skills, the intellectual and social climate, infrastructure support, and the clarity of goals. The quality of supervision proved to be a crucial factor influencing both the quality of research reports and students' overall satisfaction with the internship. The intellectual and social climate had a positive influence on the quality of research reports. The results of our study were in line with previous studies in which the supervisor and the intellectual and social climate were found to be the key success factors for research experiences of *postgraduate* students.[17,18]

In a final study, reported within this thesis, the perceptions of alumni were investigated. **Research question 4** was formulated as follows: "What are alumni's experiences with the curriculum they completed and how well do they think it has prepared them for professional practice?" The results are reported in Chapter 7. A questionnaire was administered to alumni. From this study it was concluded that alumni from the more innovative, student centred curriculum of 1995 felt better prepared for veterinary practice concerning clinical knowledge and skills, academic, and social/communication competencies than the alumni of the traditional teacher-centred curriculum of 1982. These findings suggest that the emphasis on generic, non-technical competencies in the renewed curriculum has not led to a decrease in students' acquisition of clinical knowledge and skills in the perception of the alumni. These findings are in line with the recommendations of (inter)national reports concerning the need for change in veterinary education worldwide.[19-23] In the medical education domain, studies also showed that changes towards a more student-centred curriculum (i.e. problem-based learning) resulted in better preparation of alumni in generic competencies without the feared decline in clinical competence.[24-26] Alumni of both veterinary curricula reported that too little attention was paid to acquiring practical (technical) skills, skills for primary care, and business management skills. The alumni were also of the opinion that their training in competencies related to communication with clients needed improvement. Studies in veterinary education in all parts of the world have shown similar findings and perceived competency gaps.[27,28]

The studies reported within this thesis were aimed at answering the general research question: *What happens to students in a student-centred veterinary curriculum with ample coverage of generic competencies and what are students', teachers' and alumni's perceptions of this curriculum, in particular in regard of seminar group learning, research internship and preparation for professional practice?*

From the analysis of the documents in which the student-centred veterinary curriculum was described, it was concluded that the educational approaches proposed in the documents fit with current student-centred approaches to learning, but that little attention was paid to the assessment component of the curriculum. However, the studies we conducted also demonstrate mismatches between the intended curriculum, as described in the documents of the curriculum revisions of 1995 and 2001, and what actually happens in reality and what is perceived by students, teachers and alumni.

Seminar learning, as an instructional method was introduced to create a learning environment for students in which students could interact with the teachers and with each other. The seminar group learning sessions succeeded partly because the assignments were seen as highly effective, at least in the students' perceptions. However, interactions between students were not observed often and most of the interaction in the group sessions was undertaken by the teacher. This suggests that in the educational setting of this thesis, seminar group learning is probably less student-centred than was intended.

The research internship, an instructional method aimed at stimulating academic skill development, was perceived by the students as a good learning experience. The quality of supervision and the departments' intellectual and social climate were found to be crucial factors for student learning. The students' research reports as an outcome measure reflected the students' competency levels and both strengths and weaknesses could be identified.

The results of the alumni study show that according to the alumni the curriculum review of 1995 has succeeded to some extent in bringing about the intended effects, such as an increased competence in clinical knowledge and skills and in academic and communication skills. It was also concluded that some competencies should receive more attention in the revised curriculum. This applies to practical (technical) skills, business management skills and also to communication skills.

PRACTICAL IMPLICATIONS

Based on the findings from the studies in this thesis some recommendations for the improvement of veterinary medical education can be made.

First, what the curriculum was intended to accomplish (the intended curriculum) can be better aligned with what happens in reality (Chapter 2). To do so, a clear mission statement about the philosophy of the student-centred curriculum is an absolute necessity.[29] Both teachers and students need to be made

aware of the mission statement and of the rationale underlying the statement. A sound didactic model (including teaching, learning and assessment strategies), based on what is known from literature on student-centred education, should be described and attention needs to be paid to aligning the didactics to the mission statement and explicit objectives and outcomes.[1] In addition, continuous quality assurance programmes are needed, aimed at continuous improvement of the curriculum.

Second, the studies on seminar learning (Chapters 3 and 4), indicate that seminar group learning sessions need improvement, mainly directed at increasing the amount of interaction between students. Since many variables are related to the enhancement of group interaction, no quick fix is possible. First of all it is important to take a critical look at the assignments. The students were positive about the assignments, but do they stimulate students to interact with each other and with the teacher? Second, how are the seminar sessions aligned with other parts of the curriculum, such as the lectures, practicals, self-study activities and assessment tools. Are all these aspects in alignment or are they in competition with each other? And finally, students and teachers need training in small group learning.

Third, the studies on academic training (Chapters 5 and 6) indicate that students need to be better prepared in the years preceding the research internship. In these years more attention should be paid to acquiring research competencies. Students' research competencies related to formulating sound research questions and grounding the question in the literature need further improvement. More longitudinal research training in the curriculum and more practice in generating and formulating research questions could be included. Furthermore, teachers need to become even more aware of the importance of their role as supervisor and their department's intellectual and social climate. They need to be trained in coaching students in their academic development. This may result in students being better prepared for evidence-based veterinary medicine in practice and for incorporating research into their future professional careers.[30, 31]

Fourth, the alumni study (Chapter 7) indicates that more attention should be paid to practice-oriented specific and generic skills by offering training in practical (technical) skills for primary care cases, communication skills, and business management skills. Students should gradually be given more complex tasks in the curriculum that resemble the work as a veterinary practitioner.[25]

In conclusion, parts of the curriculum need to be redesigned in order to better fit with the ideas underlying a student-centred curriculum. Some interventions have already been implemented or are in a preliminary phase of implementation. The Bachelor-Master structure is implemented which has led to a better definition of the outcomes of the curriculum in the different phases. Academic research training

has become more longitudinal and evidence based veterinary medicine has become a core aspect of the curriculum. Time is allocated for students to perform a literature review in preparation for their empirical research internship. Extramural primary care training is being implemented and ambitious plans for skills lab training are formulated.

SUGGESTIONS FOR FUTURE RESEARCH

A student-centred curriculum is a multifaceted complex learning environment in which many different variables interact with each other. Consequently, it is no easy job to investigate what is actually happening to students. The aim of this thesis was to contribute to a better understanding of what happens to the students. The studies we conducted shed some light on some aspects of the curriculum but not on all aspects. The studies focussed on seminar group learning, the research internship and a global evaluation of the whole curriculum by alumni. Seminar learning and the research internship were investigated in considerable depth and both process and outcome variables within these settings were investigated and their relationships. Strength of the studies is that different methods were used, such as document analysis, questionnaires and video observations, and different respondents investigated, such as students, teachers and alumni. These different sources and different respondents ensured that the educational settings were investigated from different perspectives. Nevertheless, further research is needed, since this thesis reports (only) on a first series of studies conducted within our veterinary curriculum.

Further research is needed to monitor and evaluate the existing discrepancies between the intended curriculum and the curriculum in action, in other words between the plans and what actually happens in the curriculum or how that is perceived, and also between veterinary training and professional practice.

The teacher is an important factor in the transition from a teacher-centred curriculum to a student-centred curriculum. Teachers' roles need to change accordingly. What teachers actually do and how (part of) the curriculum is delivered to the students reflects the teachers' beliefs about education.[32] Future research should focus on the teachers' beliefs and their perceptions of student-centred learning.

From the learner's perspective, the studies in this thesis focussed on only two aspects, i.e. seminar learning and the research internship. Future research should focus on the coherence of the different instructional methods and assessment.

Finally, more in depth research is needed to investigate why alumni do or do not feel well prepared for practice and how the gaps can be bridged to ease the

transition between veterinary training and professional practice. Qualitative research methods, such as interviews with alumni and employers, would be useful to obtain better insight.

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Summary

More than two decades ago the Americans with Pritchard's Pew Report 'Future Directions for Veterinary Medicine'[1] and the Europeans with 'Reflections on the Future of Undergraduate Veterinary Education in Europe'[2] presented at the general assembly of the European Association of Establishments for Veterinary Education (EAEVE) proposed innovations in veterinary medicine as a profession and in veterinary medical education in particular. The core elements of both proposals were more student-centred learning in the veterinary curriculum as well as more emphasis on generic, not specifically veterinary competencies for professional practice, such as interpersonal and communication skills, academic skills and skills for life-long learning. Inspired by the realisation that veterinary education had to adapt to societal and professional developments in a changing world, these documents triggered educational innovation in veterinary education in all parts of the world. One of the veterinary schools to embark on curriculum revision was the Dutch Faculty of Veterinary Medicine of Utrecht University, which decided to introduce a curriculum based on a student-centred educational approach.

The introduction to this dissertation in **Chapter 1** discusses the transition from a teacher-centred to a student-centred curriculum and the consequences for teachers and students. Student-centred learning uses methods that promote active participation of students in educational activities based on the concept that it is more effective for students to be the constructors of their own knowledge than to be the passive recipients of the knowledge imparted by their teachers. The implications for educational practice is that learning environments have to be created that stimulate students to engage in learning activities and interact with other students. One way to achieve this is to bring students together in small groups to collaborate in performing assignments and problem solving tasks.

Another important reason for curriculum renewal was the need to foster students' generic academic competencies. A method to attain this type of competence is a research internship which is considered an appropriate activating educational method to help students acquire research competence.

Good preparation for the professional workplace and the labour market can be achieved by equipping graduates not only with competencies specifically related to

veterinary medicine but also with generic competencies. The latter encompass interpersonal, communication and management skills. Activating methods and dedicated modules are to be offered to provide students with the opportunities to become competent professionals in these areas as well.

The main research question addressed in this dissertation is: *What happens to students in a student-centred curriculum with ample coverage of generic competencies and what are students', teachers' and alumni's perceptions of this curriculum, in particular in regard of seminar group learning, research internships and preparation for professional practice?*

Two educational methods are at the centre of the studies conducted for this dissertation: seminar groups and research internships. Four subquestions were formulated to address the broad main research question:

1. How are different elements of student-centred learning and the acquisition of generic competencies incorporated in the new curriculum design? (Chapter 2)
2. What are students' and teachers' experiences with seminar group learning? What happens during seminar group sessions? Which factors affect learning in this environment? (Chapters 3 and 4)
3. What are students' experiences with the research internship? What are the strengths and weaknesses of students' research reports? Which factors affect learning in this environment? (Chapters 5 and 6)
4. What are alumni's experiences with the curriculum they completed and how well do they think it has prepared them for professional practice? (Chapter 7)

The studies were conducted from process-directed and outcome-directed perspectives. We used a variety of research methods and resources, such as document analysis, development of an assessment instrument, questionnaire surveys to examine students', teachers' and alumni's perceptions and experiences, and observational techniques to explore students' and teachers' behaviour in a group learning environment.

Chapter 2 describes a study in which we used document analysis and Prideaux's model of curriculum development[3] to gain insight into the curriculum revisions of 1995 and 2001 as compared to the traditional curriculum of 1982. Our analysis of the reports of the respective curriculum committees was guided by the aspects of curriculum development in Prideaux's model[3]: (final) objectives, content (in particular three interventions aimed at clearing content so as to combat curriculum

overload: electives, integration, and differentiation), didactic concept, assessment, educational organisation and interactions between these aspects. Contrary to the reports on the 1982 curriculum, which had little to say on these aspects, the documents on the 1995 curriculum report extensively on curriculum objectives and how to translate them into content and didactic concepts? Key objectives are generic competencies of which the principal ones are: problem-solving skills, interpersonal and communication skills, and research skills. Assessment receives little explicit attention. The analysis of the 2001 curriculum documents reveals continued development of curriculum objectives and outcomes with even more emphasis on research skills and differentiation. The descriptions of didactic methods are mostly confined to methods to stimulate self study. Again assessment is rather neglected. A look at all the curricular revisions combined reveals a clear trend over the years, characterised by a decrease in lectures and (preclinical) laboratory sessions, an increase in small group learning, such as seminar groups and group assignments, an increase in time for self study, more differentiation, integration and electives and, finally, more time for clinical clerkships. One of the methods introduced to achieve the curriculum objectives is the research internship.

In **Chapter 3**, a quantitative study is described in which we investigated seminar group (15-30 students) learning by seeking students' perceptions on the following factors related to the learning process: the quality of the teacher, group interaction, the quality of the assignments and the interrelationships of these factors and how they impact on the learning effects as experienced by the students. A questionnaire containing 28 items concerning these factors was administered to students in Years 1-4. We found high ratings on the quality of the teacher, the assignments and the learning effects but low ratings on the quality of group interaction. The quality of the teacher and the learning effect were positively correlated while the relationship between group interaction and the learning effect was a strongly negative one. This appears to suggest that students perceive themselves as highly dependent on their teachers for effective learning while they do not think that group interaction makes a valuable contribution to their learning.

Because the previous study yielded unexpected results about group interaction in the seminar groups, we conducted a further study of group interaction. This study is presented in **Chapter 4**. Two methods were used: a questionnaire and observation of videotaped group interactions. Both methods are quantitative and aimed at further insight into learning-oriented interactions. An existing questionnaire was administered to seek students' opinions on the following learning-oriented interactions: exploratory questioning, cumulative reasoning, and discussing conflicts about knowledge. The students were also asked to name

positive and negative aspects of the group sessions and to suggest ways to improve them. Students in Year 4, who took part in group seminars in the Anaesthesiology course (117 students in eight seminar groups) and their teachers answered items about the occurrence and desirability of the learning oriented interactions during seminar group sessions. Quite frequently occurring interactions were exploratory questioning and cumulative reasoning according to both the teachers and the students but conflicts about knowledge were rare. The fact that desirability received higher scores than occurrence for all the interactions appears to point to a need for improvement. Positive aspects of group interaction mentioned by the students were: deep learning, better understanding, better retention, recall, and application of knowledge. The students appeared to rely very much on their teachers for guidance and expected the teacher to provide them with the correct answers.

For the analysis of the videotaped teacher-guided discussions in four of the eight seminar groups we used a coding scheme[4] that distinguishes five group activities: the three types of learning-oriented interactions addressed in the questionnaire and procedural and off-task interactions. We found that, on average, 93% of the discussion time was taken up by the teacher's verbal interactions, mostly consisting of cumulative reasoning.

The results of the study in Chapter 4 confirm the suspicion raised by the study in Chapter 3 that there is not a great deal of student interaction in seminar groups and teachers dominate the group activities. This may be explained by group size being too large for effective discussions, students and teachers not being appropriately informed of the objectives of group work (the intended curriculum), students not preparing the assignments adequately or the assignments being not sufficiently challenging. Strategies to achieve the desired effects of seminar group learning should be directed at these aspects.

We developed a reliable instrument to assess the quality of research reports and to identify the strengths and weaknesses of these reports. The study in which this was done is reported in **Chapter 5**. The research report is the final product of a student's research internship and considered to reflect the development of research competencies. The assessment instrument consists of 15 specific and 4 global items addressing aspects of a good research report: clearly defined research question, which is embedded in underlying theory, a clear description of methods and results and conclusions that provide an answer to the research question. Three independent assessors rated 18 reports by responding to the questionnaire items on a five-point scale. The strength of the reports lies in the descriptions of methods and results, whereas the weaknesses relate to clearly formulated research questions, a theoretical framework, (statistical) data analysis and the clarity of graphs, tables

and figures. The instrument proved to be reliable with three assessors. The study offers insight into the research competencies acquired by the students.

The assessment instrument resulting from the study described in **Chapter 5** was used to examine students' experiences in relation to factors affecting the research internship. This is the aim of the study in **Chapter 6,** which addresses the quality of supervision, skill development, the intellectual and social working climate at the internship setting, the organisation of the internship and clarity of the objectives. The relationship between these factors and two outcomes measures, namely the quality of the research reports and students' overall satisfaction with the internship, was examined as well. A 25-item questionnaire was completed by 80 out of 101 fifth-year students, who were asked to participate in the study (response 81%). On the whole, the students had a positive opinion of the internship. All factors received high ratings, although intellectual and social climate and infrastructure showed a rather wide spread, possibly reflecting differences between internship settings. Two independent assessors used the instrument we had developed in the previous study to assess the research reports of all the students who completed the questionnaire. There appeared to be a significant positive association between the quality of supervision and students' overall satisfaction and the quality of their research reports. This suggests that the quality of supervision may need improvement, a need which could be met by faculty development. The intellectual and social climate also appears to need attention. One way to enhance this could be to stimulate social interaction among students during the internship.

The study described in **Chapter 7** compares the experiences and opinions of graduates from the revised, more student-centred curriculum of 1995 and the traditional lecture-based curriculum of 1982 with respect to their opinion of the curriculum and how they felt it had prepared them for veterinary practice. The objectives of the 1995 curriculum stated in the 'intended curriculum' as described in Chapter 2, were translated into questionnaire items about: (clinical) problem solving, interpersonal and communication skills, research skills, practice skills, management skills, assessment, and independence. All veterinary doctors graduating between 2001 and 2003 were asked to complete the questionnaire within 24 months after graduation. We analysed questionnaires from 337 veterinarians (55% from the 1982 curriculum). The graduates from the 1995 curriculum were more satisfied than their 1982 counterparts with their preparation for veterinary practice with respect to clinical knowledge and skills, interpersonal and communication skills, and research skills. Graduates from both curricula experienced gaps in practical skills, skills for primary veterinary practice, and practice management skills. They claimed that this had complicated the transition

from university to workplace and advocated more attention in the curriculum for these aspects as well as for communication skills. Apparently, the curriculum revision has had a positive impact on at least some of the objectives. Workplace-related skills appear to be the obvious target for further curriculum improvements.

Chapter 8 synthesises the results of all the studies of this dissertation in relation to aspects that are relevant to student-centred learning. Other important topics are generic competencies and the 'intended curriculum' (as described in Chapter 2) and developments in veterinary medical education. Recommendations will be made for improving today's veterinary education and further research based on the insights afforded by the studies.

The main conclusions from **Chapters 3 and 4** are that seminar groups are perceived by the students as useful for their learning and that the students are generally satisfied with the quality of the teachers and the assignments. The results also raise concerns as to whether this educational method meets the expectations with respect to the enhancement of learning-oriented interactions and active participation by students as key characteristics of student-centred learning. This concern is caused by the finding that group interaction is less extensive than anticipated and the verbal interaction is dominated by the teacher. Measures will have to be taken to improve the seminar groups as activating learning method.

The studies in **Chapters 5 and 6** give a positive evaluation of the research internship on all factors that influence the learning processes during internships. It proved feasible to measure the research competencies reflected in the research reports using the instrument we developed. Supervision and the intellectual and social work climate at the internship setting affected the quality of the reports and students' general satisfaction with the internship.

The study described in **Chapter 7** which surveyed alumni to compare the effects of the new 1995 curriculum and the traditional 1982 curriculum demonstrated that the goals of the curriculum revisions have largely been achieved. However, the alumni also identified gaps in their training which were not described in the curriculum reports, relating to skills for primary care veterinary practice, practice management and communication skills.

The strengths of the studies we performed are that they were both process- and outcome-oriented and used a variety of analytical methods and data resources. However, we were unable to chart all the aspects of curriculum renewal. Further studies should investigate the effects of the educational methods used in today's veterinary medical curriculum that were not addressed in this dissertation, such as group assignments, clinical clerkships, external training and above all the didactic cohesion of these methods in the curriculum.

Recommendations for measures to enhance the quality of veterinary medical education are:

- increase practice-oriented training (for instance early encounters with patients and veterinary practice, extended external training, training in specific skills, such as practice management and communication skills);
- increase active participation of the students in the interaction in seminar groups by reducing group size and training in dialogue and discussion skills for both students and teachers;
- train supervisors of research internships for their role and prepare students better for their internship;
- increase the coherence of training in research skills by incorporating them in a longitudinal programme.

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Samenvatting

Ruim twee decennia geleden gaven zowel de Amerikanen, onder leiding van Pritchard in hun Pew report “Future Directions for Veterinary Medicine”[1], als de Europeanen geconcentreerd in de EAEVE met hun “Reflections on the Future of Undergraduate Veterinary Education in Europe”[2] voorstellen voor vernieuwingen in de diergeneeskunde en in het bijzonder in het diergeneeskundige onderwijs. De voorstellen kwamen neer op: meer studentgecentreerd onderwijs en meer aandacht voor de niet-veterinair technische aspecten van de beroepsuitoefening zoals sociale –en communicatieve vaardigheden, academische vaardigheden en levenslang leren. Om zodoende aan te sluiten bij veranderende maatschappelijke en professionele ontwikkelingen. Deze documenten vormden de aanzet tot wereldwijde onderwijsvernieuwingen. Voor de Faculteit Diergeneeskunde van de Universiteit Utrecht was dit aanleiding om curriculumvernieuwingen in gang te zetten waarbij een studentgecentreerde aanpak werd verkozen.

In **hoofdstuk 1**, de introductie, wordt ingegaan op de overgang van docent gestuurd onderwijs naar meer studentgecentreerde vormen van leren en de betekenis voor de rol van zowel de docenten als de studenten. Voornamelijk actieve participatie van studenten waarbij de student eigen kennis construeert in tegenstelling tot het passief opnemen van gedoceerde stof wordt beschouwd als effectief onderwijs dat beter aansluit bij de doelstellingen van de voorgestelde onderwijsvernieuwingen. In de praktijk worden opvattingen van studentgecentreerd en dus actief leren vaak toegepast in leeromgevingen waar zelfwerkzaamheid wordt gestimuleerd en waar studenten onderling interactie kunnen hebben, door in kleinere groepen samen te werken aan opdrachten of problemen.

Het belang van academische vorming wordt uitgewerkt. De onderzoeksstage wordt gezien als een belangrijke activerende onderwijsvorm voor het bereiken van academische vaardigheden bij studenten.

Een juiste voorbereiding op de professionele arbeidsmarkt hangt samen met zowel specifieke als generieke (algemene) competenties van studenten en afgestudeerden. Generieke competenties, zoals sociale –en communicatieve vaardigheden en managementvaardigheden, zijn van belang voor succes in de latere veterinaire beroepsuitoefening. Daarom is het van belang in het veterinaire

curriculum aandacht te geven aan deze competenties door het implementeren van daarop gerichte activerende werkvormen en specifieke modules.

De hoofdvraag was: *Wat gebeurt er met de lerende (de student) in een studentgecentreerd veterinair curriculum met substantiële aandacht voor onderwijs in generieke competenties en hoe wordt het ervaren door studenten, docenten en alumni, in het bijzonder de werkcolleges, de onderzoeksstage en de voorbereiding op de professionele praktijk?*
In de verschillende deelonderzoeken werd ingezoomd op twee specifieke onderwijsvormen, te weten de werkcolleges en de onderzoeksstage. Om de hoofdvraag te beantwoorden, werden vier deelvragen geformuleerd:

1. Hoe zijn de verschillende aspecten, van studentgecentreerd onderwijs met aandacht voor generieke competenties, in het ontwerp van de nieuwe curricula ondergebracht? (Hoofdstuk 2)
2. Hoe ervaren studenten en docenten de werkcolleges als onderwijsvorm, wat gebeurt er precies tijdens de werkcolleges en welke factoren zijn van invloed op het leren? (Hoofdstukken 3 en 4)
3. Hoe ervaren studenten de onderzoeksstage als onderwijsvorm, wat zijn de sterktes en zwaktes van de onderzoeksverslagen en welke factoren zijn van invloed op het leren tijdens de onderzoeksstage? (Hoofdstukken 5 en 6)
4. Hoe hebben alumni hun curriculum ervaren en hoe voelden zij zich voorbereid op hun beroepsuitoefening? (Hoofdstuk 7)

Zowel procesgerichte als uitkomstgerichte invalshoeken zijn gehanteerd in de verschillende studies, met gebruikmaking van een verscheidenheid aan onderzoeksmethodieken en bronnen, te weten documentanalyse, constructie van een beoordelingsinstrument, meningen en ervaringen van studenten, docenten en afgestudeerden m.b.v. vragenlijsten, als ook observatietechnieken.

In **hoofdstuk 2** staat het bedoelde curriculum centraal en wordt door middel van documentanalyse een beschrijving gegeven van de onderwijsvernieuwingen van 1995 en 2001 afgezet tegen het traditionele curriculum van 1982. De documentanalyse behelst de rapporten opgesteld door de betreffende curriculumcommissies. Het model van Prideaux[3] werd als leidraad gehanteerd om inzicht te krijgen in de volgende aspecten gerelateerd aan curriculumontwikkelingen: (eind)doelen, inhoud (en dan voornamelijk het aspect van opschonen van de inhoud door een drietal interventies: keuzevakken, integratie en differentiatie), didactische concept, toetsing, onderwijsorganisatie en de onderlinge samenhang tussen deze aspecten. De conclusie is dat in de rapporten

van curriculum ’82 maar zeer marginaal wordt gerapporteerd over bovenstaande aspecten. Dit in tegenstelling tot de rapporten van curriculum ’95 waarin uitgebreid wordt stilgestaan bij de doelstellingen en de vertaling van deze doelstellingen naar inhoud en didactische concept van het curriculum. De doelstellingen focussen op bepaalde generieke competenties waar de studenten bij afstuderen aan moeten voldoen, met als belangrijkste probleemoplossende, sociale –en communicatieve en wetenschappelijke vaardigheden. De toetsing wordt echter maar weinig expliciet beschreven. De analyse van curriculum ’01 laat een verdergaande ontwikkeling van de doelstellingen en eindtermen zien met meer nadruk op academisering en differentiatie. De beschrijving van de didactiek is vooral gericht op zelfstudie. Tevens is de toetsing ook hier minimaal beschreven. Alle curriculumvernieuwingen samen laten een duidelijke trend zien over de jaren heen van vermindering van hoorcolleges en (preklinische) practica, een toename van kleinschaliger onderwijs, zoals werkcolleges en werkcollegeopdrachten, een toename van zelfstudietijd, een toename van differentiatie, integratie en keuzevakken en tenslotte een toename van de klinische (coschap)fase. Een aantal vakken, specifiek gericht op het bereiken van de doelstellingen werden geïntroduceerd, waarvan de onderzoeksstage er één van is.

In **hoofdstuk 3** wordt een kwantitatief onderzoek beschreven naar de percepties die studenten in een werkcollegegroep (15-30 studenten) hebben ten aanzien van bepaalde factoren gerelateerd aan het onderwijsproces, te weten de kwaliteit van de docent, de groepsinteractie en de kwaliteit van de opdrachten en hoe deze factoren onderling samenhangen en gerelateerd zijn aan het gepercipieerde leereffect? Bij alle vier de jaren van de voorbereidende fase werd een vragenlijst afgenomen die bestond uit 28 vragen betreffende de genoemde factoren. De studenten binnen de werkcollegegroepen ervoeren de kwaliteit van de docenten, de opdrachten en het leereffect als hoog, echter, de kwaliteit van groepsinteractie scoorden laag. Een sterke positieve relatie werd gevonden tussen de kwaliteit van de docent en het gepercipieerde leereffect en een sterke negatieve relatie werd gevonden tussen de groepsinteractie en het gepercipieerde leereffect. Deze bevindingen duiden er op dat studenten sterk afhankelijk zijn van de docent en dat ze groepsinteractie niet als nuttig ervaren voor hun leren.

Om meer inzicht te krijgen in het proces in de werkcolleges en dan voornamelijk wat er gebeurt aan groepsinteractie, is het onderzoek, beschreven in **hoofdstuk 4,** opgezet. De studie beschrijft twee onderzoeksmethodieken, namelijk een vragenlijst en verdiepende observaties met behulp van video-opname, die beiden het kwantitatief in kaart brengen van leergerichte interacties als doel hebben. Met behulp van een bestaande vragenlijst betreffende verschillende leergerichte typen

van interactie (explorerende vragen stellen, cumulatief redeneren, bespreken van inhoudelijke tegenstrijdigheden) zijn sterke aspecten, tekortkomingen en verbeterpunten ten aanzien van interacties in de werkcolleges onderzocht. Vierdejaars studenten binnen het vak Anesthesiologie (117 studenten verspreid over 8 werkcollegegroepen) en hun docenten beantwoordden items over het optreden van een aantal leergerichte interacties tijdens het werkcollege en hun mening werd gevraagd over de wenselijkheid van deze interacties. Explorerende vragen stellen en cumulatief redeneren bleken vrij vaak voorkomende leergerichte interactietypes in zowel de perceptie van de studenten als docenten binnen de werkcollegegroep, echter, het bespreken van tegenstrijdigheden in de leerstof gebeurde weinig in hun perceptie. Studenten en docenten gaven ten aanzien van het totaal van alle interactietypes significant hogere scores aan voor de wenselijkheid dan voor het optreden. Blijkbaar vonden ze dat de interacties binnen de werkcolleges verbeterd kunnen worden. Uit de open vragen bleek dat studenten vooral kenmerken die gerelateerd zijn aan (dieper) leren, zoals verhoogde begripsvorming, beter onthouden en het beter toepassen van kennis als positieve aspecten van groepsinteractie benoemden. Daarentegen, leunden ze ook sterk op de docent om de leiding te hebben en uiteindelijk het juiste antwoord te geven.

Middels de videoanalyse werden de groepsinteracties, bij vier van de acht werkcollegegroepen, geanalyseerd met behulp van een codeerschema[4] dat onderscheid maakt in vijf activiteiten: de drie voorgenoemde types van leergerichte interacties (explorerende vragen stellen, cumulatief redeneren, bespreken van inhoudelijke tegenstrijdigheden) aangevuld met procedurele en niet-taakgerichte interacties. Het bleek dat de docenten gemiddeld 93% van de groepsdiscussie tijd in beslag namen met door hen geuite verbale interacties, waarvan het overgrote deel cumulatief redeneren betrof.

De resultaten uit hoofdstuk 4 bevestigen de vermoedens geuit in hoofdstuk 3, namelijk dat studentinteracties maar weinig voorkomen binnen de werkcolleges en de sterk dominante rol van de docent. Mogelijke verklaringen hiervoor zijn: te grote groepen voor effectieve discussies, de doelstellingen van de werkcolleges (dus het bedoelde curriculum) niet duidelijk genoeg zijn voor zowel docenten als studenten, dat studenten onvoldoende voorbereid zijn en/of dat de opdrachten niet genoeg interactie stimuleren. Om de werkcolleges te verbeteren dienen dan ook oplossingen gezocht te worden in bovengenoemde richtingen.

Hoofdstuk 5 beschrijft een studie naar de ontwikkeling van een betrouwbaar (beoordeling)instrument dat de kwaliteit van onderzoeksverslagen kan meten en sterktes en zwaktes identificeert. De onderzoeksverslagen worden gezien als eindproduct van de stage waaruit de ontwikkelde onderzoekscompetenties zijn af te

meten. Het beoordelingsinstrument bestaat uit 15 specifieke en 4 globale items gebaseerd op aspecten gerelateerd aan goede onderzoeksverslagen, zoals een heldere onderzoeksvraag, theoretische inbedding, duidelijk beschreven methoden en resultaten en conclusies die de onderzoeksvragen beantwoorden. Drie onafhankelijk beoordelaars gaven op een vijfpuntsschaal aan in hoeverre ze het met de bewering (item) eens of oneens waren. Het instrument werd toegepast op 18 onderzoeksverslagen. De resultaten laten zien dat de sterktes van de verslagen de beschrijving en structuur van materialen en methoden en van de resultaten waren. De zwaktes waren de onderzoeksvraag en de inbedding in een theoretisch kader, de (statistische) analyses en de helderheid van grafieken, tabellen en figuren. Met drie beoordelaars bleek het instrument voldoende betrouwbaar. De studie geeft aldus inzicht in het niveau van de door studenten verworven onderzoekscompetenties.

Het ontwikkelde meetinstrument is vervolgens ingezet in de vervolgstudie over de onderzoeksstage zoals beschreven in **Hoofdstuk 6**. Allereerst was het doel inzicht te krijgen in de ervaringen van de studenten met de onderzoeksstage met betrekking tot factoren van invloed op het leerproces, zoals de kwaliteit van de begeleiding, de ontwikkeling van vaardigheden, het intellectuele en sociale werkklimaat, de organisatie en de helderheid van de doelen. Ten tweede werd de relatie onderzocht tussen deze factoren en twee uitkomstmaten, te weten de kwaliteit van de onderzoeksverslagen en de totale tevredenheid van studenten. Aan 101 vijfdejaars werd een vragenlijst voorgelegd van 25 items. De respons was 80 ingevulde vragenlijsten (81%). De studenten ervoeren de stage als zeer positief. Alle factoren scoorden hoog, enkel de factoren; intellectuele en sociale werkklimaat en organisatie, vertoonden een vrij grote spreiding die kan duiden op verschillen tussen onderzoekslocaties. Alle onderzoeksverslagen behorend bij de studenten die de vragenlijst beantwoorden, werden gescoord door twee onafhankelijke beoordelaars met behulp van het eerder beschreven meetinstrument. De resultaten lieten zien dat er een positieve significante relatie was tussen enerzijds de kwaliteit van de begeleiding en het werkklimaat en anderzijds de kwaliteit van het onderzoeksverslag. Tevens bleek een positieve significante relatie tussen de kwaliteit van de begeleiding en de totale tevredenheid met de stage. Dit betekent dat aandacht voor de kwaliteit van de begeleiding noodzakelijk is en mogelijk middels training verhoogd kan worden. Het belang van een goed intellectueel en sociaal werkklimaat voor studenten kan worden verbeterd door sociale interactie tussen studenten te stimuleren tijdens de stage.

Hoofdstuk 7 beschrijft een studie naar de ervaringen en meningen van afgestudeerden van twee verschillende curricula met als doel om te analyseren of afgestudeerden van het nieuwe meer studentgecentreerde curriculum (1995)

positiever terugkijken op hun doorlopen opleiding dan studenten van het conventionele ('oude') curriculum (1982) en of ze zich beter voorbereid voelden op de diergeneeskundige praktijk. De doelstellingen voor curriculum '95, zoals verwoord in het 'bedoelde curriculum' en beschreven in hoofdstuk 2, werden geoperationaliseerd tot vragen in een vragenlijst en geclusterd rond de thema's: (klinisch) probleem oplossen, sociale –en communicatieve vaardigheden, wetenschappelijke vaardigheden, praktische vaardigheden en vaardigheden in praktijkmanagement, toetsing en zelfstandigheid. De vragenlijsten werden gestuurd 24 maanden na het afstuderen naar alle dierenartsen die hun diploma ontvingen in de periode van 2001-2003. De respons van in totaal 337 dierenartsen (55% van curriculum '82) werden geanalyseerd. In vergelijking met de afgestudeerden van het '82 curriculum, voelde de afgestudeerden van het '95 curriculum zich beter voorbereid op de veterinaire beroepsuitoefening wat betreft klinische kennis en vaardigheden, sociale –en communicatieve vaardigheden en wetenschappelijke vaardigheden. Afgestudeerden van beide curricula ervoeren hiaten in praktische vaardigheden, eerstelijns diergeneeskunde en vaardigheden in praktijkmanagement en gaven aan dat dit redenen waren voor een moeilijke overgang van opleiding naar de praktijk. Ze gaven aan dat er meer aandacht binnen het curriculum moet zijn voor deze aspecten en voor verdere training in communicatie vaardigheden. De onderwijsvernieuwing lijkt een duidelijk positief effect te hebben op in ieder geval enkele doelstellingen. Verdere verbeteringen van het curriculum dienen gericht te zijn om meer praktijkgerelateerde vaardigheden.

In **hoofdstuk 8** worden de resultaten, van de studies die verricht zijn in het kader van dit proefschrift, besproken. De bevindingen worden bediscussieerd in relatie tot aspecten die van belang zijn bij studentgecentreerd onderwijs met aandacht voor generieke competentie ontwikkeling en de intenties (zoals beschreven in Hoofdstuk 2) en ontwikkelingen in diergeneeskundig onderwijs. Daaruit worden de aanbevelingen voor verbetering van het moderne diergeneeskundige onderwijs en voor verder onderzoek voorgesteld.

Uit **hoofdstuk 3 en 4** kan geconcludeerd worden dat de studenten de werkcolleges percipiëren als een onderwijsvorm van nut voor hun leren en ze zijn over het algemeen tevreden over de kwaliteit van de docenten en de opdrachten. Groepsinteractie gebeurt echter niet in die mate en op die wijze die bedoeld was bij het invoeren van de werkcolleges als onderwijsvorm. De docenten domineren in de geuite verbale interacties. Leergerichte interacties tussen studenten en actieve participatie van studenten zijn belangrijk kenmerken van studentgecentreerd onderwijs. Aandacht zal besteed moeten worden aan verbeteringen van werkcolleges als activerende onderwijsvorm.

Uit **hoofdstuk 5 en 6** kan geconcludeerd worden dat de studenten de onderzoeksstage als zeer positief ervaren op nagenoeg alle factoren van invloed op de leerprocessen tijdens de stage. De onderzoekscompetenties die tot uiting komen bij het schrijven van een onderzoeksverslag bleken meetbaar met het ontwikkelde instrument. De begeleiding en het intellectuele en sociale werkklimaat hadden invloed op de kwaliteit van de verslagen en de algemene tevredenheid met de stage.

Uit **hoofdstuk 7** kan geconcludeerd worden dat de afgestudeerden van het 'nieuwe' 1995 curriculum zich op meerdere competenties beter toegerust voelen voor het beroepsveld dan hun collega's van het 'oude' 1982 curriculum. Deze resultaten komen grotendeels overeen met de intenties van de curriculumvernieuwingen. Echter, duidelijke hiaten in de opleiding worden opgemerkt die tevens niet verwoord stonden in de curriculumrapporten; zoals (eerstelijns) praktische vaardigheden, praktijkmanagement en alsnog een extra nadruk op communicatie vaardigheden.

De sterke kanten van het uitgevoerde onderzoek zijn dat het zowel procesgericht als uitkomstgericht was en uitgevoerd werd met behulp van verschillende analysemethoden en databronnen. Echter, niet alle aspecten van de curriculumvernieuwingen konden in kaart gebracht worden. Er is meer onderzoek nodig naar andere onderwijsvormen binnen het moderne diergeneeskundige curriculum, zoals de werkcollegeopdrachten, de klinische (coschap)fase, het externe onderwijs en vooral de didactische samenhang tussen deze onderdelen.

Praktische aanbevelingen om de kwaliteit van het diergeneeskundige onderwijs te verhogen zijn:

- meer praktijkgericht onderwijs (zoals vroege patiënt –en praktijkcontacten in het curriculum, verlenging van het externe onderwijs, specifiek vaardighedenonderwijs waaronder onderwijs in praktijkmanagement en communicatieve vaardigheden);
- vergroten van actieve participatie van studenten binnen de werkcolleges door bijvoorbeeld kleinere groepen te formeren en dialoog –en discussievaardigheden te trainen bij zowel studenten als docenten;
- begeleiders van onderzoeksstage trainen in hun belangrijke begeleiderrol en studenten beter voor te bereiden op hun stage;
- meer longitudinaal samenhangend onderwijs in wetenschappelijke vaardigheden.

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Debbie Jaarsma

Curriculum Vitae

Debbie Jaarsma was born in Wassenaar, the Netherlands on the 19th of October 1973. In 1991 she obtained her diploma at the Christelijk Gymnasium Sorghvliet in The Hague, the Netherlands. A gap year was spend on obtaining a degree in Chemistry as a requirement to veterinary training. In 1992 she started her veterinary training at Ghent University, Belgium, where she gained her 'kandidaats' with honours in 1995. From 1995 until her graduation (with honours) in 2000, she completed her veterinary training at Utrecht University, the Netherlands. Subsequently, she worked for 8 months as a resident in the Department of Pathology, Faculty of Veterinary Medicine, Utrecht University. It is here where her interest for education really started and she pursued a further career in education at HAS Den Bosch (University of Applied Sciences, Department of Animal Husbandry & Animal Health and Care) from 2001 to 2003, where she worked as a teacher and project leader and where she immersed in problem-based learning. To spread her wings and broaden her horizon, she left her beloved HAS to try out a career in the pharmaceutical industry at Janssen-Cilag BV. Human psychopharmaca, sales and marketing were her 'thing' from 2003-2004. She, however, missed education too much and needed an intellectual challenge. Since 2004, Debbie has worked on a project for her PhD thesis, entitled 'Developments in Veterinary Medical Education: Intentions, Perceptions, Learning Processes and Outcomes', at the Chair Quality Improvement in Veterinary Education, Faculty of Veterinary Medicine, Utrecht University. She was nominated by Utrecht University for the Price "Young Teacher Talent 2008". In the same year she won the Price "Junior Teacher of the Year 2008" of the Faculty of Veterinary Medicine. Currently she works as an assistant professor at the same Chair. Debbie is married to Sjoerd and has a four year old daughter, Lara.